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

In re:	)
Panoche Energy Center, LLC, Class I Underground Injection Wells 1-6, Permit No. R9UIC-CA1-FY17-2R	)

PETITION FOR REVIEW

TABLE OF CONTENTS

TABLE OF AUTHORITIES

Page(s)

Cases

Other Authorities

INTRODUCTION

Pursuant to 40 C.F.R. § 124.19(a), Panoche Energy Center, LLC ("Petitioner" or "PEC") petitions for review of certain conditions of federal Underground Injection Control ("UIC") Class I Non-hazardous Permit No. R9UIC-CA1-FY17-2R ("the Permit"), issued to PEC on September 30, 2022 by the U.S. Environmental Protection Agency, Region 9 ("EPA") (attached hereto as Attachment 1).

PEC operates a 417 megawatt simple cycle power generation plant, critical to the reliability of California's electrical grid, consisting of four natural gas-fired combustion turbine generators located in Central California. PEC operates under the terms of a long-term Power Purchase Agreement with Pacific Gas and Electric Company through July 2029. To address waste water associated with power generation, the Permit authorizes PEC to continue operating four injection wells, and to construct up to two additional wells with no change in injection volume or maximum allowable injection pressure. PEC has operated the injection wells since 2008 under a prior UIC permit.

PEC challenges certain conditions of the Permit, specifically Part II.E.2, that require PEC to expend millions of dollars drilling and operating a 3,953 foot-deep monitoring well without factual justification and for no rational purpose. PEC undertook an analysis of abandoned wells within the Area of Review ("AoR") specified by EPA regulations and found no risk of endangerment to Underground Sources of Drinking Water ("USDWs") from PEC's injection activities. EPA agreed there was no risk of endangerment and required no corrective actions.

Despite that finding of no endangerment, EPA contends that a monitoring well is required because of EPA's "concerns" that drilling muds used in the 1970s to seal wells within the AoR

may have somehow deteriorated over time, such that there is "potential" risk of endangerment to USDWs.

Overwhelming evidence in the record cuts against EPA's concerns and shows no potential risk of endangerment to USDWs from PEC's injection activities. Records for each well in the AoR demonstrate they were properly plugged, sealed and decommissioned with oversight by California regulators. EPA agrees that no indication of failure exists at any of these wells. Projections provided by PEC show that the weight of drilling muds alone in the wellbores can withstand nearly four times the change in pressure expected to occur from PEC's activities at these abandoned wells from PEC's activities adjacent to where EPA is requiring a monitoring well. The analysis used to demonstrate this was approved by EPA and was extremely conservative, such that additional pressure control from gel strength of the mud, cement plugs in the wellbore, and a steel plate welded over top of the wellhead was not accounted for during the AoR analysis. The Permit authorizes PEC to inject fluids at 7,199 to 8,897 feet below ground, which is thousands of feet beneath any USDWs. Even if the drilling muds, concrete plugs and steel caps employed to the plug the wells in the AoR somehow failed, the record shows that multiple different layers of the underground geology would inhibit fluids from migrating up an abandoned wellbore before reaching any USDW.

Under EPA's regulations, implementing an "ambient monitoring" program is not a criteria to issue a Class I UIC permit. Rather, ambient monitoring must be "based on a site-specific assessment of the potential for fluid movement from the well or injection zone *and* on the potential value of monitoring wells to detect such movement." 40 C.F.R. § 146.13(b)(1) (emphasis added). In this case, EPA's "site-specific assessment" was deficient. EPA disregarded the entire and extensive record, based on empirical data, technical literature, well

closure reports, and site-specific modeling, which show no potential risk of movement of fluids from the injection zone into USDWs. EPA's site-specific assessment is based on a speculative theory that the drilling muds in abandoned wells are old and might fail. EPA points to no site-specific technical data or site-specific literature in support of its conclusion. Rather, EPA points to a study of a different site (in Utah) where drilling muds in wells that were *improperly* plugged and abandoned *may* have failed.

The sole piece of evidence EPA cited in its Response to Comments – the Utah study – is thus totally irrelevant to *the PEC AoR* where all wells were properly plugged and abandoned, the plugging and abandonment was witnessed and certified by the California Geologic Energy Management Division (CalGEM), and no indication of well failure exists. Moreover, the Utah study concludes that injection activities in the area *were not* the cause of water quality changes in USDWs. A study from a different site with different conditions, combined with EPA's speculation that "old" drilling muds in a properly plugged and abandoned wells at this site *might* somehow fail, cannot constitute the requisite "site-specific assessment" necessary to impose a multi-million dollar monitoring requirement. EPA's monitoring requirement is clearly erroneous because it lacks a rational foundation supported by the record.

Nor is there any rational purpose for the monitoring well. EPA required the monitoring well to provide "early warning should the assumptions about gel strength in wells in the AoR be inaccurate and potentially allow fluid movement to USDWs." But the criteria PEC is required to monitor for under the Permit would not provide any such "early warning," as observed changes in water quality could be caused by a variety of factors totally unrelated to PEC's injection activities. There is a mismatch between the concern EPA identified and the ambient monitoring

it required. The other monitoring conditions of the Permit are sufficient, and indeed more likely, to provide the "early warning" EPA contends is necessary.

The Board should vacate and remand to require removal of the Permit condition requiring PEC to construct and operate an ambient monitoring well.

THRESHOLD PROCEDURAL REQUIREMENTS

Petitioner satisfies the threshold requirements for filing a petition for review under 40 C.F.R. part 124, as follows:

1. Petitioner has standing to petition for review of the Permit because it is the permittee and is thereby directly affected by the conditions of the Permit, and it participated in the public comment period on the Permit. See 40 C.F.R. §124.19(a). PEC's written comments dated May 11, 2021 ("PEC Comments") will be included in the Administrative Record (also attached hereto as Attachment 2).

2. The issues raised by Petitioner in this petition were raised during the public comment period and therefore preserved for review. See PEC Comments at pp. 1-35; EPA's Response to Comments ("RTC") (attached hereto as Attachment 3), Comment Nos. 1-14, at pp. 2-15.

FACTUAL BACKGROUND

A. Description of Panoche Energy Center

In the early 2000s Pacific Gas and Electric Company selected PEC to construct and operate a simple cycle power generation plant consisting of four natural gas-fired combustion turbine generators because such a plant possesses operating characteristics favorable to stabilizing California's electric grid and meeting peak consumer demand. PEC, having an industry-leading generation availability rate of 97.9%, is and will continue to be critical to grid

stability for the foreseeable future, given the difficulty to develop new fired natural gas generation plants under California's current regulations. In addition, PEC is positioned to support the grid during California's buildout of intermittent renewables generation, including solar and wind generation. Throughout this buildout, there will be a sustained period of significant reliance on flexible supply resources, such as PEC, which has a rapid-start capability to reach full load in less than 10 minutes.

With respect to injection activities, in April 2008, EPA issued a federal Class I UIC permit authorizing PEC to construct and operate up to six injection wells (the "Facility") at the PEC site. PEC installed four wells at the Facility between 2008 and 2009.

