

**BEFORE THE ENVIRONMENTAL APPEALS BOARD
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C.**

In the Matter of:)
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Penneco Environmental Solutions, LLC)
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)

UIC Permit PAS2D701BALL)
)
_____)

Appeal No. UIC 18-02

**PENNECO ENVIRONMENTAL SOLUTIONS, LLC's
RESPONSE TO PETITION FOR REVIEW**

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| “Minimizing and Managing Potential Impacts of Induced-Seismicity from Class II Disposal Wells: A Practical Approach,” U.S. Environmental Protection Agency, UIC National Technical Workgroup (2015)..... | 9, 11-12, 15 |

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| “Seismicity in Pennsylvania from February 2013 to June 2015: Report submitted to the State Geologist and Director of the Bureau of Topographic and Geologic Survey, Department of Conservation and Natural Resources,” A. Nyblade and K. Homman, Pennsylvania State University Dept. of Geosciences (2016)..... | 13 |
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EXHIBIT LIST

Ex. A – April 12, 2016 Penneco UIC Permit Application Form Submission (Supporting Attachments Omitted) (“Permit Application”)

Ex. B. – July 8, 2016 Notice of Deficiency Letter re UIC Permit Application (“Notice of Deficiency”)

Ex. C. – September 10, 2016 Penneco Response to Notice of Deficiency (“NOD Response”)

Ex. D – Statement of Basis for Draft Penneco UIC Permit (“Statement of Basis”)

Ex. E – Final Penneco UIC Permit (“Permit”)

Ex. F – Response to Comments for the Issuance of Penneco UIC Permit (“Response to Comments”)

Ex. G – Transcript of Penneco UIC Permit Public Hearing (“Transcript”)

Ex. H – Public Notice of Draft Penneco UIC Permit (“Public Notice”)

STATEMENT OF COMPLIANCE WITH WORD LIMITATION

This Response does not exceed the word limitation established pursuant to 40 C.F.R. Section 124.19(d)(1)(iv).

I. INTRODUCTION

Penneco Environmental Solutions, LLC (“Penneco”) submits this Response to the Petition for Review filed with the Board by the Borough of Plum challenging Underground Injection Control (UIC) permit no. PAS2D701BALL (“Permit”) issued by the Environmental Protection Agency, Region III (“EPA”) for the operation of a Class IID brine disposal injection well known as the SEDAT #3A well (“SEDAT Well”). The Petition fails to meet its burden of establishing that Board review of the Permit is warranted because its arguments have been waived and it alleges no particularized facts or errors of law that establish deficiencies with EPA’s specific findings with respect to the geologic characteristics of the SEDAT Well. For these reasons, as explained below, the Board should deny the Petition for Review.

II. FACTUAL AND PROCEDURAL BACKGROUND

On March 9, 2016, Penneco submitted an application for a UIC permit to EPA for the operation of the SEDAT Well, located in Plum Borough, Allegheny County, Pennsylvania. Ex. A (Permit Application); Ex. B (Notice of Deficiency) at PENN-000009. The SEDAT Well is situated within the Murrys ville Sand as the injection zone target formation, with a maximum depth of approximately 1,940 feet. Ex. C (NOD Response) at PENN-000023; Ex. D (Statement of Basis) at PENN-000146. Penneco’s application included over 15 attachments and supporting documents, including, among other things, details on geologic data in the location of the proposed well, information regarding shallow drinking water wells and gas production wells in the area of the SEDAT Well, well engineering and construction plans, and operational

parameters such as average and maximum injection rates, volumes and pressures.¹ In addition, the application included details of the monitoring program to be implemented at the SEDAT Well, as well as contingency plans in the event of encountering operational issues.

Upon completing an initial review of Penneco's application, on July 8, 2016, EPA sent Penneco a Notice of Deficiency letter, requesting that Penneco submit further information on certain aspects of its application, specifically including a request for Penneco to expand geologic mapping and review, as well as to include discussion as to whether geologic displacement exists in the area of the proposed well to further confirm the absence of faults near the proposed well. Ex. B (Notice of Deficiency) at PENN-000012. EPA asked that Penneco submit a seismic evaluation of the area to confirm the lack of seismicity in the area and that injection to the SEDAT Well would not induce seismicity, inclusive of information from published geologic reports and United States Geologic Survey (USGS) Hazard Maps. *Id.*

On September 10, 2016, Penneco submitted a response to EPA's NOD Letter, which contained over 100 pages of additional material pertaining to EPA's requests for further information on geologic data, the absence of faults in the area, and the lack of potential for induced seismicity from injection to the SEDAT Well. Ex. C (NOD Response). In particular, Penneco included published geologic structure contour maps and cross section maps, and consulted additional published geologic literature for the area of the SEDAT Well and records associated with historical mining activities in the area to confirm that there were no faults in the target formation within the area of the SEDAT Well. Ex. C (NOD Response) at PENN-000023 – PENN-000137. Penneco reviewed and provided USGS Hazard Forecast maps for the area of the

¹ The attachments to Penneco's Permit Application are not included with this brief due to their voluminous size. However, each of the attachments is part of the administrative record and were originally identified within the Permit Application as Attachments A – U.

