

December 25, 2017

Via electronic mail – 3 separate e-mail messages regarding each injection well permit application:

To: Ohio Department of Natural Resources (ODNR)

From: Buckeye Environmental Network (www.buckeyeenvironmentalnetwork.org); Center for Health, Environment and Justice (www.chej.org); Frackfree America National Coalition, based in Youngstown, Ohio (www.frackfreeamerica.org); and Freshwater Accountability Project (www.fwap.org)

RE: Part 1 of 2 parts: Public comment / objection regarding proposed injection wells to be located in Brookfield, Ohio (Please consider Part 1 and Part 2 as our objection/ comments on the applications for the three proposed wells. Part 2 is our previous comment dated March 28, 2017 on the first two injection well applications, and we are submitting Part 2 as part of our comment on the following Highland injection well application numbers:

Application number:

Permit Application aPATT031638 (SWIW #38) (Highland Brookfield #4)

Permit Application aPATT031639 (SWIW #39) (Highland Brookfield #3)

Permit Application aPATT031640 (SWIW #40) (Highland Brookfield #2)

For more information:

Contact Teresa Mills at 614-539-1471, tmills@chej.org or Jane Spies at 234-201-8007 or e-mail at frackfreeamerica@gmail.com

Part One of Two parts: Objections, comments, and request for a public hearing by the Ohio Department of Natural Resources (ODNR) to be held in Brookfield, Ohio:

We hereby object to the potential permitting by the Ohio Department of Natural Resources (ODNR) of three new proposed fracking waste injection wells in Brookfield, Ohio and request a public hearing as described in Ohio law.¹ We ask that the public hearing take place in Brookfield, Ohio. We also object to any and all proposed injection wells to be located in Brookfield, Ohio, including the two proposed Brookfield injection wells for which ODNR has already issued drilling permits. ODNR must not allow any of these proposed injection wells to be located in Brookfield because they pose an imminent danger to public health, safety, and welfare, which cannot be remedied by ODNR issuing any future permit conditions.

This region is not suitable for fluid waste injection, in part, due to the geology of the area. Placement of these three injection wells, and also the other two Brookfield injection wells, is

against the public interest. Regulations or permit conditions cannot prevent nor adequately mitigate any potential abandoned coal mine subsidence or man-made earthquakes. Earthquakes cannot be regulated with one hundred percent certainty. In this area of Ohio, we are risking a large and damaging earthquake. In fact, according to scientist Won -Young Kim referring to the Youngstown, Ohio magnitude 4.0 earthquake of 2011:

“Although we do not know the WSW-ENE extent of the fault(s) in the Youngstown area, it is possible that continued injection of fluid at Northstar 1 well could have triggered potentially large and damaging earthquakes.”²

It is truly astonishing and unconscionable that ODNR would even consider placing this heavy industrial injection well operation in Brookfield. This is especially so, since ODNR knows, or should know, of the risks of induced seismicity, potential collapsing abandoned coal mines, and other threats to public health and safety in this highly populated residential area of Brookfield. We believe, based upon science and experience, that siting five injection wells so close together to inject all at the same time in an area that is close to multiple known areas of seismic activity dangerously compounds the risks to public health, safety, and welfare, as well as violates private property rights of the region and can negatively affect private property values. This level of heightened risk is unacceptable. ODNR should immediately deny the three new applications, revoke the two drilling permits already issued, and deny any future permit applications, as operating injection wells in this earthquake – prone region is an unacceptable risk to the public interest and health, safety, and welfare.

The potential siting of five high injection rate and volume injection wells in a highly urbanized area way too near family homes, businesses, and government buildings, including the Brookfield fire station, should raise a major red flag to anyone who is thinking clearly with the welfare of the public in mind. This is true especially in light of the fact that this is a well-known abandoned coal mine area that is located in the “Eastern Disturbed Zone³ that has in recent years experienced induced earthquakes that independent scientists or ODNR have linked to injection wells and even hydraulic fracturing.⁴ Ohio homes, structures, and other infrastructure are not built to withstand earthquakes.

The risk of creating induced earthquakes is magnified by adding three more proposed injection wells as requested in the Highland / Seneca Resources permit application.⁵ The first two proposed Brookfield injection wells already introduced an unacceptable level of risk to the community and region.⁶ Scientist Michael C. Hansen wrote: “On the basis of historic seismic activity, it is likely that large earthquakes with epicenters in the state would occur in the western Ohio seismic zone or in northeastern Ohio; there is a lesser possibility of a large earthquake in southeastern Ohio. Some researchers have suggested that northeastern Ohio is capable of a maximum magnitude 6.5 earthquake, whereas western Ohio may be capable of producing an event in the 6 to 7 magnitude range (maximum MMI of IX). These suggestions are speculations

at best, because there are inadequate data to accurately judge the extent of the area available for rupture on any earthquake – generating fault.”⁷

Hansen said that northeastern Ohio may be capable of a magnitude 6.5 quake, in theory. Obviously, this is not a small tremor. To the extent that it is possible, preventing the increased risk of this kind of event should be paramount. ODNR set a precedent by ordering that the Khalil injection well, to be sited in Mahoning County, would not be allowed to inject. The ODNR Chief found that “the Khalil #3 saltwater injection well is located in close proximity to an area of known seismic activity.”⁸ The Chief’s Order regarding the Khalil injection well also indicates:

“The Khalil #3 saltwater injection well is located approximately 3.8 miles from the Northstar #1 saltwater injection well, 6 miles from seismic events that occurred in 2014 near the Hilcorp Energy Company wells in Poland Township, 11.4 miles from the seismic event that occurred in 2014 near the American Water Management Services’ saltwater injection wells.”⁹

It’s important to stress that there had been no earthquakes detected at the Khalil injection well site that we know of. It seems that the ODNR Chief denied the Khalil permit to inject “Brine or Other Waste Substances” apparently, as least in part, to prevent seismicity. This is highly relevant, in our opinion, to the proposed Brookfield injection well site. Brookfield is only about 10.6 miles from an area of known seismic activity, i.e., the American Water Management Services injection wells in Weathersfield, Ohio. We believe that Brookfield is also too near the site of the magnitude 4.0 Youngstown man-made, injection well-linked earthquake of 2011, and too near the Poland Township man-made earthquakes.

