

**MEMO**

**TO** Craig Lobins, PG *SLZ*  
District Manager  
Northwest District Oil and Gas Office  
District Oil and Gas Operations

**FROM** Brian Babb, PG *B*  
Professional Geologist Manager  
Northwest District Oil and Gas Office  
District Oil and Gas Operations

**DATE** March 20, 2017

**RE** Seneca Resources Corporation Well Permit No. 047-23835  
Class II Disposal Well application to inject waste into an underground formation for disposal  
Fee-SRC WT 3771 No. 38628 Highland Township, Elk County

**Background**

Seneca Resources Corporation (“Seneca”) submitted an application to alter the use of the Fee-SRC WT 3771 No. 38628 conventional well, Well Permit No. 047-23835, on November 12, 2014 (“Application”). The location of Fee-SRC WT 3771 No. 38628 well (“Well”) is in Highland Township (“Township”), Elk County, off of Lamont Road. The surface landowner at the location is Seneca. The Application proposes to alter the use of the Well from the production of gas in the Elk formation to disposal of waste in the same formation, to a maximum depth of 2530 feet. On January 8, 2015, the Department received a letter from the Township notifying the Department that Highland Township had a local ordinance that prohibited the presence of the proposed underground injection disposal well. On April 6, 2015, Seneca filed a complaint in Federal Court challenging the validity of the Highland Township Ordinance. On August 12, 2015, the Department suspended its review of the Application pending the outcome of the litigation over the Highland Township Ordinance. On August 11, 2016, Seneca notified the department of the rescission of the Highland Township Ordinance and requested the Department take action on the Application. On August 17, 2016, Seneca filed a Petition for Review in the nature of a complaint in mandamus, seeking an order directing the Department to either grant or deny the Application. The matter is pending at docket No. 455 MD 2016. On November 8, 2016, the citizens of the Township voted to adopt a home rule charter that changed the form of government in the Township from a Second Class Township to a Home Rule Municipality. The newly enacted Home Rule Charter prohibits injection wells within the township through Article IV (§ 401) and Article IX. Seneca has commenced an action challenging the legality of the Home Rule Charter.

### **Application Review**

The Department's authority to deny a well permit application is set forth in Section 3211(e) of the 2012 Oil and Gas Act, 58 Pa. C.S. §3211(e). This section provides that "the department shall issue a permit within 45 days of submission of a permit application unless the department denies the permit application for one or more of the reasons set forth in subsection (e.1), except that the department shall have the right to extend the period for 15 days for cause shown upon notification to the applicant of the reasons for the extension." Pursuant to Section 3211(e.1) of the 2012 Oil and Gas Act, the Department may only deny a well permit application for the following six reasons:

**§3211 (e.1) Denial of permit.** -- The Department may deny a permit for any of the following:

- (1) The well site for which a permit is requested is in violation of any of this chapter or issuance of the permit would result in a violation of this chapter or other applicable law.
- (2) The permit application is incomplete.
- (3) Unresolved objections to the well location by the coal mine owner or operator remain.
- (4) The requirements of section 3225 (relating to bonding) have not been met.
- (5) The Department finds that the applicant, or any parent or subsidiary corporation of the applicant, is in continuing violation of this chapter, any other statute administered by the Department, any regulation promulgated under this chapter or a statute administered by the Department or any plan approval, permit or order of the Department, unless the violation is being corrected to the satisfaction of the Department. The right of the Department to deny a permit under this paragraph shall not take effect until the Department has taken a final action on the violations and:
  - (i) The applicant has not appealed the final action in accordance with the act of July 13, 1988 (P.L.530, No.94), known as the Environmental Hearing Board Act; or
  - (ii) If an appeal has been filed, no supersedeas has been issued.
- (6) The applicant failed to pay the fee or file a report under section 2303(c) (relating to administration), unless an appeal is pending. The commission shall notify the Department of any applicant who has failed to pay the fee or file a report and who does not have an appeal pending.

**§3211e1(1)** *DEP may deny a permit if the well site for which a permit is requested is in violation of any of this chapter or issuance of the permit would result in a violation of this chapter or other applicable law.*

The Department has reviewed the application and has determined that the well site is not currently in violation of Chapter 32, or any other applicable law. The Application meets all applicable distance requirements of 58 C.S. 3215(a) of the 2012 Oil and Gas Act.

Additionally, the Department reviewed the Application in connection with 25 Pa.Code §91.51(Potential Pollution Resulting from Underground Disposal).

