



REGION 3

PHILADELPHIA, PA 19103

STATEMENT OF BASIS

U.S. EPA UNDERGROUND INJECTION CONTROL (UIC)
DRAFT CLASS II-D PERMIT REISSUANCE VAS2D932BDIC

FOR

ENERVEST OPERATING LLC
809 HAPPY VALLEY DRIVE
CLINTWOOD, VA 24228

FOR

A project consisting of one Class II-D injection well used for the disposal of produced fluids (brine) associated with coal bed methane and conventional gas production located at:

VWD-535517 Injection Well
Nora Field, Ervinton District
Dickenson County, Virginia

On September 13, 2023, EnerVest Operating LLC (“EnerVest” or “the Permittee”) submitted a UIC permit renewal application to the U.S. Environmental Protection Agency (“EPA” or the “Agency”), Region 3, for the reissuance of a permit that would allow for the continued operation of a Class II-D brine disposal injection well, VWD-535517 (“Injection Well” or the “Facility”), located in the Nora Field, near Cane Creek, Ervinton District of Dickenson County, Virginia. The coordinates for the Injection Well are: Latitude 37° 04’ 19.64” Longitude -82° 09’ 56.17”. EPA Region 3 staff reviewed the initial permit renewal application and found deficiencies. EPA issued a Notice of Deficiency to EnerVest on October 25, 2023 to which EnerVest responded on November 2, 2023. On December 5, 2023, EPA deemed the application complete. In the technical review of the permit application, EPA requested more information from EnerVest to calculate the Maximum Allowable Injection Pressure (“MAIP”) on November 27, 2023. EnerVest submitted data to calculate the MAIP on January 31, 2024. The Permittee’s September 13, November 2, and January 31 submittals are collectively referred to in this Statement of Basis as the “Permit Application”.

Equitable Production Company of Charleston, WV held the previous permit for the construction and operation of this injection well, effective on November 25, 2003, for a period of 10 years. The permit was reissued to EQT Production (note name change) on November 25, 2013, for a period of 10 years. On June 14, 2014, the permit was transferred to Range Resources of Abingdon, Virginia. The permit was then transferred to EnerVest on January 14, 2016, and the permit expired on November 25, 2023.

Because EnerVest timely submitted its permit renewal application, the permit was administratively extended.

Pursuant to the federal Safe Drinking Water Act, 42 U.S.C. §§ 300f *et. seq.*, and its implementing regulations, 40 C.F.R. Parts 144-146, and § 147.235, the EPA UIC program is responsible for regulating, through the issuance of permits, the construction, operation, monitoring and closure of injection wells that place fluids underground for disposal or enhanced recovery in oil and gas production. Today's draft permit specifies conditions for injection well construction, operation, monitoring, reporting, and plugging and abandonment which are specified to protect, and prevent the movement of fluids into Underground Source(s) of Drinking Water (USDW). The final permit will contain the same conditions as in this draft permit unless EPA receives information supporting and warranting alternative final permit conditions or actions on this Permit Application.

The Permittee's UIC project and the draft permit conditions specific to the project are described below:

Area of Review: Pursuant to the applicable regulations, 40 C.F.R. §§ 144.3 and 146.6, the "Area of Review" is an area surrounding the Injection Well, which the applicant must first, research, and then develop a program for corrective action to address any wells that penetrate the injection zone and which may provide conduits for fluid migration during the injection operation. EnerVest proposed a fixed radius Area of Review of one-quarter mile which EPA determined is acceptable. In determining the fixed radius, EPA has considered the following information provided by the Permittee: chemistry of injected and formation fluids; hydrogeology; population and groundwater use and dependence; and historical practices in the area. EnerVest has provided documentation on the fluid to be injected, the groundwater use in the area, and on the well population within the one-quarter mile Area of Review. The injectate is compatible with the formation as evidenced by historical successful use of the Weir Formation by not only the VWD-535517 injection well but also other permitted injection wells issued to EnerVest. In the Permit Application, the Permittee stated that there are no gas or drinking water wells within the Area of Review. However, within the one-mile radius, a total of 25 wells exists, of which 21 are coal bed methane wells and four are conventional natural gas wells. If any unplugged/abandoned wells that penetrate the injection zone are found within the Area of Review after the issuance of this permit, the draft permit requires the Permittee to perform corrective action.