We ask ODNR Chief Simmers to apply his own precedent and logic used in the Khalil injection well situation to the Brookfield case by halting the proposed injection well operation in order to protect public health, safety, and welfare of Brookfield and the entire region. Wisely arguing in an appellee brief of the Division of Oil and Gas Resources Management, dated September 22, 2016 (on the court docket) in the case involving the Weathersfield, Ohio injection well that has been suspended for about three years, the Division wrote:

“Should the Chief of the Division of Oil and Gas Resources Management (“Chief”) have to wait for a damaging earthquake to hit a community before issuing a chief’s order suspending operations? Of course not. Nonetheless, the implications of Appellant, American Water Management Services, LLC’s (“AWMS”) arguments would lead to this absurd result.”¹⁰

Furthermore, according to The “Findings, Conclusions and Order of the [Oil & Gas] Commission” that ruled on the AWMS injection well [p. 12, 8/12/15]:

“While science may aid us in understanding the geophysics and lithostratigraphies associated with injection operations, to a certain extent both the industry and the Division are ‘working with their eyes closed.’ “¹¹

Distances and “unknowns” were addressed in the latter document as well. According to the document:

“We cannot directly visualize the ‘terrain’ that exists thousands of feet below the Earth’s surface. And, it is possible that geologic connections exist at these great depths that we cannot readily anticipate. There simply are many unknowns regarding the complexities of deep geology in eastern Ohio. 12

The AWMS #2 Well is located seven miles northwest of the Northstar #1 Well. Seismic events of magnitudes ML 2.7 and ML 4.0 were attributed to injections at the Northstar #1 Well, suggesting the existence of an ‘energized’ fault in the area. While seven miles distance may not seem ‘close’ to us on the surface, in geological terms that distance is not so great. Testimony at hearing revealed that it is entirely possible that the AWMS #2 Well has ‘tapped into’ the same geologic fault system that plagued the Northstar #1 Well. Again, we are dealing in many unknowns. Yet, the fact that data is lacking or uncertain, does not relieve the Division Chief of his responsibility to protect public health and safety.”¹²

Indeed. We agree, and it must be stressed that the proposed Brookfield injection well operation is only 10.6 miles away from the AWMS injection well operation discussed above. Could it also be too near the “same geologic fault system that plagued the Northstar #1 Well,” as the document put it? (The Northstar #1 injection well is linked to the magnitude 4.0 Youngstown quake of 2011.)¹³

It is too risky to allow injection in Brookfield especially in light of the following information: It is a little-discussed fact that Brookfield is only about one hour and 17 minutes away from Painesville, Ohio, the area where a magnitude 5.0 earthquake occurred in 1986. USGS seismologist Art McGarr argues that this quake is now considered to possibly be an induced earthquake linked to injection wells.¹⁴ Brookfield, Ohio is only about a half an hour away from Pymatuning, Pennsylvania where a magnitude 5.2 earthquake occurred in 1998 (near Jamestown, PA). This Pymatuning quake is considered a natural earthquake.¹⁵ Isn’t it clear that any potential man-made quakes resulting from injection well activity in this region could be large and potentially very damaging? The potential for more induced quakes in this region must be prevented, in part, by ODNR’s denying the Brookfield injection well permits, thereby protecting the public interest.

There is concern that Ohio could become the next Oklahoma, which has been experiencing man-made earthquakes due to injection wells over the years including a magnitude 5.7 Prague, Oklahoma quake and a magnitude 5.8 Pawnee earthquake, which scientists suspect was induced seismicity. Now regulators are acknowledging hydraulic fracturing induced quakes, as well, in Oklahoma.¹⁶

It is obvious that regulators cannot stop the Oklahoma quakes despite their trying to do so. If they could stop them, they would have done so by now, but quakes are continuing. Oklahoma

had been relatively seismically quiet before injection apparently reached its tipping point for the production of earthquakes in 2009. Just because it is relatively quiet now, is Ohio going to reach its tipping point, like Oklahoma, as more and more fluid waste is injected? Every day, enormous amounts of waste are being injected under Ohio at injection well sites in Vienna, Ohio, North Lima, Ohio, and elsewhere. We believe that every day of injection increases the volume and thereby the potential for more induced seismicity (man-made earthquakes.)¹⁷

The cumulative history of injection, not just in one well, but also in surrounding injection wells must be considered by ODNR. Brookfield is not far from the KTCA injection well operation in Vienna, Ohio. Brookfield is also near Weathersfield and North Lima where injection wells are located. Even though some injection wells may be inactive now, their volume of waste must be assessed and considered. Where might the waste or pressure migrate? If the volume of waste proposed to be injected under the Brookfield site migrated under neighboring private property in Brookfield, couldn't this be considered toxic trespass? Can Seneca prove that its injection waste will stay under its own private property? We believe that it cannot, because science and history show that waste migrates.¹⁸ And, as it migrates, it might encounter an unknown, unmapped fault.

There are too many troubling knowns and unknowns about induced seismicity. The science is evolving quickly, but we believe that not enough is known right now to allow this proposed injection well operation to proceed.¹⁹ What science has established already should dictate that this proposed injection well operation should be halted by ODNR in the interest of protecting the public. The people of Brookfield and the entire region are not subjects for an earthquake prevention experiment. Health, safety, and welfare of the community must come first.

There are many unanswered questions pertaining to the Brookfield injection well permit applications. Permit application question #25 says there are wetlands, but there is nothing in the application on how these wetlands will be protected. Are they having the storage capacity at each well or where? It is not clear. Are there going to be five surface facilities? Will each well have its own storage tank battery, and loading and unloading pad as evidenced by the schematic drawing in each permit application? If yes, this will just compound the possibilities of surface spills, and potential soil, air, and water pollution. Or, will there be only one storage tank battery, and where precisely is it intended to be located - how close to family homes, businesses, and government buildings? If only one storage tank battery is being planned, the application fails to tell us how the waste will get from the storage tanks to the injection well. Is it going to be underground piping, surface piping, or, in other words, is the proposed potential pipe going to be above ground or below ground? Again, it is five times the potential for disaster.

It seems from the applications, that it is not clear, even if the facilities are to be constructed at each well site, that there is enough capacity to store and receive waste on the level of 5,000 to 10,000 barrels for each of the five wells per day. How are they going to handle all of this predicted waste if they only have one settling tank (2500 barrels) and only one clean tank of

2500 barrels? These numbers do not add up. They have two tanks to store 5000 barrels per day, but there is much more waste that is predicted to be received, per the application. We need an ODNR public hearing to clarify these questions and other very important issues.

It is unfortunate and an insult to the Brookfield community and region that both ODNR and Highland / Seneca Resources failed to participate in a very well-attended public meeting and panel discussion held in Brookfield by concerned citizens and groups on November 30, 2017. Their lack of attendance and attention to residents' legitimate grievances and concerns does not inspire citizens' confidence nor trust in ODNR's and Seneca's current and future handling of injection well-related issues.