B. PEC's Permit Renewal Negotiations with EPA

In October 2017, PEC submitted a renewal application to EPA. Thereafter, a series of communications and submittals began. *See* PEC Comments at Attachment 1. On July 27, 2020, EPA shared an early draft of the permit with PEC. That draft included a "corrective action," which in part required PEC to install a monitoring well within 100 feet of the Silver Creek 18 Well ("Silver Creek"), an abandoned well located within the AoR, "in order to evaluate injection zone conditions" and "identify potential changes in the USDW." *See* PEC Comments at Attachment 1. Because PEC demonstrated that there is no potential for endangerment to USDWs, consistent with 40 C.F.R. §§ 144.55 and 146.7, EPA removed the monitoring well requirement as a "corrective action" when it published a draft permit for public comment on April 12, 2021. *See* Draft Permit Part II.C (attached hereto as Attachment 4). But EPA included the very same requirement to construct and operate an "ambient monitoring" well as a new "monitoring condition" in the published draft, as well as in the Permit issued by EPA on September 30, 2022. *See* Draft Permit Part II.E.2; Permit Part II.E.2. PEC challenged the

inclusion of the ambient monitoring well during the notice and comment process and now challenges it through this appeal.

Part II.E.2 of the Permit requires PEC to install an ambient monitoring well "to perform chemical analysis and measure specific conductance and formation pressure in order to identify potential changes in the USDW" within 100 feet of Silver Creek. Monitoring is to occur immediately adjacent to a properly plugged and abandoned well, and in a formation more than 3,000 feet above the injection zone, which is separated from the injection zone by two confining layers and an intervening buffer aquifer that is more than a mile away from the Facility injection site. PEC does not own or have rights to access the land on which Silver Creek is located. In addition to daily monitoring for conductivity and pressure, Part II.E.2 also requires PEC to sample and perform chemical analysis for various other parameters (TDS, alkalinity, anions and cations, trace metals, hardness, pH, specific gravity, total sulfide, oil and grease, and total metals). Such sampling and analysis must be performed monthly for the first year and quarterly thereafter.

The requirements under Part II.E.2 of the Permit to install an ambient monitoring well and perform monitoring and sampling are herein referred to as the "Ambient Monitoring Requirement."

C. PEC's Conservative Analysis of Potential Endangerment of USDWs

PEC developed information and analysis to support EPA's issuance of a renewed UIC permit for the Facility. Over that time, PEC has demonstrated that no empirical basis exists to conclude that ongoing injection activities will result in the movement of fluids from the injection zone into a USDW, and therefore, do not present a potential endangerment to USDWs.

As part of its analysis, PEC demonstrated through an extensive evaluation of CalGEM records that none of the wells within the AoR were improperly plugged and abandoned. EPA accepted that analysis in reaching the conclusion in the Draft Permit that no "corrective action" is required because PEC has demonstrated, consistent with 40 C.F.R. §§ 144.55 and 146.7, that there is no potential for endangerment to USDWs. This conclusion is supported by five factors:

(1) PEC's quantitative analysis demonstrating that the hydrostatic pressure in the reservoir will not exceed the pressure required to move fluid in any of the wells;

(2) Compliance with UIC regulations for Class I non-hazardous waste injection wells, *and* voluntary use of UIC regulations for Class I *hazardous waste* injection wells for USDW endangerment analysis (this quantitative analysis is thus more protective than the applicable Class I non-hazardous injection well regulations require);

(3) PEC's conservative assumptions when completing its analysis and modeling associated with its operations and AoR analysis;

(4) Detailed certification records demonstrating the proper plug and abandonment of the wells in the AoR; and

(5) Two separate confining layers and an aquifer buffer zone between the injection zone and overlying USDWs.

1. PEC voluntarily used Class I hazardous waste injection well regulations for the USDW endangerment analysis.

PEC applied for a UIC Class I non-hazardous permit. Regulatory requirements for a Class I non-hazardous injection well are substantially different than for a Class I hazardous waste injection well. *Compare* 40 C.F.R. 146, subpart B *to* 40 C.F.R. 146, subpart G.

In developing the Facility, PEC met all the conditions for a Class I non-hazardous well permit. In addition, PEC met the following three conditions that apply to hazardous waste wells. *See* 40 C.F.R. § 146.62 (c)(1)-(2) and (d)(1). First, PEC demonstrated that the injection zone has sufficient permeability, porosity, thickness and areal extent to prevent migration of fluids into USDWs.

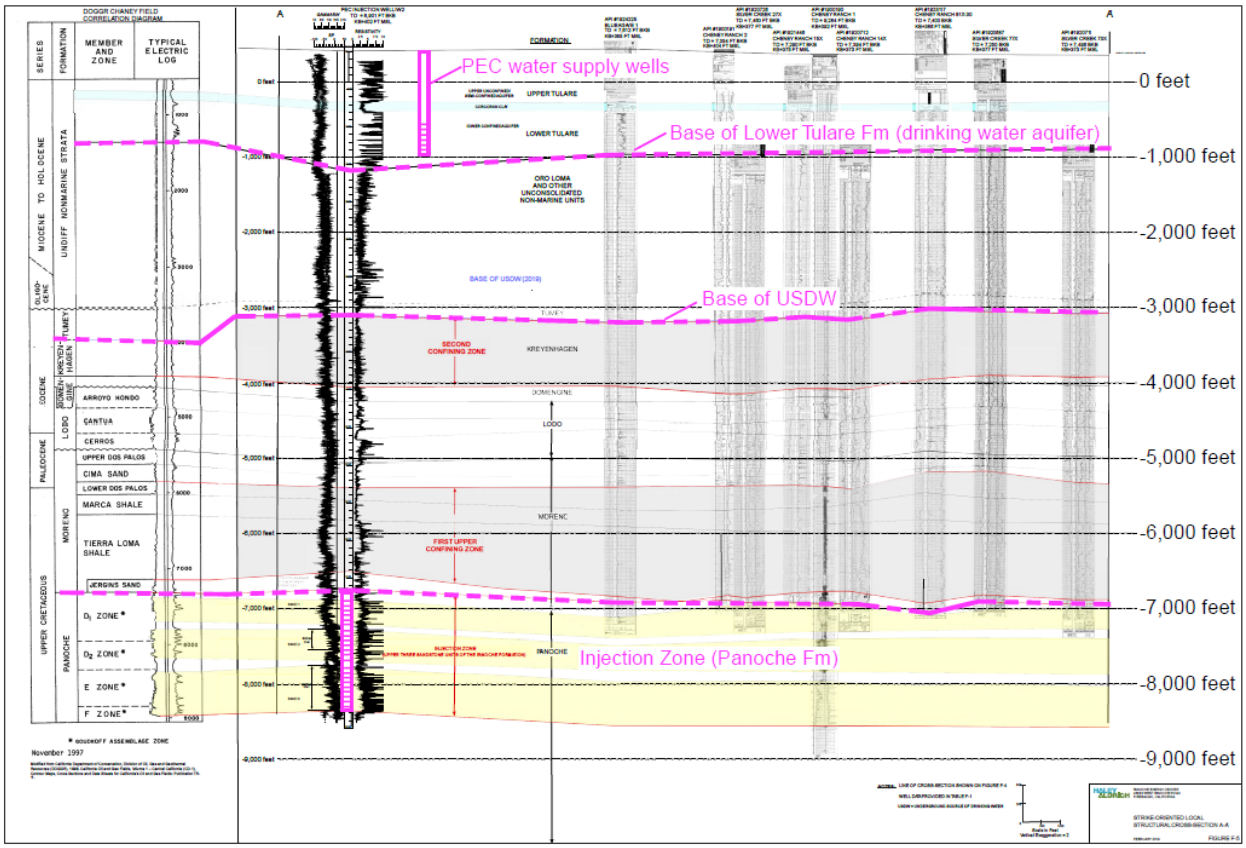
Here, the PEC injection zone consists of sandstones of the Late Cretaceous aged Panoche Formation, which occurs below the Marca and Tierra Loma Shale members of the Moreno Formation Confining Zone.