Pursuant to 25 Pa.Code §91.51(b), the disposal of wastes into underground horizons is prohibited unless the proposed underground disposal is for an abatement of pollution and it is improbable that the underground disposal would be prejudicial to the public interest and is acceptable to the Department.

The proposed fluid has been recycled for hydraulic fracturing activities to a point where it is not feasible for hydraulic fracturing activities any longer and disposal is necessary. The disposal of this fluid through the proposed injection at the Well is an alternative to the other forms of disposal available. If not disposed at the Well, the fluid would have to be trucked a distance to a properly permitted industrial wastewater treatment facility, publically owned treatment works or another permitted underground injection well. These identified alternatives result in a greater likelihood of pollution to the waters of the Commonwealth, as opposed to the disposal of the fluid at the Well that will result in no pollution to the fresh groundwater.

The Department considered the possible potential pollution and to ensure “the applicant can show by the log of the strata penetrated and by the stratigraphic structure of the region that it is improbable that the disposal would be prejudicial to the public interest.” In making this determination, the Department conducted an analysis of the mechanical integrity of the well casing; and a review of the targeted geologic formation and its ability to accept the waste at the pressures proposed without causing a detrimental impact to the environment, the public or the geologic formation, including an analysis of the potential for inducing seismic activity. The mechanical integrity analysis was conducted by Department employee Bruce Jankura P.E., and a technical memorandum setting forth his analysis, conclusions, and recommendations is provided in Attachment A. The geologic analysis was conducted by Department employee Harry Wise P.G., and a technical memorandum setting forth his analysis, conclusions, and recommendations is provided in Attachment B.

The Department determined that the requirements of 25 Pa.Code §91.51(b) have been satisfied and the issuance of a permit will not lead to a violation of 25 Pa.Code §91.51(b)

As stated above, the Department had previously suspended review of the application pending Seneca’s lawsuit against Highland Township regarding the Highland Township Ordinance that prohibited injection wells within Highland Township. Highland Township rescinded the ordinance that sought to prohibit injection wells, resolving the pending lawsuit with Seneca Resources. Subsequently, Highland Township adopted a home rule charter, changing the form of government in Highland Township from a Second Class Township to a Home Rule Municipality. The Home Rule Charter specifically prohibits disposal wells in the municipality

through Article IV (§ 401) and Article IX. The Home Rule Charter was not enacted pursuant to the Municipalities Planning Code. The Home Rule Charter is not legally enforceable and therefore would not be an applicable law. Further, the permit will include a special condition indicating that the issuance of the permit by the Department does not alleviate Seneca from otherwise complying with local laws.

**§3211e1(2)** *The Department may deny a permit if the permit application is incomplete.*

Pursuant to 58 Pa. C.S. §3211(b) and 3211(b.1), an application shall include a plat and proof of notification. The Application included a complete plat as required by 58 Pa. C.S. §3211(b) and all required proof of notification as required by 58 Pa. C.S. §3211(b.1).

Additionally, because the Application was submitted as an alteration to the existing production well, to inject waste as a disposal well, additional application requirements are set forth in 25 Pa.Code §78.18(a).

Specifically, 25 Pa.Code §78.18(a) requires an applicant to:

- (1) obtain a well permit pursuant to 25 Pa.Code §78.11,
- (2) submit the EPA approved UIC Permit and necessary application material and documents pursuant to 40 CFR Part 146,
- (3) submit a copy of the control and disposal plan for the well and related facilities pursuant to 25 Pa.Code §91.34 and
- (4) submit a copy of the erosion and sedimentation plan for the well site pursuant to 25 Pa.Code §102 and 25 Pa.Code §78.53.

Seneca submitted the EPA approved UIC permit, along with the application material and other related documents under 40 CFR 146, pursuant to 25 Pa.Code §78.18(a)(2).

Seneca submitted the control and disposal plan as required by 25 Pa.Code §78.18(a)(3). Seneca's control and disposal plan must meet the requirements of 25 Pa.Code §91.34, detailing the preventative measures to be utilized to prevent the activity from directly or indirectly reaching waters of the Commonwealth through accidents, carelessness, maliciousness, hazards, weather or other causes. Also, 25 Pa.Code §91.34 indicates that the applicant should address the nature of the disposal activity. Seneca detailed numerous preventive measures to meet the requirements of 25 Pa.Code §91.34, including: training, sound detection, remote access, battery back-up, material compatibility, automatic shut-in, clay absorption material, floor sloping to sumps, emergency shut-off, fire extinguisher, facility fencing, secondary containment, totes for chemicals, pressure monitoring, emergency contacts, cameras, motion lights, access codes for entry and regular inspections. Seneca indicates treatment to protect the injection well and geologic formation, to include oil/water separation, biocide, corrosion and scale inhibitors to reduce potential problematic constituents into the well or waste stream. The fluid has been

recycled to a point where it is not feasible for fracking activities any longer and disposal is necessary.

