REGION 3

PHILADELPHIA, PA 19103

Responsiveness Summary to Public Comments
for
The Issuance of an Underground Injection Control (UIC) Permit
for
Seneca Resources Company, LLC

On May 22, 2024, the U.S. Environmental Protection Agency (EPA) Region 3 issued a public notice requesting comments and offering the opportunity for a public hearing for the proposed issuance of an Underground Injection Control (UIC) permit, PAS2D025BELK, to Seneca Resources Company, LLC (Seneca Resources) for Seneca injection well #38268. EPA received numerous requests to hold a hearing, and on June 24, 2024, EPA held a virtual public hearing. At this hearing, EPA received zero (0) additional oral comments from the eight (8) people in attendance. EPA also extended the period for submitting public comments until July 10, 2024.

The responsiveness summary which follows provides answers to questions and responses to comments raised by eight (8) commenting individuals and entities who sent a written public comment to the attention of EPA Region. EPA wishes to thank all commenters for their informative and thoughtful comments.

There have been two changes between the draft permit and the final permit. First, the business address of the injection well operator on the cover page of the draft permit was incorrectly listed as being in Highland Township, PA. The address has been corrected to being in Cranberry Township, PA in the final permit. After the Region issued the public notice of the draft permit, the Region discovered a typographical error in the draft permit. Part III.A.1 of the draft permit includes the following statement:

> Notwithstanding any other provision of this Permit, the Permittee shall inject through the Injection Well only into a formation which is separated from any USDW by a confining zone, as defined by 40 C.F.R. § 146.3, and is free of unknown open faults or fractures within the ¼ mile-radius Area of Review, as required by 40 C.F.R. § 146.22.

The phrase “unknown open faults or fractures” in the final permit was changed to “known open faults or fractures.”

To require that the wells inject into a formation separated by a confining zone free of **unknown** faults or fractures is illogical. If a fault or fracture is unknown, the permittee does not know whether or not it can inject into the injection zone. The Statement of Basis on page 3 in the discussion of the Potential for Seismicity references 40 C.F.R. § 146.22 and correctly states the requirement.

COMMENT 1: One commentor was concerned about the potential risks that injection wells pose when they are situated closely to unplugged or poorly plugged abandoned wells.

RESPONSE: The determination of possible influence of wells surrounding the proposed injection well is carried out during the assessment of the "Area of Review" or "AOR." Pursuant to the applicable regulations, 40 C.F.R. §§ 144.3 and 146.6(b), the Area of Review is an area surrounding the injection well for which the applicant must first research, and then develop, a program for corrective action to address any wells that penetrate the injection zone and which may provide conduits for fluid migration during the injection operation at the facility. The area of review can be a fixed radius of not less than one-quarter mile around an injection well or injection wells for an area permit or may be a calculated 'zone of endangering influence.' The zone of endangering influence calculation is based on geologic parameters found in the injection zone, such as permeability, porosity, etc. and proposed operational conditions, such as injection volumes, rates, length of injection, etc.

When Seneca Resources applied for the initial permit for this injection well, both it and the Region calculated the zone of endangering influence applying two different models. Seneca used the Matthews and Russel equation and EPA used the modified Theis equation as described in 40 C.F.R. 146.6. The parameters used in each calculation were based on analysis and results of injectivity testing conducted on the proposed injection well (#38268) in March 2012. Under both calculations the zone of endangering influence did not extend beyond the immediate area surrounding the well bore. Considering the ground water use and the historical practices in the area, EPA determined for the initial permit that extending the area of review to the one-quarter mile radius, thus incorporating a much broader area than would have been determined by the zone of endangering influence calculation, was reasonable.

For renewal of the permit, the Permittee proposed a fixed radius AOR of one-quarter mile. As with the initial permit, taking into account ground water use, and the historical practices in the area, EPA determined that a one-quarter mile radius AOR was reasonable. In determining the fixed radius, EPA considered the following information provided by the Permittee: current information available for all wells obtained from Seneca Resources Company, LLC internal records; maps produced by ARM Group LLC; and a list of property owners within ¼ mile of the wellbore.