Second, PEC demonstrated that the injection zone is protected by a confining zone: i.e., a zone laterally continuous and free of transecting, transmissive faults or fractures over an area sufficient to prevent the movement of fluids into a USDW, and contains at least one formation of sufficient thickness and with lithologic and stress characteristics capable of preventing vertical propagation of fractures.

Here, there are two confining layers between the USDW and the injection zone. Specifically, the Moreno Formation Confining Zone is 2,018 feet in thickness and provides the primary seal to the Panoche Injection Zone. In addition, there is a second shallower confining layer, the Kreyenhagen Formation, a 994 foot thick shale that immediately underlies the USDW. Further confinement is provided by the Lodo Formation, which is located between the Moreno and the Kreyenhagen, and provides another 360 feet of confinement.

Third, PEC demonstrated that the confining zone is separated from the base of the lowermost USDW by at least one sequence of permeable and less permeable strata that will provide an added layer of protection for the USDW in the event of fluid movement in an unlocated borehole or transmissive fault.

Here, porous and permeable sandstones of the Martinez Sand and the Domengine Sand serve as buffer aquifers. These buffer aquifers are intended to address more than just abandoned boreholes, such as Silver Creek. They are also capable of addressing any concerns relating to the geology of the injection site such as fractures or faults that could allow hydrologic connection between the injection zone and overlying USDWs. *See* 53 Fed. Reg. 28118, 28133 (July 26, 1988).



2. PEC applied conservative assumptions when completing its AoR and endangerment analysis.

PEC reviewed every artificial penetration within the AoR and, per EPA direction, focused its analysis on those wells within the AoR that do not have a cement plug at the base of the lowermost USDW. To be clear, all wells within the AoR have cement plugs; some of them simply do not have cement plugs at the base of the USDW as EPA now prefers.

To determine remaining wellbore conditions at the time of well plugging, the corrective action evaluation conservatively assumed, per EPA direction, a maximum initial reservoir fluid pressure gradient, a maximum modeled pressure buildup in the reservoir due to injection, and only relied on official well records and logs filed with and certified by CalGEM. Because of the availability of certified well records for all of the wells, no assumptions had to be made to address inadequate well records or orphan wells.

Applying this methodology and relying on empirical evidence available through CalGEM, PEC's analysis shows that ***all wells*** within the AoR have sufficient mud column weight alone to resist fluid entry without relying on mud gel strength, cement plugs, or welded steel caps on the wellheads. In fact, PEC's analysis shows that reservoir pressures would have to increase by 380% over their 2017 value to overcome the mud weight alone and by 414% at Silver Creek to overcome the combination of gel strength[1] and mud weight based on the 2017 reservoir buildup value. PEC Comments at Attachment 3, Figure 3. Therefore, EPA concurred that no corrective action is required for any of the plugged and abandoned wells within the AoR because there is no likelihood for the movement of fluids from the injection zone into the USDW.[2]

[1] To provide a more quantitative basis for defining the AoR, PEC developed a "Gel Strength Entry Pressure" methodology that quantified the minimum pressure differential in the injection zone required to overcome a gel strength of 25 lbs./100 ft2. PEC specifically developed a methodology approved by EPA Region 6, which regulates through primacy or direct implementation more Class I industrial wells than any other EPA region. EPA discounted PEC's application of this methodology without offering any basis for doing so, stating only that the "approach has not been adopted by Region 9." PEC Comments at 5; RTC at 11.

[2] PEC provided a detailed analysis to EPA supporting the conclusion that no corrective action is needed in Silver Creek. *See* PEC Comments at 21-28 (Comment 4 – Monitoring Silver Creek #18 is Not Supported by Empirical Evidence).

This analysis was conservative and did not include the contribution of the following additional margins of safety inherent to all the wells with the AoR[3]:

a. Cement plugs were discounted

The presence and impedance/resistance to flow of any cement plugs placed in an abandoned well, including for instance the three cement plugs in Silver Creek, were completely discounted in the pressure screening analysis. These cement plugs were tagged and verified during abandonment but any additive resistance that would be needed to displace the cement plugs were not considered in the calculations. The conservative proxy used for the static mud column pressure calculation is that the cement plugs are not present in the wellbore.

b. Base screening calculations were conservative

The added resistance due to gel strength for a mud was calculated with a very conservative ultimate gel strength of 20-lb/100 ft^2. Empirical laboratory data and muds recovered in the field indicate much higher ultimate gel strengths are likely. For instance, recovered mud from the Nora Schulze No. 2 well indicated average gel strength values of 267 lb/100 ft^2[4], which are an order of magnitude greater than values employed for Silver Creek. Additionally, only that distance from the base of the lowermost cement plug at 1,700 feet to the top of the Panoche Injection Zone at 7,735 feet was considered in the calculation. Using the full length of the borehole to the top of the Panoche Injection Zone would add an additional 28% to the calculated resistance due to gel strength. Additional safety in the calculation is added to the presented calculation by discounting additional resistance due to borehole rugosity, which can

[3] The studies referenced in footnotes 4 through 9 are attached hereto as Attachment 5.
[4] Davis, K. E., and Pearce, M.S., 1989, Draft Report-A Review of Literature and Laboratory Data Concerning Mud Filled Holes: prepared for Chemical Manufacturing Association, Washington DC, Envirocorp Project No. 10-1302.

increase the contribution in pressure from gel strength by a factor of 3 to 5[5] over that calculated for a "smooth" borehole. Open hole caliper logs from Cheney Ranch Field show significant rugosity along the borehole wall with washouts extending inches out from the nominal wellbore diameter to more than 6 inches beyond the nominal wellbore diameter.

c. Clay and shale swelling was discounted

Clay and shales, especially smectities, are able to absorb water, which commonly results in borehole blockage. There is swelling clay in the PEC area. For instance, studies show high smectite clay content, ranging from 92% to 98% in the Moreno Formation and from 70% to 95% in the Kreyenhagen Formation. These data are from samples in the nearby Tumey and Panoche Hills to the west of the facility.[6] In the Kreyenhagen Formation, the Upper and Lower Kreyenhagen has average smectite values of 88.9% and 86.1%, respectively; illite is also present in all samples ranging from 1% to 11%.[7] Therefore, the primary sealing formations at PEC (the Kreyenhagen and Moreno) contain significant swelling clay content. Smectite-rich clay is known to be a drilling hazard due to the problem with clay-swelling, resulting in borehole instability. These hazards include sloughing shale, tight (undergauge) borehole, and bit balling that results from the clay hydration process and results in the expansion of clay platelet spacing and significant increase of bulk volume. All of the above empirical facts and analyses in the record regarding the injection formation, confining layers, buffer aquifer, and highly