Seneca submitted a copy of the erosion and sedimentation control plan pursuant to 25 Pa.Code §78.18(a)(4). The erosion and sedimentation control plan must meet the requirements of 25 Pa Code Chapter 102 and 25 Pa Code 78.53. The erosion and sedimentation control plan describes the project and earth disturbance activity. The earth disturbance is less than 5 acres, so no Erosion and Sedimentation Control Permit is necessary. This plan indicates soil types and the geologic formations. The limit of disturbance is in an area known to contain acid-producing sulfide minerals. Since the excavation is less than 30 feet below the ground surface, the risk of producing acid drainage is minimal. Seneca indicates that there are no riparian buffers in the limit of disturbance and that thermal impacts are minimized. The area of interest is delineated for streams and wetlands; two wetlands are identified. The project is located in the Wolf Run watershed. Wolf Run is designated as a High Quality, Special Protection Watershed. Anti-degradation, best management plan technologies are proposed that meet the requirements of 25 Pa Code Chapter 102. Specific entry and road designs, along with filter material, vegetation stabilization, energy dissipation and material management plans should meet the requirements of Chapter 102 and 25 Pa.Code §78.53. Several updates were necessary for completeness, consistency and accuracy. Seneca submitted satisfactory revisions promptly and they are included with the submittal. A general review of the topographic map shows a drainage pattern to the south, which is consistent with the erosion and sedimentation plan. Any escaping material will follow this drainage pattern and pose no threat to the Highland Township Municipal Authority located to the north in a different watershed.

A new Pennsylvania National Diversity Inventory (PNDI) receipt was necessary, as the Department is requiring all PNDIs to be updated as of May 4, 2015, to ensure including the updated status for the Long-Eared bat; the bat was not present. No endangered or threatened species were noted on the receipt. Seneca completed two separate PNDI reports with different parameters. One for energy production facilities, and one for waste facilities, to ensure covering all aspects of this facility to the jurisdictional agencies.

The Department's review disclosed that there are no deep mines or gas storage fields in the area. The Departments review of other oil or gas wells within the area of review is consistent with the submittal. There are two other gas wells in the area; both are Seneca wells. One is plugged and the other will be utilized as a monitoring well for the injection activity. The Department does not see a discrepancy with the water supplies indicated in the area of review by Seneca.

The Application is complete and accurate. All portions of the necessary forms have been completed and all necessary submittals required by law and applicable regulations for review have been submitted.

**§3211e1(3)** *The department may deny a permit if unresolved objections to the well location by coal mine owner or operator remain.*

Coal owners and/or operators can object to the permit with good cause, pursuant to 58 Pa. C.S. §3211e.1(3) of the 2012 Oil and Gas Act, potentially leading to the denial of the permit after sufficient review by the the Department of the issues brought forth by the coal owner/ operator.

The Department did not receive an objection to the well location from a coal mine owner or operator.

**§3211e1(4)** *The department may deny a permit if the requirements of Section 3225 (relating to bonding) have not been met.*

The operator must secure sufficient bond in accordance with 58 Pa. C.S. §3225 of the 2012 Oil and Gas Act, or risk denial of the permit.

Seneca has provided sufficient bond in accordance with 58 Pa. C.S. §3225. Agreement ID No. 5133 indicates that Seneca has \$25,000 Blanket Surety Bond approved on June 15, 2005 for all of their conventional wells including this proposed injection well.

**§3211e1(5)** *The department may deny a permit if the Department finds that the applicant, or any parent or subsidiary corporation of the applicant is in continuing violatoin of this chapter, any other statute administered by the Department, any regulation promulgated under this chapter or a statute adminstered by the Department or any plan approval, permit or order of the Department, unless the violation is being corrected to the satisfaction of the Department.*

The applicant and its parent or subsidiary corporations must be in compliance as defined by 58 Pa. C.S. §3211e.1(5) of the 2012 Oil and Gas Act. The applicant and its parent or subsidiary corporations must not be in continuing violation of this chapter, any other statute administered by the Department, any regulation promulgated under this chapter or any plan approval, permit or order of the department, unless the violation is being corrected to the department's satisfaction, or risk denial of the permit.