The Permittee has reported the presence of one (1) plugged oil and gas well and one (1) existing oil and gas well within the Area of Review. The Permittee reports that it is using the one existing oil and gas well as a monitoring well for Seneca Well #38268. There is one (1) surface water body (unnamed tributary to Wolf Run) located 630 feet south of Seneca Well #38268.

If any unplugged/abandoned wells that penetrate the injection zone are found within the Area of Review at a later date, the final permit requires the Permittee to perform corrective action. For corrective action, the permit requires that, if an abandoned well is discovered within the AOR after injection operations begin, the Permittee must stop the injection operations and notify the EPA. Then, within five (5) days of discovering the abandoned well, the Permittee must submit to EPA a written plan for corrective action that is consistent with the requirements of 40 C.F.R. §§ 144-147. The Permittee cannot resume injection operations until EPA approves the corrective action plan and the Permittee has completed the actions specified in the plan. Paragraph III.A.4 of the Permit.

COMMENT 2: There is concern about Class II injection wells because they have caused earthquakes in other states like Texas and Ohio and that is why they will no longer accept this waste flow from Pennsylvania.

RESPONSE: With respect to seismicity generally and induced seismicity specifically, the SDWA regulations for Class II injection wells do not require consideration of the seismicity of the region, unlike the SDWA regulations for Class I injection wells used for the injection of hazardous wastes. See regulations for Class I hazardous injection wells at 40 C.F.R. §§ 146.62(b)(1) and 146.68(f). Nonetheless, because of public concerns about injection-induced seismicity, for the Seneca Well #38268, the EPA evaluated the factors relevant to seismic activity.

In general, regarding seismicity, a report from the *Commonwealth of Pennsylvania Department of Conservation and Natural Resources Bureau of Topographic and Geologic Survey*, "Earthquake Hazard in Pennsylvania" documents the known epicenters found in Pennsylvania. With regards to Elk County, Pennsylvania, the location of the well, per the report, there are no documented cases in which the epicenter of an earthquake was traced back to the county. On page 7 of the report, the author states, "The great majority of earthquakes occur along boundaries between tectonic plates. The reason for this is not completely clear, but it appears that stress levels are higher along plate boundaries, and that strain energy builds up more rapidly in those areas. Eastern North America, including Pennsylvania, today is far from the nearest plate boundary – the mid-Atlantic Ridge, some 2,000 miles to the East."

The United States Geological Survey (USGS) tracks, records and maps earthquake epicenters and faults in certain areas throughout the United States. According to Earthquake Hazard in Pennsylvania, the USGS rates the probability of seismic activity in western Pennsylvania with sufficient intensity to cause damage as low. The USGS as well as the Pennsylvania Bureau of Topographic and Geologic Survey have not recorded and EPA has not been notified of any seismic activity that originated in Elk County, Pennsylvania.

With regards to seismicity produced by human activity, according to data available to Region 3 in 2013, there had been very few documented cases of injection well-induced seismicity in the United States compared to the large number of wastewater disposal injection wells then in operation. Induced Seismicity Potential in Energy Technologies, National Academy Press, 2013, at p. 10-11, quoted in the Region 3 framework for evaluating seismic potential associated with UIC Class II permits ("Framework"). Since 2013, as far as the Region is aware, there have not been any cases of well-induced seismicity in Pennsylvania.

Region 3 has addressed the issue of induced seismicity more fully in the Framework. Much of the following discussion is taken from the Framework.

Scientists have long recognized that human activities, such as construction of dams and water reservoirs, mining and oil and gas production, can trigger seismic events, including those that are felt by humans. Under certain conditions, disposal of fluids through injection wells has the potential to cause human-induced seismicity. However, induced seismicity associated with fluid injection is uncommon, as additional conditions necessary to cause seismicity often are not present.