In our March 28, 2017 objection to the first two proposed Brookfield injection wells we established a substantive health and safety issue for which ODNR Chief Simmers should have used his discretion to hold a public hearing. This was not done, and we consider this an error made by ODNR Chief Simmers that should be immediately corrected by ODNR arranging a public hearing to be held in Brookfield, Ohio. The ODNR website answers to the public comments for the first two proposed injection wells in Brookfield were inadequate and not enough to fully inform the public and to allow the public to engage in dialogue with ODNR in order to be fully informed. This is partly why a hearing must take place.

Why do we think that there a clear and valid public health, safety, and welfare issue and grievance associated with the siting of these wells? There are many reasons, including those cited above and also including the following:

No one knows where all of the faults might lie that could be activated and cause potential earthquakes. The harm from activating a dormant, unknown fault or energizing an active fault system is irreparable. Therefore, drilling and operating an injection well in this region, the eastern disturbed zone, is gambling with the public health and safety. The ODNR Chief must protect the public health and safety as indicated by Ohio law. By adding three more injection wells, the public health and safety issues are compounded. The estimated amount of waste to be injected is enormous, and much of it will come from out-of-state if ODNR approves the injection well operation. This large volume of waste will increase the risk of man-made earthquakes.

Furthermore, no one knows where all of the abandoned coal mines are because the state did not require companies to file mine maps until 1874.²⁰ Recently, ODNR had to seal collapsed abandoned 1890s coal mine areas in a Brookfield park.²¹ Seneca claims there are no mines below the proposed injection well site, but how do they know that? We believe that they don't know for sure. Since it is unknown where all of the abandoned coal mines are, it is again gambling with the public health and safety when injection wells are placed in areas where coal mines might lie, or hidden or unknown, or even known faults might be. The damage that could potentially result is irreparable and cannot be remedied by the Chief issuing permit conditions. Furthermore, even if the proposed Seneca injection well site in Brookfield is not directly above

any abandoned coal mines, any man-made earthquakes potentially resulting from injection activities could still have an adverse effect upon the stability of the old mines. Logic dictates that even small, repeated, tremors due to injection activities potentially could have the effect of destabilizing already weakened old mine structures, thereby risking subsidence or ground movement.

The issue of why the Hray – Mullenax injection well in Brookfield never operated must be clarified publicly by ODNR. This is especially true because, if there were problems with the geology possibly at the Hray well, what is to prevent the same or similar problems from happening at the new proposed injection well site that is not that far away from the Hray old injection well site?

It is crucial that ODNR tell the public exactly why the Hray injection well was never put into operation. The ODNR inspection records show that a “mine void” was encountered and large amounts of cement were poured in. A public records request about the Hray-Mullenax well includes a document whose conclusions section indicates,

“Because there is a range associated with the results, there is uncertainty in the exact kh value; however, all these results are very low and indicate that the geologic strata within the open interval in the HRAY #1 well collectively have overall poor injectivity.”²²

If there was “poor injectivity” at the old Hray injection well, why wouldn’t there be similar poor injectivity at the proposed new injection well site that is located not that far away? Wouldn’t the geology be similar at the new site?

In the same document there is another troubling passage:

“The spike in the injection pressure data shown in Figure 1-2 suggests that the acid treatment and injection process may have created a fracture in the open borehole section. Results of an injection/fall-off test performed following the flow-meter logging test also displayed fracture-flow response characteristics, which supports a the [*sic*] hypothesis that a fracture may have been created within the open borehole section”²³

Residents need more information about the “fracture” cited above, and there are still many unanswered question about the Hray injection well that ODNR must resolve in the interest of protecting public health and safety. Was there microseismicity detected at the Hray site? Was there leaking? Was there any abandoned coal mine subsidence near the injection well site? Will similar or the same problems encountered at the Hray injection well be encountered at the nearby, new proposed five-well injection operation? Why or why not?

We are concerned about news reports of previous violations by Seneca Resources in Pennsylvania. According to one news report, violations included “Discharge of an estimated 500 barrels of flowback fluid generated from a valve failure to the ground and surrounding wetlands

in Forest County;” and “Discharge of an estimated 70 to 100 barrels of crude oil which flowed across land then into a tributary of Windfall Run, a high quality cold water fishery in McKean County” According to the same news report, “Seneca, the exploration and production segment of National Fuel Gas Company, is one of the largest natural gas producers in the state of Pennsylvania. Since 2005, Seneca has had 654 violations and 236 enforcements as a result of 6,979 inspections of 1,760 wells.”²⁴

There is another troubling, recent Skytruth alert report about a Seneca Resources violation dated 2017-12-19. An excerpt from the Skytruth report follows: “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 i.. Flowback water was released to the ground due to a weld separation in an above ground 16"HDPE water line.”²⁵

Residents of northeastern Ohio are very aware of a Vienna, Ohio fiasco in 2015 where a spill related to an injection well destroyed two wetlands and a pond. We do not want a repeat of that kind of destruction anywhere.

The Ohio Constitution is highly protective of private property rights, and therefore the rights of all human persons, not just of Seneca’s corporate personhood rights, must be honored and protected by ODNR Chief Simmers. No one has the right to pollute or degrade their neighbor’s property. The private property rights of the entire Brookfield community and the entire region are adversely threatened by the placement of these wells. It is a large number of people who are at risk of losing their investments in their family homes and land and not being able to enjoy or use their property as originally intended in order for one company to make money at the expense of the surrounding community. There also are issues with diminishing quality of life if this operation is permitted.

It must be emphasized that the residents of Brookfield and the region have private property rights, too. Imagine all of the money, time, effort, work, and love that everyday people invest into developing their own private property in the form of their family homes, farms, and/or small businesses. Many hope to maintain the freedom to pass what they have built and cherished to their family members – their children, grandchildren and beyond. Their enormous private property investment cannot be jeopardized in order to allow one company to unfairly profit at the expense of the community and surrounding region.

The people need to know that their investment in their homes and land will be protected and not threatened by a heavy industrial injection well operation located practically in some residents’ backyards, and that, we believe, will introduce an unacceptable level of risk of potentially large and damaging man-made earthquakes, risks to water, air, and land and risk to public health, safety, and welfare. ODNR must deny the permits in order to protect the community and to preserve the public interest.