SEDAT Well, showing a very low comparative probability of seismic activity for the area. *Id.* at PENN-000040 – PENN-000043. Penneco also included the results of a Pennsylvania State University study based on USGS seismicity monitoring data and data from the Pennsylvania State Seismic Event Network (“PA SEIS”), finding no correlation between historical injection well and/or gas production activity and seismicity for the region. *Id.* at PENN-000079. Finally, Penneco included the results and underlying calculations from a series of geologic tests it conducted at the site to determine the Murrysville Sand formation’s closure stress, fracture extension and breakdown pressures, which all demonstrated that the maximum injection pressure and injection rate parameters for the SEDAT Well are less than the critical pressure values to initiate fractures in the Murrysville Sand formation. *Id.* at PENN-000094 – PENN-000137.

EPA reviewed and verified the information referenced in the permit application and Penneco’s response to the Notice of Deficiency and considered whether granting the Permit would be protective against endangerment from the proposed injection. Ex. D (Statement of Basis); Ex. E (Permit); Ex. F (Response to Comments). EPA also followed its September 2013 “Region 3 framework for evaluating seismic potential associated with UIC Class II permits” (“Regional Framework”),² as well as its 2015 UIC Technical Workgroup Report (“Minimizing and Managing Potential Impacts of Induced-Seismicity from Class II Disposal Wells: A Practical Approach”) for assessing induced seismicity concerns associated with injection wells. Ex. F (Response to Comments) at PENN-000176 – PENN-000180. Based on its review, EPA found Penneco’s submission, including the additional materials provided in response to the NOD Letter, as acceptable, and issued a draft permit and statement of basis on June 22, 2017, on which

² Available at [https://yosemite.epa.gov/oa/eab_web_docket.nsf/Attachments%20By%20ParentFilingId/0EA8C0D9BA82F48B85257CD9006624C2/\\$FILE/Tab%20I%20seismicity%20framework9-26-13.pdf](https://yosemite.epa.gov/oa/eab_web_docket.nsf/Attachments%20By%20ParentFilingId/0EA8C0D9BA82F48B85257CD9006624C2/$FILE/Tab%20I%20seismicity%20framework9-26-13.pdf).

day EPA also provided public notice of the draft permit in the Pittsburgh Tribune Review. Ex. H (Public Notice). During the comment period, the mayor of Plum Borough, among others, raised concerns regarding linkage between underground injection and induced seismicity, by referencing induced seismicity events from other regions.³ See, e.g., Ex. G (Transcript) at PENN-000204:13 – PENN-000205:4.

On March 7, 2018, EPA issued the Permit to Penneco for the SEDAT Well. Ex. E (Permit). EPA's Response to Comments document included details on EPA's findings regarding seismicity concerns raised during the comment period. Ex. F (Response to Comments). In making its final permit determination, EPA relied, in part, on its technical review of the geology of the injection and confining zones in the area of the SEDAT Well, the lack of a path of communication from the injected fluid to faults, and the limits on injection pressure and quantity/duration of injection. EPA determined that none of the conditions necessary to induce seismic activity exists at the SEDAT property, particularly under the permitted operating parameters. The characteristics of the SEDAT Well are thus factually distinct from cases in other regions of the United States in which injection was associated with induced seismicity. Ex. F at PENN-000176 – PENN-000180. EPA found that contamination of drinking water supplies due to well failure associated with a seismic event had never occurred previously, and that the design of the SEDAT Well was sufficient to mitigate any impacts by automatically ceasing injection in the unprecedented occurrence of well failure due to seismic activity. *Id.* at PENN-000180.

The Permit contains several conditions that restrict injection operations at the SEDAT Well, including maximum monthly limits on injection fluid quantity, maximum injection

³ None of the comments raised any of the articles provided for the first time within the Petition.

pressure and bottom-hole pressure, which were specifically calculated to prevent fracturing of the injection zone during operations. Ex. E (Permit) at PENN-000166. In addition, the Permit requires Penneco to conduct a pressure test to ensure mechanical integrity of the well prior to injection and continuous monitoring of these and other operational parameters upon commencing operations. *Id.* at PENN-000158, PENN-000163.

On April 2, 2018, the Borough of Plum filed a Petition for Review with the Board, raising the sole argument that “injection wells may cause an increase in seismic activity, and the effect of such increased seismic activity can impact underground sources of drinking water.” Petition at p. 3.⁴

III. STANDARD OF REVIEW

Pursuant to 40 C.F.R. Section 124.19, review of a UIC permit must be denied unless the Petition for Review establishes that the Permit was based on clearly erroneous finding(s) of fact or conclusion of law, or an issue involving an important matter of policy discretion that warrants review. A decision to grant review of a permit is a matter of discretion exercised by the Board, which discretion is exercised sparingly. *In re Beeland Group*, 14 E.A.D. 189, 195-196 (EAB 2008). It is the petitioner who bears the burden of demonstrating that review by the Board is warranted, and the burden is characterized as a “heavy” one. *In re Env'tl. Disposal Sys., Inc.* 12 E.A.D. 254, 264 (EAB 2005).