Seismic activity induced by Class II wells is likely to occur only where all of the following conditions are present: (1) there is a fault in a near-failure state of stress; (2) the fluid injected has a path of communication to the fault; and (3) the pressure exerted by the fluid is high enough and lasts long enough to cause movement along the fault line.

A fault is a fracture or a crack in the rocks that make up the Earth's crust, along which displacement (that is, when one body of rock moves with respect to another) has occurred. The presence of a fault in a formation receiving injected fluid potentially creates a more vulnerable condition for a future seismic event. During an earthquake, energy is radiated away from the area of the fault in the form of seismic waves. This causes the ground to move as the seismic waves travel away from the fault. Depending on the force of an earthquake, seismic waves can travel far away from the epicenter, and thus be felt far from where the fault is located.

Scientists believe that injection can cause seismicity when the pore pressure in the formation increases to such levels as to overcome the friction force that keeps a fault stable. Pore pressure (the pressure of fluid in the pores of the subsurface rocks) increases with increases in the volume of fluid injected and the rate of injection. Thus, where a fault exists in the formation receiving the injected fluid, the probability of triggering a significant seismic event during injection increases as the volume and rate of injection increase.

In addition, the larger the volume injected over time, the more likely the fluid intersects a fault because the fluid will travel farther within a formation. When injected fluid reaches a fault, frictional forces that have been maintained within that fault can be reduced by the fluid. At high enough pore pressure, the reduction in frictional forces can cause the formation to shift along the fault line, resulting in a seismic event. Therefore, limiting both the volume of the fluids injected on a monthly basis and the maximum injection pressure checks the potential for seismicity. (Paragraph III.B.3 of the final permit limits the Permittee to injecting no more than 75,000 barrels of injection fluid per month.)

Increases in pore pressure due to the volume of fluid injected and the rate of injection can act on existing faults and provide a mechanism for induced seismicity. Most examples of injection-induced seismicity are in cases where the receiving formation has low permeability and/or the pressure or volume of fluid injected over time is quite large.

Where permeability is not low in a formation, injected fluid flows reasonably easily through the pores in this rock and therefore flow is oriented mainly through the formation and not through existing fractures or faults in the rock. Injection into a more permeable sedimentary formation is much less likely to induce seismicity.

Because of the likelihood of greater permeability and the reduction in pore pressure in formations with a significant history of oil and gas production, such as the Elk 3 Sandstone Formation, injecting into such formations is unlikely to cause seismicity. As specified in the permit, the injection well will inject fluids only into the Elk 3 Sandstone Formation, which is the injection zone. The production of oil and/or gas, with the accompanying brine produced during such operations, results in the removal of large amounts of fluid from the formation. That means there has been a corresponding decrease in pore pressure in the formation. If injection occurs into these depleted reservoirs, pore

pressure may not reach the original levels, and in some cases, may not increase at all due to the relative volumes of injection versus extraction.

With this understanding of seismicity and underground injection in mind, for Seneca Well #38268, the characteristics of the Elk 3 Sandstone Formation, which is a sedimentary rock formation, particularity in the Area of Review make it unlikely that induced seismicity will occur as result of well injection. There are no known faults in the AOR and no history of seismicity in the Formation. (The final permit provides that Seneca shall only inject produced fluids through the injection well and into a formation which is overlain by a confining zone free of known open faults or fractures within the Area of Review, as required pursuant to 40 C.F.R. § 146.22.) Paragraph III.A.1 of the Permit. Again, according to data submitted by Seneca, the Formation's porosity and permeability in the AOR make it suitable for injection.