We are also concerned that there may be hundreds of trucks traveling through the community if the permits are granted by ODNR. This could become a health and safety issue and could have adverse effects upon the quality of life for people living in the community.

The public notice says that “brine water” will be injected. To many members of the public who, understandably, do not regularly or in a detailed manner follow what the oil and gas industry is doing every day, the use of the term “brine water” will mean simply salty water or water with salt in it only. This wording is highly misleading to the public. It suggests that ODNR is permitting Seneca to only inject water with salt in it. The public notice is vague and not sufficient to fully inform the public about what they are supposed to comment upon and to understand the true nature of this proposed, heavy industrial fracking waste injection operation. It is important in the protection of public health and safety to accurately characterize what the components of the fracking waste are.

It is highly inappropriate and poses an unacceptable level of risk to place these injection wells in this community. We believe that this is not a legitimate business activity in this earthquake – prone, residential, highly populated, abandoned coal mine area where the risks of injection far outweigh any benefits. There is no benefit to the majority of people who live in the region – only potential costs and virtually no jobs are involved with injection wells. ODNR must revoke the issued permits and deny any injection permits to protect the public health, safety, and welfare. ODNR must deny the three new permit applications to protect the public health, safety, and welfare. ODNR’s denying all of the permits is in the public interest.

Please consider the following two press releases as part of this public comment and objection to the wells. The press releases can be found at the following urls:

“Brookfield OH fracking waste injection well operation poses unacceptable risks to public health, safety, and private property rights, values,” November 27, 2017, Press release: Frackfree America National Coalition, Buckeye Environmental Network, Center for Health, Environment and Justice at:

<http://www.frackfreeamerica.org/blog/brookfield-oh-fracking-waste-injection-well-operation-poses-unacceptable-risks-to-public-health-safety-and-private-property-rights-values>

“Ohio citizens to ODNR: Revoke/Deny Five Fracking Waste Injection Permits Immediately – Brookfield wells pose imminent danger to public health, safety, and welfare, October 9, 2017, Press release: Frackfree America National Coalition, Buckeye Environmental Network, Center for Health, Environment and Justice at:

<http://www.frackfreeamerica.org/blog/ohio-citizens-to-odnr-revokedeny-five-fracking-waste-injection-permits-immediately-brookfield-wells-pose-imminent-danger-to-public-health-safety-and-welfare>

Please also consider the following three links as part of this comment/ objection. For more information about the proposed Brookfield injection wells and injection wells, man-made earthquakes, etc. please see:

Our March 28th, 2017 comment to ODNR regarding the proposed Brookfield injection wells, that discusses induced seismicity and other risks at:
<http://www.buckeyeenvironmentalnetwork.org/news/2017/6/1/comment-to-odnr-re-brookfield-injection-wells-by-ben-chej-fanc>

Our open letter can be seen at:
<http://www.buckeyeenvironmentalnetwork.org/news/2017/7/4/openjoint-letter-re-brookfield-injection-wells>

Please see a previous press release regarding injection wells and induced seismicity, etc. at:
<http://frackfreemahoning.blogspot.com/2016/07/prayer-service-rally-july-12-2016.html>

Also, in addition to this Part One, please consider Part Two which is our comment and objection to the first two injection wells proposed for Brookfield, as part of our comment on the three new injection well applications. Many more of the numerous public health and safety concerns, such as combustible vapors and lightning protection, risks to well water, spills or releases, air pollution, as well as induced seismicity are addressed in Part Two.

Parts One and Part Two are also attached to the e-mail message sent to ODNR as our public comment.

Thank you for reviewing this material.

Notes:

¹ "(c) If an objection is received, the chief shall rule upon the validity of the objection. If, in the opinion of the chief, such objection is not relevant to the issues of public health or safety, or to good conservation practices, or is without substance, a permit shall be issued. If the chief considers any objection to be relevant to the issues of public health or safety, or to good conservation practices, or to have substance, a hearing shall be called within thirty days of receipt of the objection." [...] Ohio Administrative Code <http://codes.ohio.gov/oac/1501%3A9-3-06>

² Won-Young Kim, "Induced seismicity associated with fluid injection into a deep well in Youngstown, Ohio," July 19, 2013, Journal of Geophysical Research, Solid Earth, Volume 118, Issue 7, July 2013, Pages 3506-3518, <http://onlinelibrary.wiley.com/doi/10.1002/jgrb.50247/full>

³ Further support for the idea that our area is not suitable for injection comes from a Vindicator article by Mike Costarella who cited a 1986 Vindicator article written by “retired YSU geologist, Ann Harris.” In the following passage, Costarella quoted Harris: “In the 1980’s, new studies of Ohio revealed that the structure of Precambrian bedrock is very complicated. These studies have revealed that there is a series of faults in Northeastern Ohio [...] This section of Ohio is known as the Eastern Disturbed Zone.’ ” The previous excerpt is from: Mike Costarella, “Who’s At Fault?” Vindy.com, March 13, 2012, <http://www.vindy.com/weblogs/shale-sheet-fracking/2012/mar/13/whos-fault/>

⁴ “Scientists link over 1000 earthquakes to fracking or fracking waste injection wells in Ohio, yet the state of Ohio only lists 18 quakes on their website. Why? How can Illinois and other states benefit from Ohio’s experience with fracking induced seismicity?” November 14, 2014, article by Dr. Ray Beiersdorfer, Professor of Geology, Dept. of Geological & Environmental Sciences, Youngstown State University, Youngstown, Ohio: <http://www.frackfreemahoning.blogspot.com/2014/11/scientists-link-over-1000-earthquakes.html>

⁵ Won-Young Kim, “Induced seismicity associated with fluid injection into a deep well in Youngstown, Ohio,” July 19, 2013, Journal of Geophysical Research, Solid Earth, Volume 118, Issue 7, July 2013, Pages 3506-3518, <http://onlinelibrary.wiley.com/doi/10.1002/jgrb.50247/full>

⁶ “Comment to ODNR re: Brookfield injection wells by BEN CHEJ FANC,” March 28, 2017, From: Buckeye Environmental Network; Center for Health, Environment and Justice; and Frackfree America National Coalition, based in Youngstown, Ohio <http://www.buckeyeenvironmentalnetwork.org/news/2017/6/1/comment-to-odnr-re-brookfield-injection-wells-by-ben-chej-fanc>

⁷ “Earthquakes in Ohio,” by Michael C. Hansen, Updated 2015, EL 9., ODNR Division of Geological Survey, Educational Leaflet (EL) Series, page 8, <http://geosurvey.ohiodnr.gov/publications-maps-data/free-downloads/educational-leaflets>