⁴ As part of its argument regarding potential for induced seismicity from UIC wells, the Petition for Review appears to generally allege that UIC injection wells are associated with movement of injected materials causing pollution in the event of well failures. Petition at pp. 4 – 5. However, the Petition does not identify any finding of fact or conclusion of law made by EPA in the permitting process for the SEDAT Well regarding pollution impacts due to fluid migration or movement. In addition, the relief requested by the Petition does not pertain in any way to such alleged concerns with fluid migration-based pollution. Therefore, the Petition for Review should be construed as limited to the issue of induced seismicity.

To meet such burden, a petition for review must demonstrate why EPA's response to comments on a given issue is clearly erroneous or warrants review. *Beeland Group*, 14 E.A.D. at 195-196; *In re Windfall Oil & Gas, Inc.*, 16 E.A.D. 769, 785 (EAB 2015); *In re Sammy-Mar, LLC*, 17 E.A.D. 88, 96 (EAB 2016). Neither generalized objections nor restatement of previous objections is sufficient to demonstrate that review of a specific permit decision is warranted. *Windfall*, 16 E.A.D. at 799. Review is not warranted where EPA's decision making regarding a permit is deemed rational. *Sammy-Mar*, 17 E.A.D. at 96. Moreover, where scientific or technical issues are raised by a petition, the Board defers to EPA's judgment on such issues unless it is clearly erroneous or irrational. *Windfall*, 16 E.A.D. at 777; *In re Bear Lake Properties, LLC*, 15 E.A.D. 630, 646 (EAB 2012); *In re Pennsylvania General Energy Co., LLC*, 16 E.A.D. 498, 510 (EAB 2014).

The scope of review is limited to issues raised and not waived in the permitting process below. 40 C.F.R. Section 124.19(a); *In re Chevron Michigan, LLC*, 2013 EPA App. LEXIS 39 at **24 – 27 (EAB 2013).

IV. PENNECO'S RESPONSE TO PETITION FOR REVIEW

The Borough has failed to meet its heavy burden of establishing that EPA committed clear error or that Board review of the Permit is warranted. As an initial matter, the Borough did not raise during the comment period the authorities it now cites in its Petition, such that the argument regarding induced seismicity is devoid of any authority from the permitting record and is thereby waived. In addition, the Borough merely raises non-site-specific concerns regarding unrelated instances in which UIC wells were associated with induced seismicity, all of which are situated in distinct regions and geologic formations, and were operated under fundamentally different operational characteristics than the SEDAT Well. The Petition for Review alleges no

particularized errors of fact or law in EPA's findings with respect to the geologic characteristics of the SEDAT Well site. Finally, the Borough raises a generalized argument that induced seismicity cannot be predicted. Such argument, which is far removed from consideration of the particular characteristics of the SEDAT Well site, is unsupported by the authorities that the Borough itself cites, is at odds with the greater weight of scientific research that EPA considered in its review of the Permit, and has been previously deemed by the Board as insufficient to warrant review or remand in analogous cases.

For these reasons, and because EPA otherwise complied with all regulatory requirements for issuing the Permit, the Board should deny the Petition for Review.

1. The Borough waived its induced seismicity objections to the Permit.

To obtain Board review of a UIC permit, a petitioner is required to demonstrate that the issue has been properly preserved. Under 40 C.F.R. Section 124.19(a), petitioners are required to "demonstrate, by providing specific citation to the administrative record ... that each issue being raised in the petition was raised during the public comment period ... to the extent required." In applying this provision, the Board has rejected appeals where arguments that were reasonably ascertainable during the comment period were not raised at that time but, instead, were presented for the first time on appeal. *See, e.g., In re Chevron Michigan, LLC*, 2013 EPA App. LEXIS 39 at **24 – 27 (EAB 2013). Of particular note, the Board declines to consider arguments that rely upon documents that existed at the time of the public comment period and whose applicability could have been raised in timely comments, but were nonetheless not raised during such periods. *Id.*; *Bear Lake*, 15 E.A.D. at 646.

Such principle has served as the basis for denial of petitions specifically in the context of UIC permit appeals based on seismicity concerns. For instance, in *Chevron*, a petition for review

of a UIC Class II permit contended that EPA's conclusions regarding the lack of faults in the area of the proposed well was erroneous. As support for its contention, the petition cited to a 2002 study that supposedly identified a fault in the area of the proposed well. 2013 EPA App. LEXIS 39 at *18. The Board denied review, finding that the 2002 study was available to the public at the time of the comment period but the petitioner failed to raise the study during the comment period for the draft permit. Accordingly, the petitioner failed to demonstrate that the issue was preserved for review. *Id.* at *26. Similarly, in *Bear Lake*, a petition for review of a UIC permit alleged seismicity concerns based upon two publications that purportedly indicated a relationship between injection wells and seismicity. 15 E.A.D. at 645. The Board denied review based on a multitude of reasons, including the fact that publications that were not part of the permitting record could not be considered by the Board. *Id.* at 646.