[5] Collins, R. E., and D. Kortum, 1989, Drilling mud as a hydraulic seal in abandoned wellbores: Underground Injection Practices Council.
[6] Hurst, A., Wilson, M. J., Grippa, A., Wilson, L., Palladino, G., Belviso, C., Cavalcante, F. 2021, Provenance and Sedimentary Context of Clay Mineralogy in an Evolving Forearc Basin, Upper Cretaceous-Paleogene and Eocene Mudstones, San Joaquin Valley, California: Minerals, v. 11, n. 1.
[7] *Id*.

conservative AoR analysis at this site, further support EPA's conclusion that there will be no movement of fluids from the injection zone into a USDW.

d. Shale creep within the confining units was discounted

Shale creep has been recognized as barrier for well abandonment.[8] Numerous cement bond logs identify creep behavior of Horda and Lark formations forming a seal against the 9-5/8" casing.[9] Subsequent perforating and pressure testing of these annular barriers has shown good integrity such that they can be used in well plugging and abandonment. *Id*. Horda and Lark formations are high porosity, smectite-rich shale which often causes significant drilling problems in terms of borehole instability. Here, these formations (Kreyenhagen and Moreno) are similar, with very high percentage of swelling smectitic clays present in the intervals.

e. A buffer zone between the injection zone and USDWs was not considered.

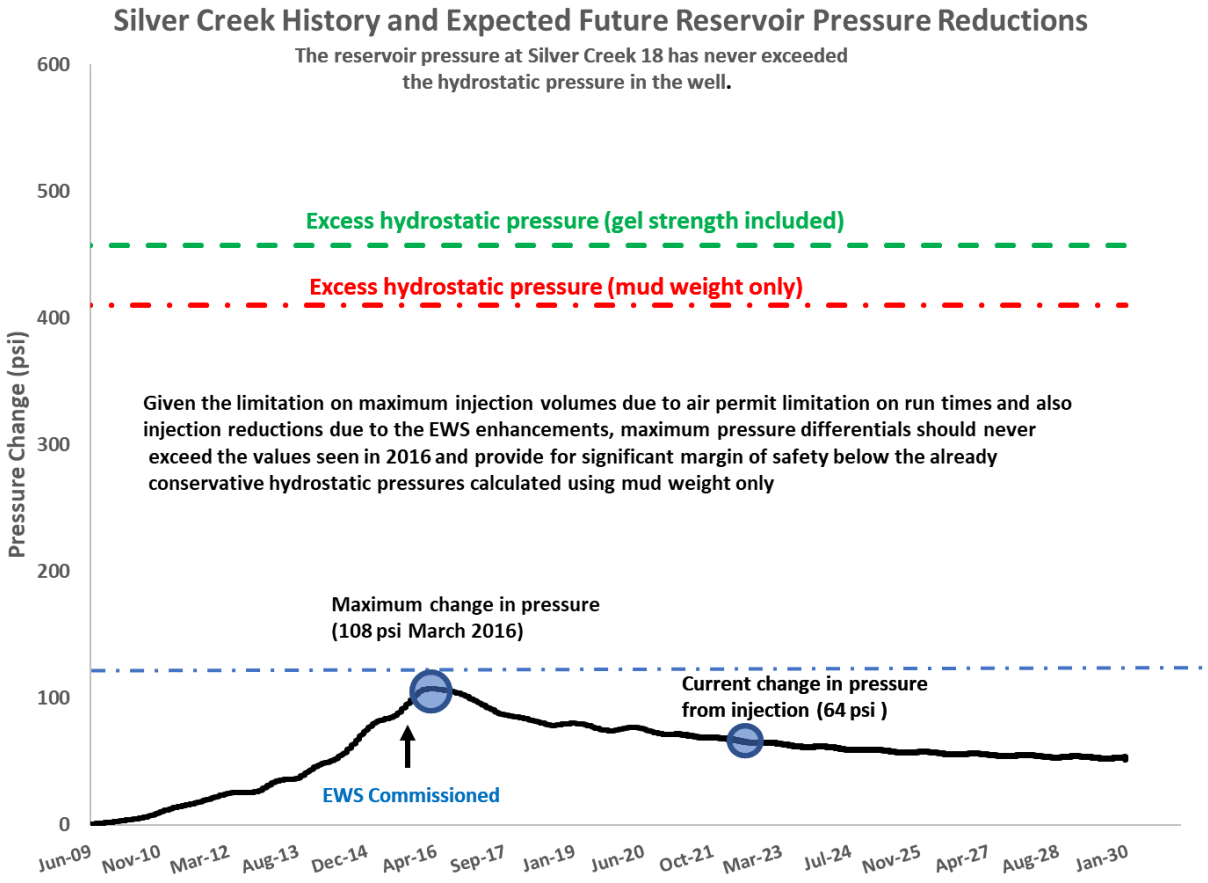
A buffer aquifer exists between the injection zone and USDWs. As EPA has explained, this buffer aquifer serves as an "additional safeguard" to protect USDWs from injection activities. 53 Fed. Reg. at 28133.

D. PEC's Enhanced Wastewater System Has Reduced Pressure in the Injection Formation

PEC demonstrated through an empirical analysis that operation of its Enhanced Wastewater System ("EWS") starting in 2016 reduced injection rates by up to 80 percent. The September 25, 2020 analysis shows that the minimum pressure level needed to potentially cause

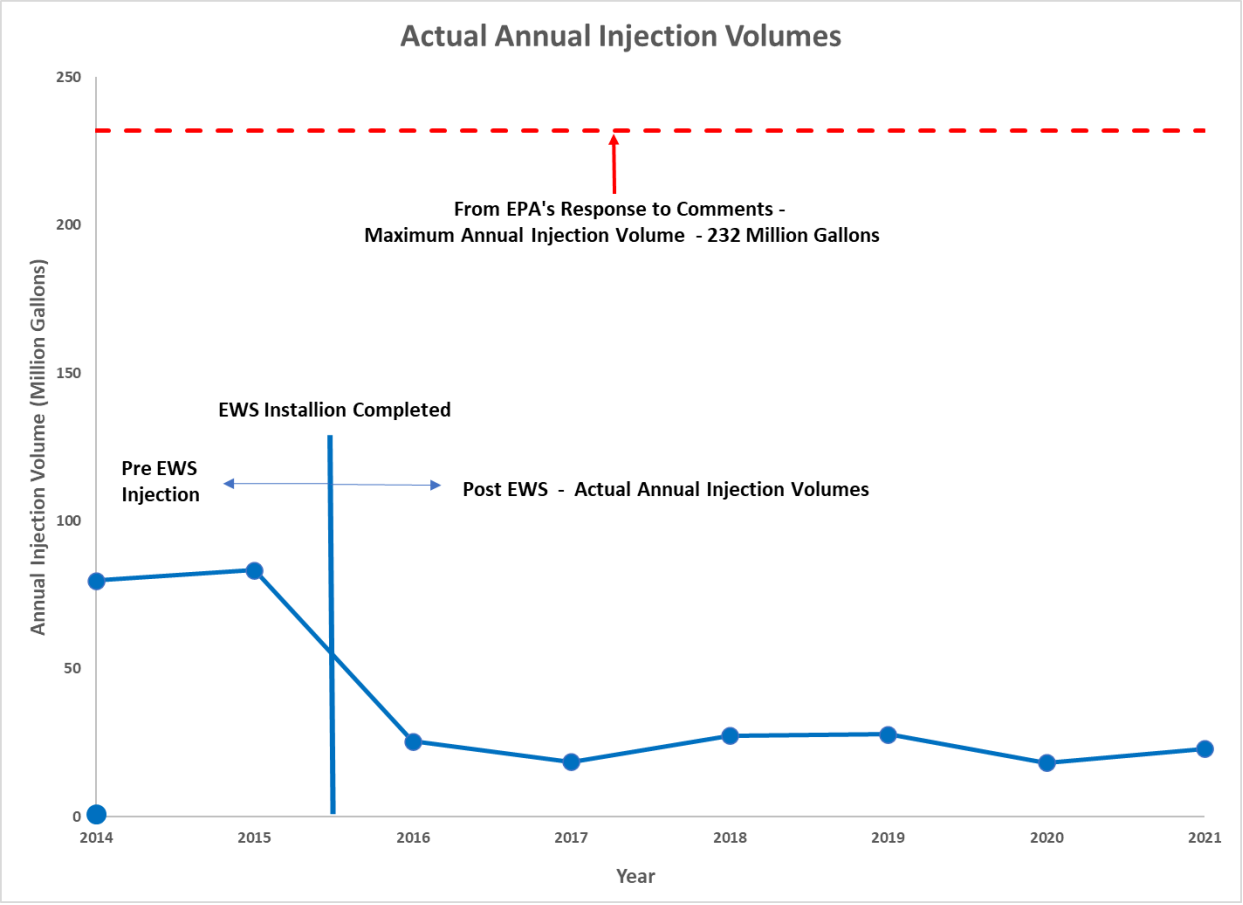
[8] Vrålstada,T., Saasenb, A., Fjæra, E., Øiaa, T., Ytrehusa, J. D., and Khalifeh, M., 2019, Plug & abandonment of offshore wells: Ensuring long-term well integrity and cost-efficiency: Journal of Petroleum Science and Engineering, v. 173, pp. 478-491.
[9] Davison, J.M., Salehabadi, M., De Gennaro, S., Wilkinson, D., Hogg, H., Hunter, C., and Schutjens, P., 2017, Plugging and Abandonment of Oil and Gas Wells: A Geomechanics Perspective, ARMA 17-451.