Additionally, to minimize conduits for fluid to potentially contaminate USDWs, operating conditions in an injection well permit can expressly limit the injection pressure to prevent fracturing (that is, the cracking of the rock) of the injection zone. The fractures could act as conduits through which fluid could flow and act upon an existing fault. In order to induce seismicity, pressure from the fluid injection would, first, have to be great enough to create or reopen fractures that would act as conduits and, second, would have to exert enough pressure and flow to overcome the frictional forces in the fault and thereby destabilize it. To prevent fracturing, Part III.B.4 of the Permit limits the injection pressure 1,416 psi. To calculate this limit, EPA did an analysis of the injectivity test provided in the permit application. The injectivity test, as performed by Seneca Resources and described in the permit application, is a procedure that establishes the rate and pressure at which fluid can be injected into a targeted zone without fracturing the formation.

Of the hundreds of thousands of injection wells operating in the United States, EPA is not aware of any case where a seismic event caused an injection well to contaminate a USDW nor is it aware of any reports of earthquakes having affected the integrity of injection wells in the cases of induced seismicity in Ohio, Texas, Oklahoma, West Virginia, or Arkansas.

A number of factors help to prevent injection wells from failing in a seismic event and contributing to the contamination of a USDW. Most deep injection wells, that are classified as Class II injection wells are constructed to withstand significant amounts of pressure. They are typically constructed with multiple strings of steel casing that are cemented in place. The casing in these wells is designed to withstand both significant internal and external pressure. The American Petroleum Institute (API) (see www.api.org) and oil and gas service companies such as Halliburton Services (see Halliburton Cementing Tables, 1980), have developed industry standards for casing and cementing wells. Drillers are required to follow these standards.

Furthermore, the final permit requires the well to be mechanically tested to ensure integrity before it is operated and will be continuously monitored during operation to ensure that the well's mechanical integrity is maintained. If a seismic event were to occur that affected the operation and mechanical integrity of the well, the well is designed to automatically detect a failure due to pressure changes in the well annulus between the long string casing and the injection tubing which would cause the well to automatically stop injection. See Paragraphs II.C.2 and II.C.5 of the permit.

The Region notes here in passing that, as part of its permit application, Seneca included Seismic Monitoring Reports for 2018, 2019, 2020, 2021, and 2022 supporting the claim that seismic activity is not known to exist within the area of the well. Furthermore, induced seismic events from underground injection have been noted to primarily occur in crystalline basement rocks. Analysis of depths to crystalline basement rocks completed by the Pennsylvania Department of Environmental Protection (PADEP) (February, 2017) show that crystalline basement rocks within the site area are located between 12,000 and 13,000 feet below ground surface. The separation of the injection "zone for Well #38268 and mapped crystalline basement rocks is offset by approximately 9,600 to 10,600 feet of overlying strata. Given all that is stated above, EPA thinks that the site conditions for the Seneca Well #38268 are favorable for injection.

COMMENT 3: One commentor stated that injection wells bring risk to the environment and human health. Another stated that these injection wells have leaked into the aquifer and other nearby wells. The waste is radioactive, has high salinity, and is laced with heavy metals and toxic chemicals. It is a toxic brew that should be handled as hazardous waste for the sake of the environment and public health. These injection wells threaten water sheds. An additional commentor stated that it has been proven over and over that injection wells are a threat to the environment, especially to water sources below ground.

RESPONSE: Seneca provided documentation identifying and describing the fluid to be injected, the groundwater use in the area, and the wells within the one-quarter mile Area of Review. The fluids are the byproducts of oil and gas production and are generated only by Seneca's oil and gas production facilities. The fluids include drilling fluids, produced brine, fracing fluids, etc. Fluids generated by other facilities are not permitted.

The permit application indicates that the produced fluids from each facility are similar in nature and that all come from the Upper Devonian formation. The nature of the produced fluid is not expected to vary much from load to load. In those instances where Seneca introduces a produced fluid with different characteristics, the Permit requires Seneca to conduct a new analysis. Part II.C.3 of the Permit.

The Elk 3 Sandstone Formation is an oil and gas bearing zone that has already produced oil and gas with the attendant flow of brine. As noted earlier, the production of oil and/or gas, with the accompanying brine produced during such operations, results in the removal of large amounts of fluid from the formation which makes the formation useful as an injection zone.