The Department has not taken any final action on any potential compliance issues that Seneca or its subsidiaries, as defined in 58 Pa. C.S. §3211e.1(5), might have incurred as of the date of this decision. Therefore, no baiss for denial of the Applicatoin exist under this subsection.

**§3211e1(6)** *The department may deny a permit if the applicant failed to pay the fee or file a report under section 2303(c) (relating to administration), unless an appeal is pending. The commission shall notify the Department of any applicant who has failed to pay the fee or file a report and who does not have an appeal pending.*

The applicant must remain in good standing regarding the proper payment of fees and/or required reports pursuant to 58 Pa. C.S. §2303(c) of the 2012 Oil and Gas Act, or risk denial of the permit.

The Department has not been notified that Seneca failed to pay proper impact fee or submit proper reports related to the impact fee pursuant to 58 Pa. C.S. §3211e.1(f) by the Public Utilities Commission ("PUC"). Seneca is in compliance with their impact fee and report requirements as of February 1, 2017, as indicated on the PUC's public website for Act 13 reporting, attached as Exhibit C. Specifically, Seneca is not listed as an operator with outstanding payments.

### **Summary**

The Department issues a permit from a submitted application unless it is denied in accordance with the provisions outlined in Section 58 Pa. C.S. §3211.e.1 of the 2012 Oil and Gas Act. The Department has determined that there is no basis for denial of the Application pursuant to 58 Pa. C.S. §3211.e.1 of the 2012 Oil and Gas Act.

Accordingly, I recommend issuance of Well Permit No. 047-23835, Fee-SRC WT 3771, located in Highland Township, Elk County, with the following special conditions as recommended by Bruce Jankura, Harry Wise and myself, attached as Exhibit D.

- Attachment A- Bruce Jankura/ Mechanical Integrity Review
- Attachment B- Harry Wise/ Geologic Review
- Attachment C- Public Utilities Commission/ Act 13 Compliance
- Attachment D- Special Conditions

# Attachment- A





# pennsylvania

DEPARTMENT OF ENVIRONMENTAL  
PROTECTION

ATTORNEY WORK PRODUCT; ATTORNEY-CLIENT  
COMMUNICATION; CONFIDENTIAL AND PRIVILEGED

**MEMO**

**TO** S. Craig Lobins *scL*  
**FROM** Bruce E. Jankura, P.E. *BJ*  
**DATE** February 10, 2017  
**RE** Seneca – Elk County Well #38268  
Mechanical Integrity Review  
EPA UIC Application Documents

**MESSAGE:**

This is an assessment of the mechanical integrity, for conversion from a production well to an underground injection well, of Seneca's existing gas Well #38268 well in Highland Township, Elk County, Pennsylvania, API # 37-047-23835.

I reviewed all the documents that were submitted by Seneca in a 3-ring binder to PADEP Office of Oil and Gas Management. The cover indicated "Change of Use – Class II Injection Well Permit Application Supporting Documents, API #37-047-23835, US EPA UIC Permit PAS2D025BELK dated November 17, 2014". Various documents were identified as having information pertaining to mechanical integrity. A well is considered to have mechanical integrity when it is in compliance with the well construction and operating requirements of Pennsylvania laws and regulations.

Each document, listed in the "Table of Contents" by Sections and Appendices and Additional Documents, that was determined applicable to mechanical integrity is listed below with comments. My comments are based on 39 years of experience as a Petroleum Engineer and Environmental Regulator.

This well is a vertical, conventional, natural gas well with 9 5/8" conductor pipe set at 63' with 106 sacks of cement and one (1) additional strings of casing cemented in place; surface casing set at 553' and cemented to surface. This well meets the most recent (2011) regulatory requirements for well construction and operation. Based on the Mechanical Integrity data reported for 2014 and 2015 (See Table #1) and a review of DEP'S eFACTS database (most recent inspection on 8/11/08, see Table #2), this well has no outstanding issues or violations. Additional information regarding the construction and operation of this well is set forth below.

Section 1 – Area of Review Methods/Calculations – Tetra Tech Technical Memorandum – Draft June 14, 2012  
– This Document includes the statement, "...we believe the well is an excellent candidate for use as a brine disposal well."