the movement of fluids from the injection zone into the USDW (again, looking at mud weight alone and not considering gel strength, cement plugs, or steel caps on wellheads) will not be reached at any of the wells located within the AoR, including those wells with no cement plug across the base of the USDW. PEC Comments at 12-21 (Comment 3 – Implementation of the EWS Demonstrates that Formation Pressures are Decreasing); PEC Comments at Attachment 3.



EPA asserts that there is a potential for PEC to increase its injection rate and volume such that the analysis provided above and in PEC's Comment Letter would be inaccurate. EPA claims there is nothing preventing PEC from increasing its injection activity to reach the maximum allowed by the Permit– i.e., 232 million gallons per year. RTC at 13. EPA is wrong about this "potential" risk of endangerment to USDWs.

EPA's maximum projection of 232 million gallons injected per year assumes that PEC is generating electricity 24 hours a day, seven days a week, 365 days per year, and injecting fluids at the maximum possible rate into all four existing wells. But PEC's facility does not operate 24 hours a day, 365 days a year; rather, the PEC facility is a peaker, called upon to provide additional electricity only when the grid demands it. In recent years, PEC has operated far below the maximum EPA assumes going forward (see chart below).



Moreover, PEC is constrained in its operation of the Facility by the terms of its air operating permit (attached hereto as Attachment 6). Under its air permit, PEC may only operate approximately 57% of the time throughout a year (5,000 hours per year for each generator; see Permit Unit Requirement # 13), not 100% of the time as EPA assumes.

All of these limiting conditions would preclude PEC from injecting the maximum possible volume into the injection wells. There is no basis for EPA to disregard the analysis PEC provided about its projected future operations and resulting pressures remaining far below thresholds of concern.

E. Monitoring Conditions in the Permit Will Warn of Any Possible Endangerment

EPA concludes in the Permit that PEC is "not required to conduct any corrective action, in accordance with 40 C.F.R. §§ 144.55 and 146.7." Permit Part II.C. EPA reaches this conclusion based on the AoR analysis, which concludes that none of the wells within the AoR, nor operation of the Facility, will result in the movement of fluids into USDWs.

Nonetheless, PEC acknowledges that the Permit includes appropriate monitoring requirements that are empirically and rationally linked to PEC's activities, are within PEC's control to implement on its property, and are appropriate to assess how PEC's injection activity may be affecting (if at all) the injection zone, the USDW, and endangering the same.

Specifically, the monitoring conditions outlined in Permit, Part II.E include continuous monitoring of injection conditions and volumes, continuous monitoring of well integrity, and an annual demonstration of internal and external mechanical integrity for each injection well. These monitoring conditions, coupled with performance of an annual Fall off Test (FOT), provide an assessment of pressures within the injection zone and provide a mechanism to increase the AoR, if necessary. Likewise, the annual Zone of Endangering Influence (ZEI) reassessment allows for a specific check and verification of the pressure buildup at Silver Creek—and all of the other wells within the AoR—versus the allowable pressure buildup, which are rational triggers for enhanced monitoring or corrective action.

Each of these monitoring conditions is an appropriate exercise of EPA's UIC authorities; and each ensures compliance with the UIC program and confirmation of continued safe operations. Furthermore, Permit Part II.C.2 provides a mechanism to require corrective action if monitoring under Part II.E warrants such action. Specifically, PEC is required under Permit Part II.C.2 to:

a. identify any new wells within the ZEI and determine whether they represent potential endangerment to a USDW;

b. reenter, plug and abandon such new wells in a way that prevents the migration of fluids into a USDW; and

c. address any wells within the AoR that may allow migration of fluids into a USDW.

These monitoring conditions are appropriate to evaluate the impact of injection activities on formation fluids and their potential to move beyond the injection formation and into a USDW.

As discussed below, EPA's purported basis for the Ambient Monitoring Requirement lacks supporting factual justification and has no rational purpose.

STANDARD OF REVIEW

"[T]o establish that review of a permit is warranted, [40 C.F.R.] § 124.19(a) requires a petitioner to both state the objections to the permit that are being raised for review, and to explain why the [permitting authority's] previous response to those objections ... is clearly erroneous or otherwise warrants review." *In re Puerto Rico Elec. Power Auth*., 6 E.A.D. 253, 255 (EAB 1995). Further:

> In evaluating a permit appeal, the Board examines the administrative record on which the permit was based to determine whether the permit issuer exercised his or her considered judgment. […] Specifically, the permit issuer must articulate with reasonable clarity the reasons for its conclusions and the significance of the

> crucial facts it relied upon in reaching those conclusions. […]. As a whole, the record must demonstrate that the permit issuer duly considered the issues raised in the comments and [that] the approach ultimately adopted by the [permit issuer] is rational in light of all information in the record.[…]

In re Avenal Power Center, LLC, 15 E.A.D. 384, 387 (EAB 2011) (internal quotations omitted).