The wastewater injected into the well is limited to fluids, such as brine, produced solely in association with oil and gas production, and the additives necessary to maintain the integrity of the injection well. Paragraph III.B.2 of the permit. The fluids to be injected are the byproducts of oil and gas production and are likely similar to the fluids that would have come from oil and gas production from the injection zone. Therefore, the produced brine to be injected is compatible with the injection zone.

This limitation on the fluids to be injected reflects the classification of the well as a Class II well.

40 C.F.R. § 144.6(b)(1). Hazardous fluids that are not the result of oil and gas production are prohibited from injection into Class II wells. 40 C.F.R. § 144.6(b)(1). The wells that inject this type of hazardous fluids below the lowermost USDW are classified as Class I wells and must meet the requirements for that class of well. 40 C.F.R. § 144.6(a). Other types of wells that inject hazardous waste are classified as Class IV and are prohibited or severely restricted. 40 C.F.R. §§ 144.6(d) and 144.13.

While the individual constituents within the fluids produced from an oil or gas operation may be toxic, hazardous, or radioactive, these fluids are exempt from hazardous waste regulation as a result of Congressional action and a determination by EPA. Regulatory Determination, 53 FR 25446, 25456 (July 6, 1988). Such production wastes are not classified as hazardous under the Resource Conservation and Recovery Act (RCRA) and EPA lacks the authority to regulate the fluids as hazardous waste. Therefore, disposal of the fluids from oil and gas production wells by using a Class II brine disposal injection well is legally permissible.

At the same time, while the fluids are not subject to hazardous waste regulation, the UIC Program must protect USDWs from contamination by the oil and gas related fluids. In addition, by providing a regulatory framework whereby the fluids can be safely managed, the Program seeks to prevent oil and gas fluids from discharging uncontrollably into a stream or river, or from overflowing and/or seeping into the groundwater from above-ground containment pits.

Public and privately owned wastewater treatment facilities are unable to adequately remove many constituents found in brine from oil and gas production, such as for example, chlorides and bromides. When these constituents are discharged to streams or rivers, they can pose serious risk to fish and other aquatic organisms living in the stream as well as contribute to serious health effects for people who obtain their drinking water from these streams and rivers. The UIC permitting program is designed to provide an alternative through which injection activities may occur in a regulated and environmentally protective manner which ensures that best management practices are identified and employed.

EPA seeks to fulfill the Program's mandate through UIC well requirements that include strict well construction criteria, monitoring and reporting requirements, and environmentally protective plugging and abandonment requirements. EPA also works to fulfill the Program's mandate by establishing testing criteria for well construction and well integrity. As a final measure, EPA also inspects injection well operations. Because of these measures, Region 3 does not anticipate that any USDW, watershed, or drinking water utilities will be compromised by permitting underground injection through this well.

COMMENT 4: Where can one find reports regarding the volume of fracking waste injected over time at this site?

RESPONSE: Per Part III.B.2 of the final permit, Seneca Resources is limited to injecting no more than 75,000 barrels of injection fluid per month. To ensure compliance with this requirement, Seneca Resources must, as stated in Paragraph II.D.8 of the final permit, "The Permittee shall submit a written Annual Report (EPA Form 7520-11, entitled "Annual Class II Disposal/Injection Well Monitoring Report") to the Director, pursuant to Paragraph II.A. above, summarizing the results of Injection Well monitoring required by Paragraph II.C. of this Permit. This Annual Report shall include monthly

monitoring records of injected fluids, the results of any mechanical integrity test(s), and any major changes in characteristics or sources of injected fluids. This Annual Report shall also list the additives used in the operation of the Injection Well. The Permittee shall complete and submit this information with its Annual Report. The Permittee shall submit the Annual Report to the Director not later than January 31st of each calendar year, summarizing the activity of the calendar year ending the previous December 31st." As with all active UIC permits in Region 3, the annual report is published on the permit web page here: https://www.epa.gov/uic/uic-permit-pas2d025belk.