⁸ PDF uploaded document: RE: Northstar Kahlil #3 Well – Mahoning County; Ohio Department of Natural Resources, ORDER BY THE CHIEF, September 24, 2014, “Denial of Permit to Inject Brine or Other Waste Substances pursuant to Ohio Revised Code 1509.22: http://www.frackfreeamerica.org/uploads/1/2/4/0/12404661/2014_421_r.e_disposal_llc_denial_of_permit_to_inject.pdf

⁹ PDF uploaded document: RE: Northstar Kahlil #3 Well – Mahoning County; Ohio Department of Natural Resources, ORDER BY THE CHIEF, September 24, 2014, “Denial of Permit to Inject Brine or Other Waste Substances pursuant to Ohio Revised Code 1509.22: http://www.frackfreeamerica.org/uploads/1/2/4/0/12404661/2014_421_r.e_disposal_llc_denial_of_permit_to_inject.pdf

¹⁰ Brief of Appellee, Division of Oil and Gas Resources Management, In the Court of Common Pleas Franklin County, Ohio, Case No. 16 CV 006218, September 22, 2016, page 1.

¹¹ “Before the Oil & Gas Commission,” American Water Management Services, LLC vs Division of Oil & Gas Resources Management; Appeal Nos. 889 & 890, Review of Chief’s Orders 2014-372 & 2014 – 374 (AWMS #2 Well); FINDINGS, CONCLUSIONS AND ORDER OF THE COMMISSION, Date Issued: August 12, 2015, page 12.

¹² “Before the Oil & Gas Commission,” American Water Management Services, LLC vs Division of Oil & Gas Resources Management; Appeal Nos. 889 & 890, Review of Chief’s Orders 2014-372 & 2014 – 374 (AWMS #2 Well); FINDINGS, CONCLUSIONS AND ORDER OF THE COMMISSION, Date Issued: August 12, 2015, page 13.

¹³ “Earthquake Time Line,” Vindicator, March 16, 2012 <http://www.vindy.com/news/2012/mar/16/earthquake-time-line/>

¹⁴ See a paper referencing the Painesville earthquakes by seismologist Art McGarr who wrote:

“There have been additional case histories of induced earthquakes attributed to wastewater injection in northeastern Ohio since 1988 at Ashtabula [*Seeber et al*, 2004] and Youngstown [*Kim*, 2013]. The Ashtabula case history has several features that tend to support the case that the Painesville earthquakes were induced. As will be described below, the larger Ashtabula event occurred 15 years after the start of injection and about 7 km from the injection well considered to have induced this earthquake [*Seeber et al*, 2004].” (Also see A. McGarr’s discussion of findings of Keranen et al on the same page). To see an important discussion of the 1986 Painesville, Ohio magnitude 5.0 earthquake, see pages 1014-1015 of the PDF at the following url: A. McGarr, 2014, “Maximum magnitude earthquakes induced by fluid injection,” *J. Geophys. Res. Solid Earth*, 119, 1008-1019, doi: 10.1002/2013JB010597 <http://onlinelibrary.wiley.com/doi/10.1002/2013JB010597/abstract> ; Also see: James Risen and Stephanie Droll, “Great Lakes Area Jolted by 5.0 Earthquake,” *Los Angeles Times*, February 01, 1986, http://articles.latimes.com/1986-02-01/news/mn-2945_1_great-lakes

¹⁵ Preliminary results from the investigation of the Pymatuning earthquake of September 25, 1998,” *Pennsylvania Geology*, 1998, by John Armbruster et al, <https://pubs.er.usgs.gov/publication/70068731> ; *Pennsylvania Geology*, Vol. 29, No.4, Winter, 1998, http://www.docs.dcnr.pa.gov/cs/groups/public/documents/document/dcnr_006823.pdf ; USGS “Hydrologic Effects of the Pymatuning Earthquake of September 25, 1998 in Northwestern Pennsylvania, Fleeger, G.M. (PaGS), D.J. Goode, T.F. Buckwalter, and D.W. Risser, WRIR 99-4170, 8 p <https://pa.water.usgs.gov/reports/wri99-4170/>

¹⁶ “Yukon – area oil operations cut following earthquakes,” by Adam Wilmoth, November 28, 2017, NewsOK <http://newsok.com/yukon-area-oil-operations-cut-following-earthquakes/article/5573744>

¹⁷ “One of the study’s main conclusions is that the likelihood of large-magnitude manmade, or “induced,” earthquakes increases over time, independent of the previous seismicity rate. A reservoir simulation model that Suckale and Dempsey developed found a linear relationship between frequency and magnitude for induced quakes, with magnitude increasing the longer wastewater is pumped into a well.” The previous excerpt is from: “Natural or manmade quakes? New Stanford technique can tell the difference,” by John Anderson, December 16, 2015, *Stanford News* <https://news.stanford.edu/2015/12/16/natural-manmade-quakes-121615/>

¹⁸ “Earthquakes [...] can also be induced by disposal of wastewater from gas and oil operations into deep vertical wells. Over time, the disposal layer migrates away from the well [...], destabilizing preexisting faults.” The previous excerpt is from an image caption in the article titled, “Small earthquakes at fracking sites may be early indicators of bigger tremors to come, say Stanford scientists,” by Mark Shwartz, December 12, 2017, *Stanford News*: <https://news.stanford.edu/2017/12/12/small-earthquakes-fracking-sites-may-indicate-bigger-tremors-come/>

¹⁹ “Combining theory and computer simulations of dynamic [earthquake](#) ruptures, Ampuero and his colleagues developed a model that explains how the size of injection-induced earthquakes depends on not only the volume of fluid being injected but also the energy stored on nearby faults. The result is a model that quantifies the distance

that an earthquake can propagate beyond an injection site—which in turn predicts the maximum magnitude of an induced seismic event. “ The previous excerpt is from: “Modeling the effects of wastewater injection,” December 20, 2017, California Institute of Technology, <https://phys.org/news/2017-12-effects-wastewater.html>

²⁰ “Old coal mines are risk to homes in eastern Ohio, Columbus Dispatch, September 2, 2008

http://www.dispatch.com/content/stories/local/2008/09/02/ohcoal.ART_ART_09-02-08_B1_GLB70C0.html

“Earthquake concerns: Some Trumbull County residents warned to be prepared,” by Jack Shea, February 16, 2017, Fox 8 Cleveland, <http://fox8.com/2017/02/16/earthquake-concerns-some-trumbull-county-residents-warned-to-be-prepared/> and

“State Line Road closed after old mine collapses beneath it State Line Road from Nora Drive to Mount Jackson Road could be closed for several months,” by Amanda Smith, November 28, 2016. WKBN 27 TV <http://wkbn.com/2016/11/28/beaver-twp-road-closed-after-old-mine-collapses/> Excerpt from WKBN article follows:

“Because no one knows where all the mines are, there’s the possibility that another collapse could happen at any time.”