This Board has held that, when issuing a UIC permit under its regulatory authority, EPA must adequately explain its technical determinations and must support those determinations with evidence in the record in order to demonstrate there was a rational basis for the approach it adopted. *See In Re: Stonehaven Energy Management, LLC*, 15 E.A.D. 817, 830 (EAB 2013) (EPA's "failure to articulate the basis in the record for its findings on the geological features of the injection zone and earthquake risk was clear error"); *In the Matter of: Carolina Power & Light Company*, 1 E.A.D. 448, 451 (EAB 1978) (holding in an NPDES permit appeal that EPA "must articulate with reasonable clarity the reasons for [its] conclusions and the significance of the crucial facts in reaching those conclusions"). Where EPA's decision on a technical issue is illogical or inadequately supported by the record, remand is warranted. *Id*.; *see also In Re Shell Offshore, Inc. Kulluk Drilling Unit and Frontier Discoverer Drilling Unit*, 13 E.A.D. 357, 391 (EAB 2007) (remanding due to a finding that EPA's "cryptic and conclusory" explanation for its permitting decision did not provide a basis upon which the Board could properly perform a review of EPA's conclusion).

ARGUMENT

EPA's imposition of the Ambient Monitoring Requirement is clearly erroneous for two reasons. First, EPA did not provide a rational basis for its conclusion that there is potential risk of movement of fluid from the injection zone into a USDW. Second, EPA did not rationally explain how the Ambient Monitoring Requirement would provide an "early warning" about USDW endangerment resulting from PEC's injection activities.

A. The Record Does Not Show Potential Risk of Endangerment of USDWs

EPA acknowledges that to impose an ambient monitoring requirement it must provide a "site-specific assessment of the potential for fluid movement from the well or injection zone *and* on the potential value of monitoring wells to detect such movement." 40 C.F.R. § 146.13(d)(1)(emphasis added); RTC at 2 ("The preamble to the rule promulgating 40 C.F.R. § 146.13 acknowledged that ambient monitoring conditions should be decided on a site-specific basis rather than a general requirement that applies at all sites across the country.").

Here, EPA failed to provide a sufficient "site-specific assessment" to impose the Ambient Monitoring Requirement. EPA disregarded the entire and extensive record developed by PEC that USDWs were not at risk of endangerment at this particular site—evidence that EPA itself agreed with in declining to impose corrective actions. EPA instead relied upon unfounded speculation that older muds in properly plugged wells within the AoR may somehow degrade and fail to perform. EPA's imposition of the Ambient Monitoring Requirement is clearly erroneous because it amounts to rank speculation and is unsupported by record evidence regarding this specific site.

1. PEC demonstrated no endangerment of USDWs and EPA agreed.

As detailed above, PEC provided EPA with a wide array of empirical analysis, modeling, and technical supporting documentation to substantiate its conclusion that PEC's injection activities will not result in the movement of fluids from the injection zone into a USDW. In summary, PEC demonstrated the following:

- The injection zone is greater than 7,100 feet deep (top of Panoche Formation in wells IW1 to IW4 is 7,152 feet, 7,142 feet, 7,182 feet, and 7,109 feet referenced to rig kelly bushing, respectively) with two confining layers and an intervening buffer aquifer.

- Every well within the AoR has sufficient mud column weight to resist fluid entry without relying on mud gel strength.
- Silver Creek has 10.03 pound per gallon mud between the injection zone and the lowermost USDW.
- Formation pressure would need to exceed 4,007 psi to displace the mud and 4,054 psi to displace the mud and gel strength in Silver Creek (this analysis does not account for the 4,219 feet of cement plugs and steel plate welded to the top of the well).
- PEC applied a conservative approach, per EPA's direction, in conducting the AoR and endangerment analysis.
- Since 2016, PEC has implemented an EWS that has resulted in an annualized reduction of its injection volume of approximately 70-80% and reduced pressure in the injection formation.
- PEC's air permit limits its ability to operate the Facility, which results in an estimated maximum injection volume of 84 million gallons/year.

Based on these factors, EPA correctly concluded that there is no potential for movement of fluid from the injection zone into a USDW, and as a result no corrective actions are needed under the Permit.

2. To claim "potential" risk of endangerment, EPA relies on rank speculation without factual foundation that older muds in properly plugged wells may fail.

Notwithstanding its finding of no endangerment, EPA nevertheless imposed the Ambient Monitoring Requirement because it speculated that older muds in properly plugged wells may somehow fail and cease performing as adequate plugging material.

EPA acknowledged "the significant volume of information and research provided to support [PEC's] position that Silver Creek was appropriately plugged." RTC at 9. EPA further "recognize[d] that at the time of the plugging, proper procedures were followed." *Id*. However, "[o]f most significance, PEC has not provided Region 9 with sufficient empirical data that Silver Creek remains plugged with appropriately strong mud and that the mud in Silver Creek has not degraded in the decades since it was plugged." RTC at 6. EPA concluded that "there is uncertainty about the present condition of the mud, which raises a concern that, as pressures increase within the injection zone due to ongoing injection activity, there is a potential that fluids could migrate along the wellbore and endanger the USDW." RTC at 9.

EPA provides only its own speculation, unsupported by any site-specific record evidence or analysis that older muds in properly plugged wells may somehow fail to perform. EPA does not explain what is "appropriately strong mud." EPA does not explain how these muds could "degrade" over time. Do the muds dissipate or disintegrate? Do they become lighter or lose gel strength? Would concrete plugs or welded steel caps not provide offsetting benefits? EPA does not say.

EPA's assertion that muds could degrade over time is completely unfounded, with no analysis or factual basis to assess the validity of that speculation. Nor does EPA provide any parameters or limitations on its concerns; under EPA's view, any muds of any age could potentially fail at any time, thus always necessitating an ambient monitoring requirement. But that type of conclusion could apply to virtually any site across the country. A "site-specific assessment" to impose monitoring requires more. *See* 40 C.F.R. § 146.13(d)(1); RTC at 2 (EPA acknowledging that a "site-specific assessment" requires more "than a general requirement that applies at all sites across the country").

PEC addressed the issue of mud performance as a plugging agent in a report entitled "Mud Column Characteristics and Conditions in the Cheney Ranch Field." PEC Comments at Attachment 6.[10] That report addressed the state of the art understanding of mud as a plugging agent.[11] The same physical characteristics that make clay-based drilling mud useful during active drilling operations also make it an effective barrier to vertical fluid movement within abandoned boreholes. The thixotropic (gelling) property of a clay-based bentonite slurry is what gives drilling mud its gel strength, which helps it maintain it properties over the long-term. These results are confirmed by laboratory studies and field studies of mud conditions in decades old abandoned wellbores. As Silver Creek and all of the other wells in the AoR were drilled using clay-based mud systems the results of the laboratory and field studies apply to wells within the Cheney Ranch area. EPA entirely discounts this technical evidence in speculating that "old muds" do not perform.

The Board's decision in *In Re Stonehaven Energy Management, LLC* is instructive. In that case, as here, EPA attempted to rely on conclusory statements for the required rational basis supporting its permitting decision. 15 E.A.D. 817 (EAB 2013). Specifically, EPA asserted three reasons why the injection activities at issue were not threatened by risk of earthquake, but the record evidence only supported one of EPA's three reasons. Finding that "[a]lthough these reasons, on their face, appear to present the required rational basis, that appearance of rationality evaporates because the Board can find little or no record support for either of the first two

[10] PEC also addressed the issue of mud performance through the submission of an expert opinion by Hadaway Consulting & Engineering, LLC on drilling mud remaining in plugged and abandoned wells, which is attached hereto as Attachment 8.