In this case, the Borough has engaged in the same practice, citing two publications⁵ that are not part of the permitting record and that were raised for the first time in its Petition. The Board does not consider publications that are not part of the permit record and should find that the Borough waived its seismicity argument. In addition, as explained below, these publications are insufficient to meet the Borough's burden of demonstrating clear error by EPA (especially considering the significant deference granted to EPA on such technical and scientific matters) or that review is otherwise warranted.

⁵ These include: P. Folger and M. Tiemann, "Human-Induced Earthquakes from Deep-Well Injection: A Brief Overview," Congressional Research Service (2015); J. Quigley, "Managing Induced Seismicity from Wastewater Injection Wells in Pennsylvania," Kleinman Center for Energy Policy.

2. *The Petition for Review fails to meet its burden of demonstrating that EPA committed clear error or that review is warranted.*

- a. The Petition does not allege any direct or specific deficiencies with EPA's findings regarding induced seismicity from the SEDAT Well.*

EPA's issuance of the Permit is based largely upon its application of its Regional Framework. Ex. F (Response to Comments) at PENN-000176 – PENN-000180. Through this analysis, EPA found that (1) there are no faults in a near-failure state of stress in the injection and confining zones of the SEDAT Well; (2) the fluid injected has no path of communication to such faults; and (3) the pressure exerted by the fluid is insufficient to allow for movement along a fault line. *Id.* at PENN-000177 – PENN-000179. This methodology for determining potential for induced seismicity has been acknowledged as authoritative by the Board,⁶ and is based upon the research findings of the EPA's UIC National Technical Workgroup discussed in "Minimizing and Managing Potential Impacts of Induced-Seismicity from Class II Disposal Wells: A Practical Approach" ("NTW Report"),⁷ as well as the findings of the National Academy of Sciences, discussed in "Induced Seismicity Potential in Energy Technologies" ("NAS Report").⁸ The Petition for Review does not directly challenge any of EPA's determinations regarding the three critical factors of induced seismicity to site-specific data from the area of the SEDAT Well.

⁶ See, e.g., *Windfall*, 16 E.A.D. 769, 798-799 (EAB 2015) (denying review of a UIC permit upon finding that EPA's resort to such criteria and the National Academy report reflected a thorough and rational response to concerns regarding induced seismicity); *Sammy-Mar*, 17 E.A.D. 88, 93-94 (EAB 2016) (referencing the NAS Report and the above factors for induced seismicity in denying an analogous petition for review). EPA specifically found that none of these three factors was implicated at the SEDAT Well.

⁷ Available at <https://www.epa.gov/sites/production/files/2015-08/documents/induced-seismicity-201502.pdf>.

⁸ Available at <https://www.nap.edu/catalog/13355/induced-seismicity-potential-in-energy-technologies>.

The Board has routinely denied such petitions that are devoid of specific information that establishes clear error on the part of EPA in the course of a UIC permitting decision. *See, e.g., Windfall*, 16 E.A.D. at 799 (“general statements, rather than specific arguments as to why [EPA’s] responses are erroneous or an abuse of discretion, do not meet the prerequisites for Board review”); *Sammy-Mar*, 17 E.A.D. at 96 (denying petition for review upon finding that petitioner failed to “substantively confront the permit issuer’s response to the petitioner’s previous objections”); *Pennsylvania General Energy*, 16 E.A.D. at 507 (“the [petition] does not address the [EPA’s] response to comments or explain why the response was clearly erroneous or otherwise warrants Board review”). Because the Borough fails to rebut any of EPA’s site-specific findings regarding the potential for induced seismicity from the SEDAT Well, the Petition should be denied.

- b. The Petition’s generalized arguments alleging deficiencies in EPA’s findings due to inherent uncertainty fail to satisfy the Borough’s burden of demonstrating clear error or that review is warranted.*

Instead of offering response or rebuttal to EPA’s specific findings regarding the critical factors of induced seismicity (e.g., absence of faults in the area, etc.), the Petition for Review offers a generalized argument that EPA’s analysis is “inherently suspect” purportedly based on “limited capability to predict human-cause earthquakes” due to uncertainty in estimating stress in the earth, “rudimentary knowledge of how injected fluids flow underground after injection, poor knowledge of faults that could potentially slip and cause earthquakes, and limited networks of seismometers.” Petition at pp. 5 – 6. The sole authority cited by the Borough on this point is a non-technical survey article, “Human-Induced Earthquakes from Deep-Well Injection: A Brief Overview,” P. Folger and M. Tiemann (2015) (“CRS Report”), that does not specifically

consider the comprehensive framework for evaluating potential for induced seismicity that EPA has developed based upon the scientific literature.

In denying a petition for review of a UIC Class II permit, the Board held in *Windfall* that such generalized concerns regarding “potential for unknowns mentioned that could cause earthquakes” are insufficient to meet a petitioner’s burden of establishing clear error by EPA or that review is warranted. 16 E.A.D. at 800.