²¹ “ODNR to seal abandoned mine,” by Bob Coupland, November 7, 2017, Tribune Chronicle

<http://www.tribtoday.com/news/local-news/2017/11/odnr-to-seal-abandoned-mines/>

²² Documents cited are part of a public records request made by Teresa Mills to ODNR regarding the Hray-Mullenax injection well that was to be sited in Brookfield, Ohio. Public records request results from ODNR were received by Teresa Mills via U.S. Mail on December 23, 2017.

²³ Documents cited are part of a public records request made by Teresa Mills to ODNR regarding the Hray-Mullenax injection well that was to be sited in Brookfield, Ohio. Public records request results from ODNR were received by Teresa Mills via U.S. Mail on December 23, 2017.

²⁴ “Seneca Resources fined \$375, 000 for violations in Elk, Forest, McKean counties,” by Katie Weidenboerner, April 26, 2017, Courier Express http://www.thecourierexpress.com/news/local/seneca-resources-fined-for-violations-in-elk-forest-mckean-counties/article_1e1e524d-0240-53de-ae38-81d11511dc2a.html and

“PA activists concerned about Northern Access,” by Jeff Preval, May 24, 2017, WGRZ

<https://www.wgrz.com/article/news/local/pa-activists-concerned-about-northern-access/442652349>

²⁵ “Skytruth alert: PA permit violation issued to Seneca Resources Corp in Shippen Twp, Cameron County 2017-12-15” <http://alerts.skytruth.org/report/43bdd184-1825-3898-95b5-a706bb4a2a4c>

PART 2

AS ATTACHMENT

To be included as part
of public comment for

**Permit Application aPATT031640
(SWIW #40) (Highland Brookfield #2)**

March 28, 2017

To: Ohio Department of Natural Resources (ODNR)

From: Buckeye Environmental Network, Center for Health, Environment and Justice, and Frackfree America National Coalition, based in Youngstown, Ohio

RE: Public Comment regarding proposed injection wells to be located in Brookfield, Ohio

For more information: Contact Teresa Mills at 614-539-1471, tmills@chej.org or Jane Spies at 234-201-8007 or e-mail at frackfreeamerica@gmail.com

Buckeye Environmental Network, Center for Health, Environment and Justice, and Frackfree America National Coalition, based in Youngstown, Ohio are hereby calling for Ohio Department of Natural Resources (ODNR) Chief Simmers to deny the permits submitted by Highland Field Services, LLC, a subsidiary of Seneca Resources, Inc., seeking to locate two injection wells in Brookfield, Ohio.¹ This denial of permits must be done to protect the public health, safety, and welfare of residents of Brookfield, Ohio and the entire region which would be adversely impacted if the permits are granted. The region would be exposed to an unacceptable risk of potential irreparable harm if the injection well operation is allowed to begin.

There are precedents set by ODNR in stopping injection wells in the local area. In the following cases, the ODNR Chief must have believed that injection would be too high risk for protecting public health, safety, or the environment. The Khalil injection well in Mahoning County was stopped by ODNR. The Northstar 1 injection well was stopped right before a magnitude 4.0 earthquake.² Operation of an AWMS injection well in Weathersfield, Ohio has been suspended by ODNR for over two years. The suspensions of the injection well operations were related to the issue of induced seismicity. This was the right thing for ODNR to do in order to protect the public health and safety and the public interest. These were lawful and correct decisions by ODNR.

In fact, in an appellee brief of the Division of Oil and Gas Resources Management, dated September 22, 2016 (on the court docket) in the case involving the Weathersfield, Ohio injection well that has been suspended for over two years, the Division wrote:

“Should the Chief of the Division of Oil and Gas Resources Management (“Chief”) have to wait for a damaging earthquake to hit a community before issuing a chief’s order suspending operations? Of course not. Nonetheless, the implications of Appellant, American Water Management Services, LLC’s (“AWMS”) arguments would lead to this absurd result.”³

According to a local 2012 news report, ODNR Media Relations manager Heidi Hetzel-Evans addressed resolutions related to injection wells. The following quote is from the news report, “ In regard to these resolutions, Hetzel-Evans previously stated that the ODNR would deny any permit application if the opposing community could provide convincing evidence that health, safety or an environmental resource would be directly threatened by a well.”⁴

The amount of convincing evidence of unacceptable risks to public health, safety, and well-being posed by these proposed Brookfield, Ohio injection wells is overwhelming. As time goes on, there are even more relevant, scientific studies becoming available on the topic of injection wells and induced seismicity. We believe that every day, as waste fluid injection continues in Trumbull County and the surrounding region, the risk of negative impacts and man-made earthquakes increases.

This continuing injection of large amounts of waste must be legally stopped or northeast Ohio seismicity levels may start to resemble those of parts of Oklahoma where man-made earthquakes linked to disposal wells are rampant and cannot be effectively stopped by regulators despite their best efforts to do so. A strong injection well-related quake occurred in 2011 in Prague, Oklahoma – a magnitude 5.7.⁵ Pawnee, Oklahoma had a magnitude 5.8 quake which some people say is related to injection.⁶ There are numerous lawsuits occurring as Oklahoma residents say they are experiencing damage to their homes and other structures, including physical injury in some cases, from the man-made earthquakes.

Furthermore, monitoring earthquakes with seismometers will not stop the earthquakes. This will only let us know that we had a quake, but will not stop any potential damage. Human beings cannot control earthquakes with one hundred percent certainty. Our local homes, buildings, and infrastructure are not built to withstand earthquakes as are homes in California. This fact adds to the risk of potential quake damage. The cost to retrofit buildings or infrastructure to withstand earthquakes would be exorbitant.