COMMENT 5: Is EPA willing to risk the citizens of Elk County simply because only about 45,000 citizens may be impacted? Years ago, EPA permitted 4 wells surrounding the Ridgway reservoir, the source for [our] drinking water. One well was installed without a blowout protector. Another company tried to install a pipe below the stream feeding Johnsonburg and had a blowout resulting in bentonite contamination.

RESPONSE: To the best of EPA's knowledge, these four wells were production wells. This was EPA's conclusion which was the result of discussing these four wells with PADEP. Because these were production wells and not UIC wells, the problems the commentor contends occurred with these other wells would not occur with a UIC well. The operating conditions required by the final permit and discussed in the response to comment 2 above are designed to ensure the integrity of the Seneca Well #38268 when it operates as an injection well. In addition, the other construction and operating conditions in the final permit were imposed to ensure the integrity of well and its operation.

Because Seneca Well #38268 is not a production well and is already constructed, EPA does not expect any issues with blowout potential regarding this permitting decision. As such, there is no requirement or reason to necessitate a blowout protector on this or any other UIC well. All other construction requirements of the injection well are in place in an effort to ensure that the well maintains mechanical integrity.

COMMENT 6: One commenter wanted to know what routes would be taken to deliver waste to this site. Another commentor stated that preserving this wildlife habitat and its tourism and recreational attractions is of grave importance to so many residents and visitors. This last comment was echoed by another commentor who noted that Elk County, where the well is located, is at the heart of recreation because of many outdoor activities and that more money is made in Pennsylvania because of recreation.

RESPONSE: The routes to be taken to deliver waste to the well site are not one of the factors for EPA to consider in issuing this permit. 40 C.F.R. § 146.24. Therefore, they do not fall under the purview of the UIC program, and, as such, the information is not available to be provided in this Response to Comments.

Also, as provided by Section 146.24, the status of wildlife habitat and recreation resources around a well are also not factors for EPA to consider in issuing the permit. Section 146.24 does require the permit applicant to submit information about some surface features and EPA to consider these features but this is in service of EPA issuing a UIC permit with conditions that protects underground sources of drinking water.

Because the legal effect of issuing the final permit for the well is limited, a permittee may have to obtain several other authorizations before it is allowed to commence construction and/or operation. The commentors' concerns might be addressed by the authorizations required by these other laws. Issuance of the final permit does not affect Seneca's obligation to comply with State and local legal requirements.

To this effect, the Final Permit contains several conditions that address compliance with other local, state, or federal laws. Paragraph I.A. of the permit provides that "Issuance of this Permit does not convey property rights or mineral rights of any sort or any exclusive privilege; nor does it authorize any injury to any persons or property, any invasion of other private rights, or any infringement of State or local law or regulations." In addition, Paragraph I.D.11 of the permit states, "Nothing in this Permit shall be construed to preclude the institution of any legal action or relieve the Permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation." Therefore, EPA's UIC permit is only one of several authorizations that a permittee may be required to obtain before being allowed to commence construction and/or operation.

COMMENT 7: Another commentor stated that fracking brine can be highly radioactive, and it is being dumped all over Pennsylvania roads.

RESPONSE: EPA addressed the radioactivity of the injectate in its Response to Comment 3. The Agency understands the concerns regarding fracking brine being dumped on Pennsylvania roads. Underground injection of fluids produced solely in association with oil and gas production into a Class II-D disposal injection well provides an alternative method to road dumping practices in an environmentally safe manner. Based upon the geological data that Seneca has submitted, the information it has submitted about wells in the Area of Review, and the requirements included in the final permit for construction and operation of the well, EPA's analysis is that injected fluids will be contained within the intended injection zone and discharges to any other unintended zones should not occur.