As noted above, the Board has found as authoritative the NAS Report, which states that the most fundamental cause of seismic activity is the occurrence of slip (movement) along a preexisting fault. NAS Report at p. 37. It acknowledges that while prediction of the magnitude or occurrence of specific induced seismic events with certainty is not currently possible due to limited predictive modeling for natural rock systems, it concludes that the general mechanisms that are prerequisites to induced seismic events are indeed well understood. *Id.* at p. 7. The NAS Report finds that seismicity induced by human activity related to energy technologies is caused by critical change in pore pressure from fluid injection and/or change in stress taking place in the presence of (1) faults with specific properties and orientations, and (2) a critical state of stress in the rocks. *Id.*

Building upon the NAS Report, the NTW Report identified, based upon an exhaustive analysis of prior induced seismicity events and review of scientific literature, three critical components that are necessary to cause injection-induced seismicity: (1) a fault under stress, (2) formation pore pressure buildup from injection of fluids, and (3) a permeable avenue of communication between the area of pressure buildup and the stressed fault. NTW Report at p. 9. The NTW Report also acknowledged that it is “essential” to understand the geologic

characteristics of the particular site at issue in order to properly evaluate the potential for injection-induced seismicity from the site. *Id.* at ES-3.

Each of these reports is fully consistent with EPA's application of its Regional Framework for evaluating induced seismicity potential from the SEDAT Well. In particular, the existence of a fault within the injection and confining zones of the well to which fluid could be communicated is a prerequisite for inducing seismicity, but there are no such faults in the area of the SEDAT Well. Ex. F (Response to Comments) at PENN-000178; Ex. C (NOD Response) at PENN-000024 – PENN-000025. Moreover, injection pressure limitations foreclose the possibility of communication of fluid to any possibly unknown faults. Ex. F (Response to Comments) at PENN-000179; Ex. C (NOD Response) at PENN-000025. It is reasonable for EPA to rely upon the predominant scientific research (which the Board has previously recognized) in its review of the potential for induced seismicity from the SEDAT Well.

The Borough's reference to the CRS Report entirely fails to rebut the point that the fundamental causes of induced seismicity identified in the NAS and NTW Reports are simply not present in this case. The CRS Report notes that, notwithstanding supposed uncertainties in predicting human-caused earthquakes, modeling induced seismicity in fact fundamentally relies upon determination of whether injection of fluids will critically increase pore pressure in the target formation, which will propagate to pre-existing faults. CRS Report at p. 5. In this case, as discussed earlier, not only is it well established that there are no faults in the area of the SEDAT Well, Ex. F (Response to Comments) at PENN-000178; Ex. C (NOD Response) at PENN-000025 – PENN-000025 (and the Borough has produced no evidence to rebut this), but, in addition, injection pressure has been limited in the Permit based upon data gathered by formation testing of the Murrys ville Sand at the SEDAT Well site. Penneco must monitor the injection

pressure continuously to ensure that injection pressure will not propagate fractures in the formation.

Further, the CRS Report's concerns with uncertainty in predicting induced seismicity are, in part, based upon the assumption of a supposed lack of seismometer networks. CRS Report at p. 5. Such assumption is, however, not valid in Pennsylvania. Under the PA SEIS program, administered jointly between Pennsylvania State University, the Pennsylvania Department of Conservation and Natural Resources ("DCNR") and the Pennsylvania Department of Environmental Protection, a comprehensive network of over 40 seismometers has been installed across the state, including multiple monitors within approximately 25 miles of the SEDAT Well. Ex. C (NOD Response) at PENN-000062. Based on data from these seismometers and mapping of known injection wells, investigators from Pennsylvania State University found that within Pennsylvania, there were no spatial or temporal correlations with wastewater disposal activities and seismic activity detected from the PA SEIS seismometers. Ex. C (NOD Response) at PENN-000079; *see also* "Seismicity in Pennsylvania for February 2015 to June 2015," A. Nyblade and J. Homman, Pennsylvania State University Dept. of Geosciences, September 23, 2016 at p. 9.⁹

The results of this study were included by Penneco as part of its response to EPA's NOD Letter to provide additional information on the lack of potential for induced seismicity from the SEDAT Well. The study found no correlation between seismic activity recorded and waste water injection. *Id.* Such assessment, coupled with a lack of any faults in the injection and confining zones of the SEDAT Well, further supports a conclusion that there is no potential for induced seismicity from operation of the SEDAT Well.

⁹ Available at <http://paseis.geosc.psu.edu/Report/PASEISReport.pdf>.

Finally, even if the CRS Report were considered to be independently persuasive, the Board must defer to EPA on technical or scientific matters. *Windfall*, 16 E.A.D. at 777; *Bear Lake*, 15 E.A.D. at 646; *Pennsylvania General Energy*, 16 E.A.D. at 510. Assessment of potential for induced seismicity from a particular injection well is a highly technical and scientific matter. *Id.* Especially considering that the authorities on which EPA relies to support its findings have been previously found as authoritative by the Board, the Board should defer to EPA's conclusions on this issue.