[11] PEC's report on the efficacy of mud plugs in abandoned wells was based on twenty-five studies of mud properties and select well sampling of wells during reentry activities in other parts of the United States, as well as on CALGEM records for abandoned wells in the AoR.

conclusions." *Id*. The Board held that EPA's failure to articulate the basis for all three of its reasons constituted clear error. *Id*. at 831, 835; *see also In Re West Bay Exploration Company,* 7 E.A.D. 204, 221 (EAB 2016) (remanding as it was not clear EPA exercised considered judgment where the information EPA relied upon to support its conclusion did not provide clear support).

Similarly, the fatal flaw here is that EPA relies on conclusory statements and speculation, not site-specific or empirical facts in support of an ambient monitoring well. As in *Stonehaven*, EPA advanced a reason why it found a potential risk of endangerment, but the record is devoid of any factual support for that reason. Accordingly, as in *Stonehaven*, EPA's permitting condition is thus clearly erroneous and must be remanded. The record is simply devoid of evidence to support EPA's stated concerns regarding the sufficiency of the muds plugging the wells in the AoR.

3. The Utah Study is irrelevant and does not provide the missing justification.

In its Response to Comments, EPA asserts that a 1996 study by the United States Geological Survey on a site in Utah (the "Utah Study"[12]) supports its concerns about the potential failure of older drilling muds in Silver Creek. RTC at 10-11 (the Utah Study "provide[s] an example of a situation where mud-plugged wells were unable to prevent upward fluid migration in an over-pressured formation"). EPA is wrong. The Utah Study says no such thing and has no relevance to PEC's site, the wells within the PEC AoR, or to this proceeding.

The purpose of the Utah Study was to examine "potentially increasing salinity in freshwater aquifers in the vicinity of the Greater Aneth Oil Field in southeastern San Juan

[12] RTC at 10, n. 13 (citing Spangler, L.E., Naftz, D.L., and Peterman, Z.E. 1996. Hydrology, Chemical Quality, and Characterization of Salinity in the Navajo Aquifer in and Near the Greater Aneth Oil Field, San Juan County, Utah. U.S. Geological Survey Water-Resources Investigations Report 96-4155).

County, Utah." Utah Study at 86 (attached hereto as Attachment 7). A question was whether higher salinity in the upper Navajo aquifer was due to oilfield brine that had been injected into the deeper Upper Paleozoic aquifer. The study examined a range of possible explanations, and ultimately concluded that "[n]either oil-field brine nor comingled injection water is the source of salinity to the Navajo aquifer." Utah Study at 1. In other words, injections into the lower aquifer for oil production were not causing increased salinity in the upper aquifer.

As one possible alternative source of increased salinity in the upper Navajo aquifer, the study suggested that:

> The Navajo aquifer may have been more susceptible to salinization in older oil wells and exploratory drill holes that were not plugged and abandoned according to current standards and procedures, particularly those plugged and abandoned prior to discovery of the Aneth Field; those in which the integrity of the cement and mud used to plug the wells has been compromised throughout time; and those in which surface casing was set to a depth insufficient to provide protection of all freshwater zones. In these wells, saline water that may breach the long string casing could potentially move uphole and corrode through other parts of the casing where salinization of the Navajo aquifer might take place.

Utah Study at 29-30 (emphasis added).

In examining potential sources of saline infiltration, the study speculated that wells that were "not plugged and abandoned according to current standards" could be one possible source. Indeed, EPA describes the wells in the study as "decades-old abandoned and improperly constructed wells." RTC at 11 (emphasis added). The Utah Study provides no direct or indirect evidence that muds within a properly plugged and abandoned well, which comply with current regulatory standards, and witnessed by a regulator that approved the plugging and abandonment procedure in a known oil and gas field, can become compromised or fail over time. Accordingly, the Utah Study has no relevance to PEC's site where it is undisputed that all wells within the AoR were properly plugged and abandoned.

Moreover, the Utah Study noted that failure of a plugged and abandoned well is indicated by water pooling at the surface: "water that discharges from the ground around plugged and abandoned wells N32, N41, and N46 indicates that upward movement of water outside of well casings or from boreholes that have been plugged is taking place." Utah Study at 30. Here, there is no evidence of any such pooling at the wells within PEC's AoR, and thus there is no evidence that the integrity of the muds used to plug and abandon those wells has been compromised.

The Utah Study simply does not stand for the propositions for which EPA cites it. EPA contends that the study "raises concerns about reliance on mud gel properties." RTC at 10. The Utah Study says nothing at all about "mud gel properties." EPA contends that the study provides observations about "an over-pressured formation." *Id*. The Utah Study nowhere refers to an "over-pressured formation." All of the wells examined in the Utah Study where water was flowing to the surface were drilled only into the upper Navajo aquifer, not into the underlying Paleozoic Zone aquifer where oilfield fluids were injected. Thus, the water observed flowing to the surface outside of "improperly constructed wells," RTC at 11, was not water from the "injection zone" but rather water originating from the Navajo aquifer where the well was completed. This portion of the Utah Study thus has no relevance to PEC's activities.

Finally, even if the Board finds that the Utah Study provided a rational basis for EPA's purported concerns about the integrity of muds plugging the wells within PEC's AoR, that does not end the matter. The plugged and abandoned wells within the AoR all have cement plugs and have certification records from CalGEM documenting that they were properly plugged and abandoned. EPA did not assess the additive benefits of those features. Nor did EPA assess the effects of the underground geologic formations–i.e., the two confining layers and buffer aquifer–within PEC's AoR that would arrest or absorb any upward migration of fluids. EPA thus

"entirely failed to consider an important aspect of the problem." *Motor Veh. Mfrs. Ass'n v. State Farm Ins.*, 463 U.S. 29, 43 (1983). Based on the record, EPA's conclusion that ambient monitoring is required under federal regulations is arbitrary, capricious, and clearly erroneous.

At bottom, the record is simply devoid of evidence supporting EPA's purported "concern" about older drilling muds failing to perform over time and resulting "potential" endangerment of USDWs. Accordingly, the Ambient Monitoring Requirement lacks a rational justification and EPA's imposition of that requirement was clearly erroneous.

B. The Ambient Monitoring Requirement is Not Rational

The ostensible purposes for which EPA justifies the Ambient Monitoring Requirement are not rationally explained or rationally related to the concerns EPA has expressed. The Board should vacate and remand the Ambient Monitoring Requirement for this reason as well.

EPA first contends that the Ambient Monitoring Requirement will "provide information to either: (1) confirm that the project is operating as expected and there is no fluid movement occurring along the boreholes in the wells in the AoR that could affect water quality of the USDW, or (2) provide early warning of potential endangerment to USDWs before any significant impact on water quality could occur." RTC at 14.

But in the very next paragraph, EPA concedes that even if a borehole is not adequately plugged and fluids move upward along the borehole, "[w]ater quality may or may not change depending on the differences in the fluids in each formation (and the dilution of components in the injectate)." *Id*. In other words, PEC's testing of water quality would not indicate one way or another whether a borehole plug has failed. There is evidently no nexus between borehole plug failure and the water quality PEC is required to measure: a borehole plug could fail without any

change in water quality, or water quality could change without any failure of a borehole plug. EPA has thus failed to explain the basis for this arbitrary monitoring requirement.