Underground Sources of Drinking Water (USDW): An USDW is defined by the UIC regulations as an aquifer or its portion which, among other things, contains a sufficient quantity of ground water to supply a public water system which also contains fewer than 10,000 mg/L (milligrams per liter) Total Dissolved Solids, and which is also not an exempted aquifer. The Permittee reported that the USDW in the area of the Injection Well to be located within the unconsolidated alluvium/colluvium deposits and the associated Norton Formation. Groundwater is typically found at depths between 1 to 500 feet below ground surface. However, drilling reports located within a 1-mile radius of the Injection well that were submitted as part of the Permit Application indicated that fresh water was encountered anywhere from 45 to 1,210 feet below ground surface. Nevertheless, the Injection Well is constructed so that the surface casing extends to a depth of approximately 1,509 feet below ground surface. Additionally, the entire length of surface casing is cemented back to the surface, thus ensuring that groundwater is protected.

Injection and Confining Zones: The draft permit limits injection of fluids for disposal to the Weir Sandstone Formation at a depth of approximately 4,459 to 4,515 feet below ground surface.

The lowermost USDW is separated from the injection zone by approximately 3,249 feet. The injection formation is overlain by the Mississippian Keener Formation, a thick gray shale with a thickness of 54 feet and the Mississippian Big Lime Formation, a dense carbonate with a thickness of 518 feet. These formations will act as confining zones and prohibit movement of fluids from the injection zone into a USDW.

Injection Fluid: The draft permit establishes a monthly maximum injection volume of 55,000 barrels, and limits injection to fluids produced solely in association with EnerVest's oil and gas production. One barrel of fluid is equal to 42 gallons.

The Permit Application includes analyses of the injection fluid that corresponds to the requirements stated in Paragraph II.C.3. in the draft permit. The parameters chosen for sampling reflect not only some of the typical constituents found in the injection fluid, but also in shallow groundwater. Should a groundwater contamination event occur during the operation of the Injection Well, EPA will be able to compare samples collected from groundwater with the injection fluid analysis to help determine whether the operation of the Injection Well may be the cause of the contamination.

Maximum Injection Pressure: The MAIP for the permitted operation of the Injection Well will be 1,258 pounds/square inch ("psi") with a bottom-hole pressure of 3,381 psi. The maximum surface injection pressure and bottom-hole pressure were developed using the injection pressure limitation calculation; a formula that considers the depth to the Weir injection zone, the highest specific gravity EnerVest expects to encounter during normal operation of the Injection Well (1.10) and a fracture gradient developed by using the instantaneous shut-in pressure of the Weir Formation.

Potential for Seismicity: The SDWA regulations for Class II wells at 40 CFR §§ 146.21 to -.24 do not require consideration of the seismicity of the region, unlike the SDWA regulations for Class I wells for the injection of hazardous wastes. See regulations for Class I hazardous injection wells at 40 C.F.R. §§ 146.62(b)(1) and 146.68(f). Nonetheless, because of public concerns about injection-induced seismicity, EPA evaluated factors relevant to seismic activity as discussed below and addressed more fully in "[Region 3 framework for evaluating seismic potential associated with UIC Class II permits](#)".

The permit provides that the Permittee shall only inject produced fluids into a formation which is overlain by a confining zone free of known faults or fractures within the Area of Review, as required pursuant to 40 C.F.R. § 146.22. The Permittee submitted geologic information indicating an absence of faults or fractures within a one-mile radius of the Injection Well Facility. Additionally, the entire Appalachian Plateau, on which the Facility will be located, is considered geologically stable with no active faults. The faults that exist in the region were last active during the Acadian and Alleghenian Orogenies approximately 375 to 260 million years ago.