– Under the document tab; “Notice of Deficiency and Response”, Seneca provided a letter dated June 13, 2013 and titled, “Response to Request for Additional Information dated May 8, 2013”. This request was made by EPA via email and telephone communication, which were not provided with the documents I reviewed. The request was for, “...information regarding reservoir pressures in the Elk 3 reservoir as well as any available production information to support our statement that the Elk 3 reservoir is depleted.” Seneca provided a pressure plot for seven (7) wells titled, “Elk 3 Reservoir Pressures Over Time, Highland Township, Elk County, PA” and a table for five (5) wells titled, “Estimated Cumulative Gas Production For Selected Wells Near Seneca Well #38268”. Seneca makes the statement, “The Elk 3 Sandstone is a depleted reservoir, as evidenced by the reservoir pressure decline curves and significant volumes of gas produced since 1898.”

Comment – Converting depleted reservoirs to water disposal zones is a common practice throughout the oil & gas industry. Based on my review of the data presented above, it is apparent that there has been sufficient pressure depletion and gas production from the Elk 3 reservoir to consider it significantly depleted. It is reasonable to consider this formation a candidate for conversion.

#### Section 2 – Maps of Well Area and Area of Review

– “The only active oil and gas well located within ¼ mile of the Seneca Well #38268 is Seneca Well 38281 located approximately 0.2 miles to the southwest (drilled in 2008; notched and frac’d). A plugged gas well, Seneca Well #01328, is located approximately 1320 ft southeast of the proposed injection well (drilled in 1902, shot with nitroglycerin, plugged in 1991).”

Comment – Both of these wells penetrated the zone of injection. Well #38281 is planned to be used as a monitoring well, which is reasonable. Well #01328 was plugged under recent regulatory requirements in 1991 that should provide adequate wellbore seals and environmental protection.

#### Section 3 – Corrective Action Plan and Well Data

– “As discussed further in Section 8, Well #38281 will be utilized as a monitoring well and is properly constructed for that purpose.”

Comment – See comment under Section 8.

– “This well (#01328) has been properly plugged and abandoned; therefore, no additional corrective action is necessary within the AOR.”

Comment – The “Certificate Of Plugging Well”, dated 2-6-91, indicates; the well plugging was completed on 2-12-91 and 5 cement plugs were set at various depths, ranging from 30’ to 350’ in length. These plugs should be adequate to provide an effective seal within the wellbore, at a distance of 1,320’ away from the injection well. This distance is equal to 1/4 mile, which is the radial length for the Area of Review. Four (4) of the plugs appear to be at depths above the proposed injection zone. I concur that no additional corrective action is necessary within the AOR, at this time.

– Seneca provided the “Well Record and Completion Report” (WRAC) and other data for the wells #38268 (injection) and #38281 (monitor).

Comment – The reports and data for both wells indicate;

1. The geologic “Formation” names wherein the #38268 has an Elk 4 interval (also depicted in the notes on the electric log provided), but no Elk 3 and the #38281 has an Elk 3, but no Elk 4. In section 1, the Tetra Tech letter says, “Brine disposal via injection well would take place into the Elk 3 Sandstone.” So there appears to be a discrepancy of planned injection into the Elk 3, but no Elk 3 formation described in the #38268 injection well.

2. The hole sizes drilled for each casing string are adequate or exceed regulatory requirements.

3. The size of casings installed are adequate.

4. The casing shoe set depths to protect fresh water sources are adequate.

5. The cement blends used to cement the surface casing strings were adequate.

6. The cement returns to surface during the surface casing string cement jobs (7 barrels on the #38268 and 6 barrels on the #38281) are indicators of good cement jobs.

#### Section 4 – Name and Depth of USDWs

– “It is noted that surface casing for the proposed injection well extends to 553 feet, which is greater than 200 feet deeper than the deepest groundwater drinking source in the Tri-Township Area.”

Comment – The surface casing program is adequate and meets the regulatory requirements.

#### Section 5 – Geologic Data

– “Maximum Injection Pressure Calculations”

Comment – The value for the ISIP (1,580 psi) is appropriate, as shown on the “Frac Data” plot dated 4/5/07 for the #38268 well. If the frac displacement fluid had a hydrostatic gradient of fresh water (which is typical for frac work), then the fracture gradient value of 1.104 psi/ft is reasonable. Using this value and a 1.14 specific gravity (equating to a 9.2 pound per gallon weight fluid) for the proposed injection fluid, then the Maximum Injection Pressure Calculation value of 1,437 psi is reasonable. See below, the “Notice of Deficiency and Response” documents for EPA Comment 3 – Revising the Maximum Injection Pressure (MIP).

#### Section 6 – Operating Data

– Various parameters are listed for the proposed injection operation.