The ODNR Chief has the legal authority and the duty to protect the public health, safety, and welfare of our communities being impacted, and potentially impacted, by oil and gas shale development and associated injection wells. According to Ohio law:

“(F) The chief shall issue an order denying a permit if the chief finds that there is a substantial risk that the operation will result in violations of this chapter or rules adopted under it that will present an imminent danger to public health or safety or damage to the environment, provided that where the chief finds that terms or conditions to the permit can reasonably be expected to prevent such violations, the chief shall issue the permit subject to those terms or conditions, including, if applicable, terms and conditions regarding subjects identified in rules adopted under section 1509.03 of the Revised Code. The issuance of a permit shall not be considered an order of the chief.”⁷

We say that there is absolutely no permit condition that the ODNR Chief can put in the permit that will protect the public from a potential induced earthquake, and potentially, a large, damaging quake. See a quote by Dr. Won-Young Kim in the endnote below.⁸

Earthquakes cannot be regulated. One need only look at the experience of Oklahoma where induced seismicity is continuing and has become an enormous concern and negative impact on public health, safety, and their environment. If regulators had the ability to stop the disposal-linked Oklahoma quakes they would have done so by now. Slowing them down is not stopping them. Instead the quakes are continuing in Oklahoma. We must learn from the experiences of those in Oklahoma and other states or countries suffering from injection or fracking-related induced seismicity.

To repeat, the ODNR Chief cannot prevent an earthquake by creating a permit condition. We believe that it is highly probable that more induced seismicity will occur as the volume of injected waste increases over time, as evidenced by the experience of those in Oklahoma who at one time had few

quakes and now have many. Since there is an imminent danger to public health, and no permit condition can prevent it in order to protect the public, the Chief must deny the two proposed permits in Brookfield, Ohio.

We say that Ohio, or any state, cannot be used as a toxic waste dump. No one's community anywhere should be used in this way. Our area is now earthquake-prone, as evidenced by numerous scientific studies, news reports, and documents. Therefore, we say it is highly immoral, reckless, and negligent to permit this waste to be injected into our densely populated communities where structures such as federally designated high hazard dams, schools, family homes, wetlands, parks or forests are located. There is no good or safe way to manage millions of gallons of toxic fracking waste that is constantly being created. Where will it all go? Furthermore, what might be the adverse impact to drinking water as a consequence of potential induced seismicity? We believe the injection wells pose an imminent danger to public health and safety and the environment, and must be legally stopped immediately.

Specifically, the proposed injection wells to be located in Brookfield, Ohio are way too close to family homes and businesses. Residents in this region remember very well the injection well spill that took place in Vienna, Ohio, that destroyed two wetlands and a pond.⁹ This region, or any region, cannot afford another fiasco like that. The injection-well truck traffic and negative impacts to air and land would be unacceptable if the Brookfield permits are granted and the operation begins. Property values will be negatively impacted. We believe there is a threat to drinking water posed by spills, or potentially, water problems that could be linked to induced seismicity if injection – well related earthquakes were to occur. This is especially so since this area has become prone to induced seismicity. These proposed injection wells in Brookfield, Ohio would not be that far away from other injection well operations, such as the injection well in Vienna, Ohio, also too near family homes, and North Lima, Ohio. What might be the cumulative negative impacts of having so many injection operations so closely located in one region?

The state believes, according to the AWMS court case, that the Weathersfield wells may be located near the same activated fault system as the one that resulted in the Northstar 1 injection well-linked 2011, magnitude 4.0 earthquake.¹⁰ Could the Brookfield, Ohio area be located near the same or perhaps another unknown fault system? No one knows where all of the faults are, therefore, permitting the proposed Brookfield injection wells would be gambling or experimenting while putting public health and safety at risk. Local residents will not and have not given their consent to be used as, in what might be termed, experimental human subjects in a company's or regulator's induced earthquake prevention experiment.

Since the magnitude 4.0 Youngstown quake, there have been more cases of induced seismicity in our region, including not only injection well-linked quakes, but also hydraulic fracturing linked quakes in Ohio and Pennsylvania. (Please also see the discussion of the Painesville area magnitude 5.0 quake and Ashtabula injection well earthquakes mentioned in the press release cited below.)¹¹

Some people might say, why worry about small earthquakes that cannot be felt? There are an abundance of reasons to be concerned. Small earthquakes can be harbingers of larger quakes. In the Youngstown Northstar 1 earthquake case, tremors went from magnitude 2.7 up to a 4.0 within one week's time.¹² Also, because injection well induced earthquakes may be shallower, could they be felt differently than natural earthquakes, and potentially cause damage even though they are lower magnitude quakes? (See the remarks of seismologist, Dr. Gail Atkinson, on how hydraulic fracturing

related quakes may be felt differently.¹³) Also, what might be the adverse effects of even small, repeated tremors on buildings or infrastructure?

Has Seneca Resources or ODNR looked at the possibility of mines being located near the proposed well sites in Brookfield? Have they looked at the possibility that the large amount of fracking waste that they are proposing to inject may greatly increase the probability of a large, damaging, quake? Have surface waters been looked at in relation to the proposed wells? Will there be lightning protection on these proposed wells, since it is known, for example, that injection wells can be subject to lightning strikes.¹⁴

A man-made earthquake can happen at any time. And, depending on its magnitude, this could become a public health issue not only for Ohio, but also Pennsylvania where induced earthquakes already have occurred linked to fracking. Every day, more and more fracking waste is being injected into Ohio. Each day that passes makes the next man-made earthquake more likely as the volume increases and underground pressure builds and waste pressure migrates. Just as an unstable old roof will not necessarily collapse right away as snow piles up upon it, over time it will reach its tipping point when it will collapse. Are we building up pressure now that will eventually result in a new activated unknown or known fault, or maybe “lubricate” an already activated fault, like that associated with Northstar 1 in Youngstown? We cannot afford to toy with earthquakes whose magnitudes have already reached 4.0 in our immediate area. There has also been induced seismicity in Ashtabula and suspected induced seismicity in the Painesville, Ohio area, years ago, and in other places such Poland, Ohio and the Marietta area, ¹“Permits Sought for 2 Injection Wells in Brookfield,” by Dan O’Brien, The Business Journal, February 2, 2017 <http://businessjournaldaily.com/permits-sought-for-2-injection-wells-in-brookfield> and elsewhere. Just because there may be no induced seismic activity, yet, does not mean that it won’t happen in the near or distant future.

There are no benefits of these injection wells to the local Brookfield community – only detriments or costs, which would fall to the public to bear if operators are not held accountable for any potential damage done. The immorality and recklessness of even considering locating waste injection wells so close to family homes is astonishing. How can any clear-thinking person think that this is a good idea? It isn't.

Has ODNR scrutinized the track record of the company trying to get permits to inject in Brookfield, Ohio? For example, violations and fines described in a 2014 StateImpact Pennsylvania article are very concerning.¹⁵ The community has a right to protect itself from similar potential infractions by any company.