Nor is there any rational basis for EPA's assertion that such monitoring would provide "early warning of potential endangerment" to a USDW resulting from PEC's injection activities. EPA has failed to draw the requisite rational connection between the facts found (i.e., water quality may or may not change due to borehole plug failure), and the choices EPA made (i.e., forcing PEC to monitor water quality as an "early warning" of borehole plug failure). *See State Farm*, 463 U.S. at 43.

EPA also contends that monitoring the pressure in the USDW could indicate whether wellbore plugging remains intact. Again, EPA offers no technical basis for this assertion supported by information in the record. The Permit authorizes PEC to inject fluids thousands of feet below the USDW, with several intervening geologic formations that serve as hydraulic barriers and bleed off zones for fluids migrating under pressure. In the case of Silver Creek, there is 3,770 feet of mud between the injection zone and the lowermost USDW; and above this level there is 3,965 feet of mud, 429 feet of cement, and steel plate welded to the top of the borehole. The minimum, conservatively calculated pressure needed to displace these plugging systems is 4,054 psi, or an incremental of 446 psi above initial formation pressures. There is no basis for EPA's assertion that a change in pressure in the USDW would somehow indicate that a wellbore plug has failed. Changes in USDW pressure could occur for a variety of reasons. EPA's response lacks any technical justification or record support, and is thus clearly erroneous. *See In Re Beckman Production Services,* UIC Appeal No. 98-4, (EAB May 14, 1999), 8 E.A.D. 302 (remanding to EPA because the record insufficiently explained the need for a chemical analysis required under the UIC permit at issue, did not explain why other reporting

requirements were insufficient, and failed to "meaningfully explain" how the required reporting parameters were related to EPA's objectives).

If EPA's real concern is related to changes in the rate or volume of injection, such that PEC's facility presents a "potential for fluid movement from the well or injection zone" and into a USDW, then there is simply no "potential value" of a monitoring well adjacent to Silver Creek. Rather, EPA should require PEC to monitor injection rates, which it already does under Part II.E.4.a of the Permit.

Indeed, the other monitoring requirements within the Permit are adequate and more likely to provide an "early warning" of any wellbore plug failure. Part II.E.4.a of the Permit requires PEC to *continuously* monitor injection rates, volumes, wellhead pressure, and annular pressure. This is the best, most timely, and most relevant information about conditions within the AoR and potential pressure buildup around plugged and abandoned wells. Likewise, PEC's air permit limits operations to a level that would not result in formation pressures that would overcome the mud, gel strength, cement plugs, and steel plate welded over top of the wellhead in Silver Creek.

Moreover, PEC's permit application included projections about future injection rates/volumes, taking into account water savings under its EWS that support a conclusion that there will be no movement of fluids into a USDW. The Permit, at Part III.E.10.e, requires the following condition:

> If the Permittee becomes aware that it failed to submit all relevant facts in the permit application, or submitted incorrect information in the permit application or in any report to EPA, the Permittee shall submit such facts or information within two (2) weeks of the time such facts or information becomes known.

This condition would require PEC to inform EPA of any material changes in project operation that exceed the assumptions and factual bases underlying the Permit.

Not only is the Ambient Monitoring Requirement not rational, it is impractical, and potentially impossible, as it requires PEC to install the well on land it does not own or control and to expend millions of dollars to do so. Costs associated with implementing the Ambient Monitoring Requirement include, but are not limited to, acquisition/access costs for the location, permitting costs, financial assurances, drilling and installation costs, costs to provide power to the monitoring well location, monitoring and reporting cost, and maintenance costs. With respect to access, in the event the private landowner denies PEC the ability to acquire or access the land necessary to install and operate the well, it would amount to an effective denial of the Permit and could, in turn, have ramifications on California's grid reliability.

EPA has not provided a rational purpose for the Ambient Monitoring Requirement and it is not supported by information in the record. Accordingly, the Ambient Monitoring Requirement is clearly erroneous and should be remanded to EPA.

CONCLUSION

Based on the foregoing, PEC respectfully urges the Board to decide as follows:

1. Issue-Specific Relief. PEC asks the Board to find that EPA's Ambient Monitoring Requirement in the Permit was clearly erroneous and/or an abuse of discretion, reverse EPA's determination to impose the Ambient Monitoring Requirement, and remand the Permit to Region 9 for further actions consistent with the Board's decision.

2. Stay of Permit Conditions. Pursuant to 40 C.F.R. § 124.16, Petitioner asks that the Board stay the contested Permit provisions pending the Board's final decision in this matter.

3. Request for Oral Argument. Petitioner requests the opportunity for oral argument before the Board for the reasons set forth in the Statement Requesting Oral Argument below.

Respectfully submitted this 28th day of October, 2022.

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STATEMENT REQUESTING ORAL ARGUMENT

Petitioner Panoche Energy Center, LLC requests that the Environmental Appeals Board hold oral argument in this matter because the issues involved are technically complex and because the appeal presents important policy considerations. With respect to the latter, EPA's determination to require ambient monitoring based solely on a speculative theory that drilling muds in properly plugged and abandoned well within an AoR are old and might fail is a major policy decision. Region 9 approach could have ramifications nationally in how the UIC Program is applied under the Class I program, but for all UIC programs; and, if not remanded here, would provide grounds for appeal of virtually any UIC permit authorizing injection activities in the vicinity of properly plugged and abandoned wells.

STATEMENT OF COMPLIANCE WITH WORD LIMITATION

I hereby certify that this Petition for Review, including all relevant portions, contains fewer than 14,000 words, pursuant to 40 C.F.R. §124.19(d).

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LIST OF ATTACHMENTS

Complete versions are being provided electronically to the EAB Clerk's office.

Attached are the following attachments, numbered in order of appearance in the petition:

Attachment #1:	Final UIC Class I Non-hazardous Permit, dated September 30, 2022
Attachment #2:	Comments submitted by Petitioner Panoche Energy Center, LLC to EPA on May 11, 2021 (with attachments)
Attachment #3:	EPA Response to Comments (September 30, 2022)
Attachment #4:	Draft UIC Class I Non-hazardous Permit (April 12, 2021)
Attachment #5:	Compendium of Technical Studies
Attachment #6:	Panoche Title V Operating Permit and Draft Renewal Permit
Attachment #7:	Spangler, L.E., Naftz, D.L., and Peterman, Z.E; Hydrology, Chemical Quality, and Characterization of Salinity in the Navajo Aquifer in and Near the Greater Aneth Oil Field, San Juan County, Utah; U.S. Geological Survey Water-Resources Investigations Report 96-4155 (1996).
Attachment #8:	Wellbore Re-entry Mud Property Expert Opinion by Hadaway

CERTIFICATE OF SERVICE

I hereby certify that copies of the foregoing Petition for Review and all Attachments in the matter of Panoche Energy Center, LLC, Permit No. R9UIC-CA1-FY17-2R, were served on the following persons, this 28th day of October, 2022, in the manner specified:

By EAB eFiling System to:

Clerk of the Board
U.S. Environmental Protection Agency
Environmental Appeals Board
1200 Pennsylvania Avenue, NW
Mail Code 1103M Washington, DC 20460-0001

By email in accordance with the Environmental Appeals Board's September 21, 2020 Revised Order Authorizing Electronic Service of Documents in Permit and Enforcement Appeals and by U.S. Mail (to be mailed on October 31, 2022) to:

Region 9 Administrator
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