Comment – The critical parameter listed here is the Maximum Allowable Surface Injection Pressure (MASIP) of 1,437 psi. This will be the controlling factor, not the injection flow rate. As the pressure increases toward the maximum, the injection rate will have to be reduced to stay below the MASIP. Based on Chart B dated 4/5/2007 for the last pumping stage of the hydraulic fracturing treatment, Seneca’s proposed injection rates appear reasonable.

#### Section 7 – Well Construction – Injection Well Configuration

– Well construction diagrams for #38268 and #38281 were provided.

Comment – Both documents are basic depictions of the well and casing program. Additional details are provided in Section 8.

#### Section 8 – Monitoring Program and Monitoring Program Addendum (dated January 23, 2013)

– From the addendum; “Wells #38281 and #1144, located 1,090 feet southwest of the subject injection well and 2,040 feet northwest of the subject injection well, respectively, will be utilized as monitor wells for injection at Well #38268.”

##### Comment

1. These documents describe subsurface casing and cementing modifications for all three (3) wells mentioned above and pressure/liquid level monitoring procedures. The installation of cemented 4½” casing in both the #1144 and #38268 and installing 4½” casing on a packer in the #38281 are adequate to effectively isolate the Elk 3 interval in the respective wellbores for injection and monitoring.

2. Detailed pipe strength data is not provided, but the common oilfield tubulars used in northwest PA are expected to have adequate internal yield pressure ratings for the tubing and production casing that would contain the proposed maximum injection pressure of 1,437 psi. Seneca should provide the detailed tubular specifications for the injection well #38268. See Recommendations below.

3. The #38268 well is currently in regulatory compliance based on a review of the PADEP eFACTS system.

4. A routine site inspection should be conducted on the #38268 well by the PADEP Oil & Gas Inspector to confirm the well status prior to initiation of injection. See Recommendations Below.

#### Section 9 – Plugging and Abandonment Plan

– “At the point when the well is no longer used, the well will be abandoned in accordance with EPA and PADEP regulations.”

Comment – The Plugging and Abandonment Plan, cost estimate and cement plug set depths appear adequate.

#### Section 11 – Plan for Well Failures

– “Pressure will be measured in the annulus between the 4½”-inch casing and tubing and continuously monitored during injection at Well #389268. Should a pressure increase occur in the monitored space, injection will cease and EPA will be verbally notified within 24 hours and notified in writing within 7 days.”

Comment – This plan outline is reasonable. Note that there are three (3) levels of protection for the USDW’s in the Area of Review considering the path from the perforations up through the (1)tubing/packer/wellhead system, (2)4 ½” casing proposed for installation and (3) existing surface casing. Seneca should specify the pressure setting for the annular space that will cease injection. See Clarification #4 below on page #7.

#### EPA Approval Notices - EPA UIC Permit & EPA Response to Summary Comments

– In Part II, D.2.b. of the UIC Permit, Seneca is required to meet the following condition; “The Permittee has demonstrated to EPA that the Injection Well has mechanical integrity in accordance with 40 CFR § 146.8 and the Permittee has received written notice from the Director that such demonstration is satisfactory; and...”

Comment – There is no reasonable need to duplicate this demonstration of mechanical integrity prior to initiating injection. I recommend that, prior to commencing injection, Seneca provide DEP with the documentation showing how they complied with this provision of the EPA UIC Permit. See Recommendations below.

#### Notice of Deficiency and Response

– Seneca’s August 16, 2012 Response to EPA’s Notice of Deficiency (Dated August 2, 1012) provided the original EPA comments and their responses. Only the EPA comments applicable to mechanical integrity with responses that prompted additional comments are addressed below.

#### EPA Comment 3 – Revising the Maximum Injection Pressure (MIP).

Comment – Seneca revised the MIP for the EPA requested injection fluid specific gravity value of 1.16 (versus the original 1.14 average value previously used). The revised MIP is 1,416 psi and is a reasonable value. Seneca repeats this information in their response dated August 29, 2012.

EPA Comment 4 – Modifications to well #38281 for monitoring; EPA suggested “A preferable alternative would be to install cemented long string in order to isolate the injection zone.”

Comment

1.Seneca' response indicates, "... (Seneca) is not willing to sacrifice the reserves in Well #38281 at this time to serve as a full time observation well." But would at a later time, "If, over time, this well became "flooded out" from nearby water injection, we would then be willing to isolate the Elk Sand, and monitor pressures and water levels from that point forward." Seneca repeats this information in their response dated August 29, 2012. It is not clear when Seneca modified its position on well #38281 to install 4 ½" casing on a packer, set above the Elk 3, but the language to do this is included in Section 8 above, reviewed previously.