The available geophysical and seismic information researched by the Permittee, as well as through EPA's review of published information of seismicity in Virginia shows no evidence of faults that reach the land surface from basement rock. Information can be found on a website about Earthquakes from the Virginia Department of Energy (<https://energy.virginia.gov/geology/EQHazardMapping.shtml>).

Geological information shows that the Appalachian Basin, including southwestern Virginia, which lies on the passive continental margin, is not currently seismically active because insufficient pressure exists to cause movement along ancient faults and fractures. These faults and fractures are closed and non-transmissive due in large measure to the tremendous downward pressure exerted by thousands of feet of overlying sediment deposited since their creation.

Virginia is located near the center of the North American Plate, thus experiences a much lower rate of seismicity compared to an area like California, which is located closer to a plate boundary and experiences shallower, more energetic seismic events due in part to less coherency in the basement rock. Additionally, California earthquakes often break the ground surface, while earthquakes in Virginia usually occur on faults at depths from three to fifteen miles below the ground surface. The rare earthquakes felt in Virginia today generally have no relationship with faults seen at surface. Residual stresses from the formation of the Appalachian Range and the Piedmont province hundreds of millions of years ago appear to be the mechanism for Virginia's earthquakes. Earthquake activity in Virginia has been associated with basement rock, either from basement faulting or faulting at a shallower depth caused by tectonic stresses that originated from the basement rock.

According to the USGS, there have been no earthquake epicenters that have occurred in Dickenson County from 1900 to the present-day. The USGS also reported the closest earthquake epicenter occurred approximately seven miles away from the Injection Well near Vansant in Buchanan County. This earthquake occurred on April 10, 1989, and had a magnitude of 4.3. USGS reviewed this seismic activity and determined it to be a "coal bump" which is defined as a seismic jolt occurring within an underground mine due to the explosive collapse of one or more support pillars.

The final permit will include an injection pressure limit to prevent the initiation or propagation of fractures that could create conduits for the injected fluid to flow to any existing faults. The surface maximum allowable injection pressure (MAIP) for this permit was calculated by the instantaneous shut-in pressure (ISIP). The 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 required to fracture the rock. The surface MAIP is less than both the ISIP and the fracture pressure to prevent the initiation of new, or propagation of existing, fractures. The formula used to calculate the surface MAIP can be found in Paragraph III.B.4. of the draft permit.

Finally, a number of factors help to prevent injection wells from failing in a seismic event and contributing to the contamination of an USDW. Most Class I and Class II injection wells, including this Injection Well, are constructed to withstand significant amounts of pressure. The VWD-535517 Injection Well is constructed with multiple steel rings of casing that are cemented in place. Furthermore, the draft permit requires EnerVest to continuously monitor the Injection Well during operations in order to identify any potential mechanical integrity concerns. The Injection Well is also designed to automatically cease operation in the event that the mechanical integrity of the well is compromised, including by a seismic event.

Testing, Monitoring and Reporting Requirements: The Permittee was required to conduct a mechanical integrity test ("MIT") after construction of the Injection Well. The MIT consists of a pressure test and a fluid movement test. The pressure test was conducted in order to ensure that the casing, tubing and

packer in the Injection Well did not leak. The fluid movement test, which includes case cement record and cement bond log or temperature log reviews, was conducted to ensure that fluid movement does not occur outside the injection zone. In addition to the initial testing above, additional testing of the casing, tubing and packer has occurred every five (5) years since the initial testing and whenever a rework on the Injection Well has been performed. Paragraph II.C.5. of the draft permit requires this mechanical integrity testing to take place for as long as the Injection Well is operational.