The only other authority cited by the Borough regarding seismicity, "Managing Induced Seismicity from Wastewater Injection Wells in Pennsylvania," J. Quigley (2016), an online article with no indication of authorship by a seismologist or professional geologist, does not counter EPA's application of its Regional Framework for assessing potential for induced seismicity specifically at the SEDAT Well. The Quigley article merely references instances of induced seismicity that have occurred in other states, such as Oklahoma and Texas. As explained below, EPA not only acknowledged the occurrence of such events in its Response to Comments, but also examined potential causes of such events and contrasted the contributing causes involved in such cases to the characteristics associated with the SEDAT Well. Ex. F (Response to Comments) at PENN-000179 – PENN-000180. Nowhere does the Quigley article state that there are faults present at or near the SEDAT Well, that there is a path for fluid to communicate with such faults, or that the permitted injection pressure for the SEDAT Well is sufficient enough to cause formation fractures to give rise to induced seismicity. In fact, the Quigley article approvingly references seismicity data recorded through the PA SEIS program, which, as explained above, supports the conclusion that there is no statistical correlation between injection wells and seismicity recorded from the program's monitors. The Quigley article is

therefore both unpersuasive and otherwise fails to offer any site-specific information with respect to the SEDAT Well to counter EPA's particular findings on potential for induced seismicity that it made in the course of issuing the Permit.

The Petition is devoid of any site-specific information that counters EPA's findings that there are no faults in the area, that there is no potential for fluid communication with such faults, and that injection pressure is properly limited to prevent fracture propagation and eliminate potential for induced seismicity. Consistent with the deference that is accorded to EPA in such technical and scientific matters, as well as the long line of Board decisions involving analogous UIC permits, the Board should deny review of the Permit.

- c. EPA reasonably determined that concerns regarding induced seismicity specifically with respect to the SEDAT Well are unfounded.*

Even if the Board were to accept review of the Permit, EPA's Response to Comments provides a detailed discussion of why the SEDAT Well location does not exhibit any of the critical geologic conditions necessary to create a potential for induced seismicity. Based on a number of technical investigations of injection-induced seismicity, EPA developed a specific Regional Framework for assessing the potential for induced seismicity from a proposed injection well. Ex. F (Response to Comments) at PENN-000176. As discussed above, the critical factors that have been identified in determining such potential are: (1) whether there is a fault in a near-failure state of stress in the injection and confining zones in the area of the proposed well; (2) whether the fluid to be injected has a path of communication to the fault; and (3) whether the pressure exerted by the fluid is high enough and lasts long enough to allow movement along the fault line. *Id.*; see also NAS and NTW Reports. These considerations and supporting authorities have been found as authoritative by the Board. See, e.g., *Windfall*, 16 E.A.D. 769, 798-799 (EAB 2015) (denying review of a UIC permit upon finding that EPA's resort to such criteria and

the NAS Report reflected a thorough and rational response to concerns regarding induced seismicity); *Sammy-Mar*, 17 E.A.D. 88, 93-94 (EAB 2016) (referencing the NAS Report and the above factors for induced seismicity in denying an analogous petition for review). EPA specifically found that none of these three factors exist at, nor are they created by operation of, the SEDAT Well. EPA's findings in this case reflect those determinations it has made regarding seismicity concerns for other UIC permits, which have been held by the Board to be reasonable in its denial of petitions for review.

i. Lack of faults within the injection and confining zones near the SEDAT Well

Based upon its Regional Framework, EPA reviewed and verified available geologic and other data regarding the SEDAT Well to confirm the absence of each of the critical factors associated with induced seismicity. In particular, EPA found that the available geologic data do not indicate the presence of any faults in the injection and confining zones in the vicinity of the SEDAT Well. Ex. F (Response to Comments) at PENN-000178. EPA reasonably found that there are no faults in the injection and confining zones of the SEDAT Well, which demonstrates that there is no potential for communication of fluid to faults under the Regional Framework.

ii. Injection pressure and rate limitations

Despite the fact that there are no known faults in the injection and confining zones of the SEDAT Well, EPA included injection pressure limitations in the Permit to eliminate the possibility of the creation of new fractures or the propagation of existing fractures in the formation that could allow for fluid transmission to unknown or undiscovered faults. These injection pressure limitations were based on an exhaustive battery of reservoir and fracture characterization tests performed by Penneco as part of its Permit application to determine the inputs that go into calculating maximum injection pressure, including but not limited to

formation breakdown pressure, reservoir pressure, bottomhole closure stress surface and, perhaps most critically, instantaneous shut-in pressure (ISIP). Ex. C (NOD Response) at PENN-000097. ISIP is the minimum pressure necessary to begin to reopen any fractures created during the fracture stimulation process and is significantly lower than the pressure necessary to fracture the rock. Ex. F (Response to Comments) at PENN-000176; Ex. E (Permit) at PENN-000166; Ex. C (NOD Response) at PENN-000097. EPA limited injection pressure and bottom-hole injection pressure so that it would not exceed either the ISIP or the fracture pressure, thereby preventing both initiation of new fractures and the propagation of existing fractures. Ex. F (Response to Comments) at PENN-000179. The Permit expressly prohibits injection of fluid at a pressure that initiates fractures in the confining zone, adjacent to a USDW, or that causes the movement of injection or formation fluids into a USDW. Ex. E (Permit) PENN-000166. The Permit is thus protective against theoretical induced seismicity, even if otherwise undiscovered faults are present.

iii. Critical differences between SEDAT Well characteristics and other wells associated with induced seismicity

EPA considered the well depth, injection volume, rate and pressure for the SEDAT Well in comparison with injection wells that were associated with induced seismicity events and found stark differences. In particular, EPA found that the Murrysville Sand formation has a much higher porosity and much shallower depth than crystalline bedrock formations, such as the Blairsville-Broadtop Lineament formation in which induced seismicity was found to occur from an Ohio injection well some 9,000 feet deeper than the Murrysville Sand. Ex. F (Response to Comments) at PENN-000179. The Murrysville Sand's higher porosity indicates that it will far more readily store injected fluid, reducing the potential for fluid transmission through fractures.