2.In Seneca's Response Dated February 4, 2013, "Addendum to Permit Application", a revised "Section 8 – Monitoring Program" is attached. The language has been revised for the second half of paragraph 1 to modify the 4 ½" casing and 2 7/8" tubing pressure monitoring scenario for Well #36268 with the addition of an automatic high pressure shut off device. This is an appropriate revision.

**Mechanical Integrity Info Clarifications**

1. Corrective Action Plan and Well Data. Clarify the apparent discrepancy of planned injection into the Elk 3 formation, but no Elk 3 formation described in the #38268 injection well.

Clarification – 6/6/15 email - When the well was originally drilled, the Seneca geologist at the time interpreted the reservoir of interest as "Elk 4". Subsequent interpretation by other Seneca geologists reclassified the target reservoir as "Elk 3". Therefore, the target reservoir is called "Elk 3" in all of our application documents.

2. Seneca should provide all the detailed tubular specifications for the injection well #38268 and monitoring wells.

Clarification – 3/7/16 email –

**Disposal well # 38268**

Casing: We are planning to run 4.5" 10.5lb./ft. J55 casing on disposal well. Collapse pressure is 4,010 psi and Burst pressure is 4790 psi

Tubing: We are planning to run 2 3/8" 4.70 lb./ft. J-55 Tubing on disposal well. Collapse pressure is 8100 psi and Burst pressure is 7700 psi

**Monitoring well #1144:**

Casing: We will check the integrity of existing 6 1/4" surface casing and based upon the surface casing integrity, we will run 3.5" production casing cemented to surface or pull 6 1/4" surface casing and run 6 5/8" surface casing and 4 ½" production casing cemented to the surface.

If we decide to install 3 1/2" casing, we will run 3.5" 9.2 lb./ft. J-55 casing. Collapse pressure is 7400 psi and Burst pressure is 6980 psi.

If we decide to install 6 5/8" surface casing and 4 1/2" production casing, we will run 6 5/8" 20.00 lb./ft. J55 surface casing and 4.5" 10.5lb./ft. J55 production casing. Collapse pressure and Burst pressure for 6 5/8" surface casing is 2970 psi and 4180 psi respectively. Collapse pressure and Burst pressure for 4 1/2" production casing is 4,010 psi and is 4790 psi respectively.

Tubing: No tubing

**Monitoring well #38281:**

Casing: We are planning to run 4.5" 10.5lb./ft. J55 casing. Collapse pressure is 4,010 psi and Burst pressure is 4790 psi

Tubing: No tubing

3. Verify the ISIP of 1580 psi on the Frac Data chart for well #38268 dated 4/5/07. There appear to be 2 pressure drops near the end of pumping. Pumping appears to be ongoing at the 1580 psi level for several minutes, then drops to a pump rate of zero where the pressure drops to approximately 1100 psi. Also, confirm the type of operation that was being performed and describe the fluid in the casing, ie. frac job, injection test.

Clarification – 3/7/16 email – The chart that we sent earlier (attached Chart A) is from stage one of the planned eleven stage frac job.

From the chart that we sent earlier (attached Chart A) the drop in pressure at 24 mins is due to the frac breaking around to other zones in Elk 4. The next seven stages (2-8) also showed signs of communication and were completed as one stage. The next three stages (9-11) broke around as well and communicated with other stages. The attached Chart B shows the last frac job where we treated all eleven stages from up above stage one and we saw 1580 psi post frac ISIP.

4. Specify the pressure setting for the 4 1/2" casing by tubing annular space at Well #38268 and the pressure deviation setting that will cease injection.

Clarification – 3/7/16 email - We would maintain zero psi pressure on the casing by tubing annulus during operations, if the pressure reaches 300 psi, we will bleed it off to zero psi. Resume injection and monitor pressure. If the pressure exceeds 500 psi we will perform diagnostics to assess the integrity.

## **Overall Mechanical Integrity Review Assessment**

Mechanical Integrity for the Seneca – Elk County Well #38268 gas well:

In my opinion, based on the data reviewed and proposed well upgrades, the mechanical integrity of the Seneca – Elk County Well #38268 is adequate for conversion from a production well to an underground injection well.

The Seneca – Elk County Well #38268 is currently in compliance with the well construction and operating requirements of Pa Code Title 25 Ch78.

## **Recommendations**

These recommendations are additions to the proposed Seneca procedures and EPA UIC Permit requirements.