The Permittee will be responsible for continuously monitoring the Injection Well for surface injection pressure, annular pressure, flow rate and cumulative volume from the date on which the Injection Well commences operation and until such date that the Injection Well is plugged and abandoned. The Permittee must submit an Annual Report to the EPA summarizing the results of the monitoring and testing activities required by the permit, including monthly monitoring records of the injection fluid, the results of any mechanical integrity testing and information identifying any major changes in the characteristics of the injected fluid. The Annual Report must be submitted to the EPA by January 31 of each calendar year.

Plugging and Abandonment: The Permittee has submitted a Plugging and Abandonment Plan that will result in an environmentally protective Injection Well closure at the time of cessation of operations. The Permittee will maintain a Surety Performance Bond along with a Standby Trust Agreement to ensure proper plugging of the Injection Well. The amount of the Surety Bond shall cover the estimated cost to close, plug and abandon the Injection Well and shall be in the amount of at least ninety-six thousand five hundred U.S. dollars (\$96,000). The amount of the Surety Bond, which is based upon an independent, third-party professional's estimate of the costs associated with the plugging and abandonment of the Injection Well, must also be sufficient to preclude the possibility of abandonment without proper plugging and closure.

Expiration Date: When issued, the final permit will be in effect for the operating life of the Facility, which includes the proper plugging and abandonment of the Injection Well when operations cease. UIC permits for Class II wells may be issued for a period up to the operating life of the facility under 40 C.F.R. 144.36. In the last twenty years that the injection well was operational, there have been no significant changes to the conditions of the permit, so EPA decided to issue the permit for the life of the facility at the end of this permit term. This is consistent with most other Class IID permits across the country. In addition, EPA will conduct an annual review of the Permittee's Injection Well operation. Paragraph II.D.9. of the draft permit also requires the Permittee to submit updated Area of Review information, a new third-party cost estimate for the plugging and abandonment of the Injection well, and an updated demonstration of signatory authority every five (5) years. EPA may modify or revoke and reissue this permit at any time if there is cause under 40 C.F.R. § 144.39.

Additional Information: The Administrative Record for the draft permit is available for public inspection. All information submitted by the Permittee in support of the draft permit, unless deemed confidential, is included in the Administrative Record for the draft permit and is available to the public for review. Copies of the Permit Application, the draft permit, the Statement of Basis, and the Administrative Record index are available for review and inspection on EPA's [website](#). Please direct any questions, comments and requests for additional information to the contact listed below. **The Administrative Record for this action will remain open for public comment until August 27, 2024.**

Tentative Public Hearing: EPA has tentatively scheduled a virtual public hearing on August 26, 2024. An in-person hearing will not take place. The call-in and log-in information for the virtual meeting is listed below:

Call-in Number: (484) 352-3221 6:00 PM Eastern Standard Time
Conference ID: 231 908 750#

MS Teams Link: <https://msteams.link/TVRP>

There is no need to register in advance for the virtual hearing. Attendees may utilize MS Teams by calling via telephone or entering the URL into a web browser. Participants who want to submit written or printed materials can do so using the information listed below.

EPA will hold the virtual public hearing only if EPA receives requests from the public to do so. **Requests to hold this public hearing must be received by EPA via email or telephone by August 19, 2024.** When requesting a public hearing, please state the nature of the issues you propose to raise. EPA expressly reserves the right to cancel this hearing unless a significant degree of public interest is evidenced by August 19, 2024.

General Notice: If you would like to be added to a general mailing list for notice of any UIC permitting actions in EPA Region 3 jurisdictions (Pennsylvania, Virginia, and Washington D.C.), please notify EPA by sending an email to R3_UIC_Mailbox@epa.gov. Please specify if you are interested in permitting actions in all three jurisdictions or only in particular jurisdiction(s). If you don't have access to email, you may also send a request to be included on the list at the physical address listed below.

Submit comments or requests for a hearing or for additional information to:

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