Moreover, the injection rates and pressures for the SEDAT Well are much less than those associated with induced seismicity events observed in Texas, Oklahoma and Arkansas, in which injected fluid likely fractured the formation and were transmitted to faults, which in turn reduced frictional stress between faults causing slippage and seismic activity. *Id.* at PENN-000170 – PENN-000180. The Borough has provided no explanation or argument that disputes EPA’s findings or that any of the critical factors necessary to induce seismicity are implicated by the SEDAT Well.

iv. Lack of seismic activity

Finally, EPA reviewed USGS seismicity hazard data provided by Penneco and gathered on its own additional data from USGS and the DCNR that demonstrates no seismic activity has ever been recorded that originated in Allegheny County. *Id.* at PENN-000178. In response to the potential for seismicity-based well failure and USDW contamination, EPA noted that of approximately 30,000 Class II-D brine wastewater disposal wells that operate in the United States, not one has ever caused contamination of a USDW due to seismic events. *Id.* at PENN-000180. Even if such pathway for contamination were assumed, the design of the SEDAT Well is sufficiently protective to prevent contamination by meeting continuous mechanical integrity requirements and automatic injection cut-off if integrity is compromised through detection of pressure changes in the well annulus. *Id.*

Throughout the permitting process for the SEDAT Well, EPA actively considered the potential for induced seismicity. This is evident based upon EPA’s specific request for additional geologic data and information to rule out potential for induced seismicity during consideration of the permit application and prior to issuance of a draft permit. Ex. B (Notice of Deficiency) at PENN-000012. Upon reviewing and verifying the pertinent data in the

application, EPA properly determined that none of the critical factors associated with induced seismicity exist at, nor are created by, the operation of the SEDAT Well, and EPA's Response to Comments and materials contained within Penneco's Permit application comprehensively discuss this in addressing the concerns raised during the comment period regarding seismicity.

The Board has regularly found such degree of analysis of seismicity concerns and site-specific data as more than sufficient to support UIC permit determinations, and has routinely denied review of petitions that allege generalized and non-site-specific deficiencies with such analysis, as the Borough does here.

A case with striking similarities is *Windfall*, 16 E.A.D. 769 (EAB 2015), in which petitioners appealed a UIC Class II permit for a proposed injection well in Clearfield County, PA. The consolidated petitions for review alleged seismicity concerns due to the proposed injection well, generally asserting that "residents in areas with no seismic activity have experienced seismic activity due to injection wells." *Id.* at 798. As here, the petitioners pointed to no site-specific evidence of potential for induced seismicity, including data pertaining to the three critical factors of induced seismicity under the Regional Framework.

EPA had responded to such comments in its response to comments document issued alongside the UIC permit, in which it provided "background information on induced seismic activity; known faults near the proposed well; factors affecting fluid transmission and pore pressure; comparisons of the geology and factors influencing induced seismic events in other parts of the country due to injection activities; the general suitability of the depleted oil and gas formation for underground injection; and the potential for seismic events to contribute to groundwater contamination." 16 E.A.D. at 799; *see also* response to comments, EAB Consolidated Docket 14-73, No. 130, Attachment 58 ("Windfall response to comments"). EPA

found that, upon consideration of these factors, granting the UIC permit would be protective against potential for induced seismicity. The Board characterized the EPA's response to comments as "thorough" and denied review. *Id.* at 799 – 800.

EPA's Response to Comments for the SEDAT Well closely mirrors the seismicity discussion in the response to comments document prepared in *Windfall*. Compare Ex. F (Response to Comments) at PENN-000176 – PENN-000180, with *Windfall* response to comments, pp. 6 – 11. Each of the topics discussed in *Windfall* are present in nearly equivalent detail in this case, of course adapted to the particular geologic data associated with the SEDAT Well. EPA properly identified the critical factors that have been found to create potential for induced seismicity, applied site-specific data to each of these factors, and reasonably found that the SEDAT Well implicates none of them.