According to the Ohio Constitution, “... All men are, by nature, free and independent, and have certain inalienable rights, among which are those of enjoying and defending life and liberty, acquiring, possessing, and protecting property, and seeking and obtaining happiness and safety. (1851)¹⁶

Ohioans have inalienable rights to protect their lives and their property, and their environmental resources, including their drinking water and air. All have a right to seek and obtain safety. This is exactly what Brookfield, Ohio residents are doing along with surrounding community members who are supporting Brookfield in their opposition to the two proposed injection wells. ODNR must deny the proposed Brookfield, Ohio permits.

The bottom line is: These proposed well permits must be denied by ODNR. The injection wells must not be allowed to operate for reasons described above and more that have not been elaborated upon here. Before Seneca puts any money in this, they and their investors need to understand that this is a bad business investment. It is astonishing, in light of the earthquake-prone nature of this area and the obvious dangers to public health and safety and the environment, that any company would seek to place their operation here, or anywhere, for that matter.

We ask ODNR to please review the following information about local injection wells and earthquakes and induced seismicity at the following link as part of our comment for the public comment period related to the proposed Brookfield, Ohio injection wells.

Thank you.

<http://frackfreemahoning.blogspot.com/2016/07/prayer-service-rally-july-12-2016.html>

¹ “Permits Sought for 2 Injection Wells in Brookfield,” by Dan O’Brien, The Business Journal, February 2, 2017 <http://businessjournaldaily.com/permits-sought-for-2-injection-wells-in-brookfield/>

² “Eastern Ohio rattled by 4.0 – magnitude earthquake,” CNN from Susan Candiotti and Ross Levitt, December 31, 2011 <http://www.cnn.com/2011/12/31/us/ohio-earthquake/>

³ Brief of Appellee, Division of Oil and Gas Resources Management, In the Court of Common Pleas Franklin County, Ohio, Case No. 16 CV 006218, September 22, 2016, page 1.

⁴ “Brookfield objects to some brine injection wells,” by Margaret Thompson, Shale Play, December 27, 2012 <http://shaleplayohiovalley.com/page/content.detail/id/500433/Brookfield-objects-to-some-brine-injection-wells.html?nav=5004>

⁵ “5.6 earthquake: 2016 has two of largest four quakes in state history; Saturday temblor matches state record,” by Paighen Harkins, Tulsa World, September 4, 2016, http://www.tulsaworld.com/earthquakes/earthquake-has-two-of-largest-four-quakes-in-state-history/article_2ba346d8-0045-5741-9314-36e042f6aaa5.html

⁶ “Pawnee Nation Sues Oklahoma Oil Companies in Tribal Court Over Earthquake Damage,” by The Associated Press, March 4, 2017, published in The New York Times, https://www.nytimes.com/2017/03/04/us/pawnee-nation-oklahoma-oil-earthquake-lawsuit.html?_r=0

⁷ Ohio Revised Code, LAWriter, Ohio Laws and Rules, <http://codes.ohio.gov/orc/1509>

⁸ See a Frackfree Mahoning Valley September 3, 2014, press release at <http://www.ohio.com/blogs/drilling/ohio-utica-shale-1.291290/frackfree-mahoning-valley-calls-for-halt-to-injection-wells-1.519578> “An important excerpt from a journal article discussing the Northstar 1 injection well by Dr. Won-Young Kim follows: “Although we do not know the WSW-ENE extent of the fault(s) in the Youngstown area, it is possible that continued injection of fluid at Northstar 1 well could have triggered potentially large and damaging earthquakes. “ JOURNAL OF GEOPHYSICAL RESEARCH: SOLID EARTH, VOL. 118, 3506–3518, doi:10.1002/jgrb.50247, 2013 “Induced seismicity associated with fluid injection into a deep well in Youngstown, Ohio,” Won-Young Kim <http://onlinelibrary.wiley.com/doi/10.1002/jgrb.50247/abstract> “

⁹ “ODNR Orders Kleese to Shut Down 5 Injection Wells,” by Dan O’Brien, April 7, 2015, The Business Journal, <http://businessjournaldaily.com/odnr-orders-kleese-to-shut-down-5-injection-wells/>

¹⁰ Brief of Appellee, Division of Oil and Gas Resources Management, In the Court of Common Pleas Franklin County, Ohio, Case No. 16 CV 006218, September 22, 2016, Page 9.

¹¹ To read more about man-made earthquakes and injection wells in our local area and elsewhere please see a Frackfree Mahoning Valley news release dated July 11, 2016 :
<http://frackfreemahoning.blogspot.com/2016/07/prayer-service-rally-july-12-2016.html>

¹² Court document, “Appellant Division of Oil & Gas Resources Management’s Reply to AWMS’s Response to Motion for Stay Pending Appeal of the December 23, 2016 Order From the Franklin Court of Common Pleas, Case No. 17-AP-45, February 7, 2017, In the Tenth District Court of Appeals, Franklin County, Ohio, page 3.

¹³ “Fracking Quakes Pose Added Risks and Require Study, Expert Warns Researchers need more seismic data to understand unique hazards,” by Andrew Nikiforuk, February 2, 2015, The Tyee
<https://thetyee.ca/News/2015/02/02/Fracking-Quakes-Study-Required/?PageSpeed=noscript>

¹⁴ [Colorado:] “Wastewater storage tank goes up in flames near Greeley,” by Will C. Holden and Web Staff, April 17, 2015, Fox 31, Denver <http://kdvr.com/2015/04/17/report-lightning-strike-sparks-oil-tank-fire-near-greeley-airport/> ; “Vienna seeks injection well aid,” by Virginia Shank, Tribune Chronicle, October 12, 2016, [The following quote addressed the issue of the Vienna, Ohio injection well not being “required to have lightning suppressors on their oil tanks” : “For example, the company installed vapor suppression systems that remove oxygen to decrease the chance of combustion. Also, the tanks the company installed are “low-profile, further mitigating risk,” Heis added.”] <http://www.tribtoday.com/news/local-news/2016/10/vienna-seeks-injection-well-aid/>

¹⁵ “DEP fined oil and gas companies \$2.5 million last year,” by Laura Legere, February 27, 2014, StateImpact Pennsylvania <https://stateimpact.npr.org/pennsylvania/2014/02/27/dep-fined-oil-and-gas-companies-2-5-million-last-year/>

¹⁶ Constitution of the State of Ohio, page 1 of the following PDF:
<https://www.legislature.ohio.gov/Assets/Laws/Constitution.pdf>