The Board reached an identical result in *Sammy-Mar*, 17 E.A.D. 88 (EAB 2016), where petitioners appealed a UIC Class II permit in Clearfield County, PA, alleging that there was strong evidence that underground injection of fluids is a trigger that has led to seismic events, and citing to various cases in the United States regarding injection-induced seismicity. The Board denied review, primarily based upon EPA's "extensive" response to comments that bears striking similarities in the level of detail contained in the Response to Comments issued by EPA in this case. *Id.* at 93.¹⁰

¹⁰EPA's response to comments included: (1) background discussion on induced seismic activity, including citation to the NAS Report; (2) an evaluation of factors relevant to seismic activity including the existence of known faults and/or fractures and history of and potential for seismic events in the area around the well based on USGS and DCNR data; (3) discussion of factors affecting fluid transmission and pore pressure and the relationship of over-pressurization to seismic activity; (4) discussion of seismic events occurring elsewhere; and (5) discussion of the potential for contamination of USDWs resulting from earthquakes. *Id.*; 17 E.A.D. at 93 – 96.

Similarly, in *Bear Lake*, 15 E.A.D. 630 (EAB 2012), a petition for review of a UIC Class II well permitted in Warren County, PA alleged concerns regarding induced seismicity from a proposed injection well, stating that a link existed between earthquakes and injection wells, referencing various induced seismicity events in other regions, and arguing that based on such link, it was unreasonable for EPA to permit the proposed well. *Id.* at 644 – 645. EPA addressed seismicity concerns in its response to comments document by noting that each of the instances of induced seismicity occurred in distinct regions, and that the wells would be permitted and operated at a pressure well below formation fracture pressure. *Id.* The Board found EPA’s basis as reasonable and denied the petition, finding that there was no evidence to suggest that there was potential for induced seismicity from the proposed well. *Id.* at 646.

Further Board decisions weigh towards denial of the cursory and non-site-specific Petition at issue in this case. *See, e.g., Pennsylvania General Energy*, 16 E.A.D. 498 (EAB 2014) (denying a petition for review referencing induced seismicity events in other regions, finding as “thorough and rational” EPA’s Responsiveness Summary analysis that concluded there were no faults in a near-failure state of stress, no path of communication between injected fluid and a fault, and insufficient pressure of injected fluids to cause movement along a fault based on maximum injection pressure limitations specified in the permit); *In re Seneca Resources*, 16 E.A.D. 411 (EAB 2014) (dismissing generalized seismicity concerns regarding a UIC injection well permit in Pennsylvania where petitioners resorted to referencing induced seismicity events in Oklahoma and Texas).¹¹

¹¹ The sole case in which the Board remanded a UIC permit for seismicity-related concerns, *In re Stonehaven Energy Management*, 15 E.A.D. 817 (EAB 2013), involved factual circumstances that are fundamentally distinct from those presented here. In *Stonehaven*, the petitioner alleged that there was evidence of seismic activity in the area around the proposed well, and that the

Because EPA's determinations, which are supported by its Regional Framework and credible scientific authorities, and which are in line with those findings it previously made regarding similar UIC permits which the Board has held as reasonable, establish that there is no evidence to suggest that the SEDAT Well carries potential for inducing seismicity, the Petition should be denied.

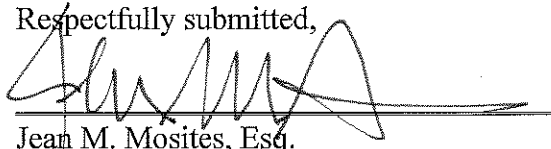
V. CONCLUSION

The Petition for Review fails to demonstrate that the SEDAT Well UIC Permit is based on clearly erroneous findings of fact, or an exercise of discretion or important policy consideration which the Board should, in its sparing discretion, review. Therefore, Penneco requests that the Board deny the Petition.

proposed well could affect a specifically identified fault within the same formation targeted by the proposed well, creating potential for induced seismicity. *Id.* at 829. EPA responded by stating that the well was not located in a seismically active area, and that there are no deep-seated transmissive faults that intersect or could be influenced by the intended zone of injection for the permit. *Id.* at 830. The Board remanded the permit because it could not find anything in the administrative record to support either of EPA's determinations. EPA had not discussed what information or records were searched, or what data were relied upon to document the lack of seismic activity in the well location. *Id.* at 831 – 832. After remand, EPA did not revise the permit to add any conditions related to seismicity.

Contrary to the *Stonehaven* record, the record here specifically identifies the authorities supporting EPA's conclusion that there are no faults within the injection of confining zones of the SEDAT Well. In particular, EPA stated that Penneco "submitted, and EPA verified, geological information indicating the absence of faults in the injection and confining zones in the vicinity of the proposed injection well," including, among other things, numerous published geologic structure contour and cross section maps, Atlas No. 36, and USGS and DCNR databases. Ex. F (Response to Comments) at PENN-000176; Ex. C (NOD Response) at PENN-000024 – PENN-000025. The administrative record here is substantial and well-documented to support EPA's findings.

Respectfully submitted,



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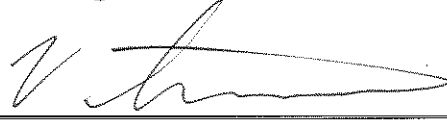
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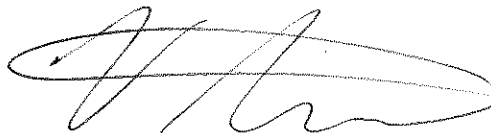
Dated: May 18, 2018

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing was served by e-mail and overnight mail this 18th day of May, 2018, upon the persons listed below:

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