1. Any stimulation treatment plan should be reviewed by the Department prior to implementation.
2. Provide, on a monthly basis to the DEP, injection pressures, annular pressures, injection rates and cumulative volume; in both digital and graphical formats. All pressures and rates should be monitored continuously.
3. An inspection of the well site and well must be conducted by the PADEP Oil & Gas Inspector to confirm the well status and wellbore mechanical integrity including annular pressure readings, prior to initiation of injection.
4. Prior to commencing injection, Seneca should provide DEP with the documentation showing how they complied with provision Part II, D.2.b. of the EPA UIC Permit, demonstrating that the well has mechanical integrity.
5. DEP should be notified in the same fashion as EPA when conditions indicate mechanical integrity problems, which call for injection to cease and EPA to be verbally notified within 24 hours and notified in writing within 7 days.

cc: John Ryder



**Table #1 – Seneca #38268 Mechanical Integrity Report – 2014 and 2015**

OPERATOR	PERMIT G API O	INSPECTION YEAR	INSPECTION DATE	RECEIVED DATE	FORM ID	DOCUMENT CATEGORY	PRIMARY PRODUCTION PRESSURE_PSIG	PRODUCTION OPEN_VENT FLOW	PRODUCTION OPEN_VENT FLOW_UNIT CFPD	ANNULAR_P RODUCTION PRESSURE PSIG
SENECA RESOURCE S CORP	# 047- 23835	2015	12/1/15	2/12/2016	C	DEP Integrity Short Form C	14		NA	
SENECA RESOURCE S CORP	# 047- 23835	2014	10/1/14	2/11/2015	C	DEP Integrity Short Form C	12		NA	

MAX ALLOWABLE PRESSURE EXCEEDED	WATER LEVEL OR OTHER	WATER LEVEL_OR OTHER UNIT VARIOUS	PRODUCTION ANNULUS OPEN_FLOW OR SHUT_IN PRESSURE	PRODUCTION_AN NULUS_OPEN FLOW_OR_SHUT IN_PRESSURE UNIT_CFPD_OR PSIG	FLUIDS NOTED	OPEN_FLOW_ OUTSIDE FRESHWATER CASING	OPEN_FLOW_ OUTSIDE FRESHWATER CASING_UNIT CFPD	OPEN_FLOW_ OUTSIDE_INTE RMEDIATE CASING	OPEN_FLOW_ OUTSIDE INTERMEDIATE CASING_UNIT CFPD	SURFACE WELLHEAD_ EQUIPMENT EMISSION RATE	SURFACE WELLHEAD_ EQUIPMENT EMISSION_RATE UNIT_CFPD
NA			0	cfpd	N		NA		NA		NA
N			0	cfpd	N		NA		NA		NA

SURFACE WELLHEAD_ EQUIPMENT EMISSION_ RATE	SURFACE WELLHEAD_ EQUIPMENT EMISSION_RATE UNIT_CFPD	LIQUIDS_TO SURFACE_OR OUTSIDE FRESHWATER CASING	CORROSION PROBLEMS	COMMENTS	STANDARD COMMENTS FOR_NO INSPECTION	FILE NAME	REGION	COUNTY	MUNICIP ALITY	UN- CONVEN TIONAL	WELL_ TYPE
	NA	N	N			PA_DEP_In	EP DOGO NWDO Dstr Off	Elk	Highland	No	MULTI PLE WELL BORE TYPE
	NA	NA	N			PA_DEP_In	EP DOGO NWDO Dstr Off	Elk	Highland	No	MULTI PLE WELL BORE TYPE

**Table #2** – DEP eFACTS Inspection Report Dated 8/11/08

Inspections											
Inspection Id	1726953	Insp Type	CEI	Compliance Evaluation	<input checked="" type="checkbox"/>	Date Inspected	08/11/2008				
Inspected Entity		Cat PF				Program					
Entity	690296	047-23835	FEE SENECA RESOURCES WARR	Specific Id	047-23835						
Type	OGI	Oil & Gas Loc	Kind	NONC	NonCoal	Status	ACTIV	Active	<input checked="" type="checkbox"/>		
More SF	SF	939600	047-23835	FEE SENECA RESOURCES WARR	Type	OGW					
SF Status	ACTIV	Active	Documents		Launch Inspection Report						
General   Insp SF   Viol   Rel Insp   Comp Asst   Cover Area   Admin   P2E2   Summary											
Owner/Operator	72933	OGO-15547	SENECA RESOURCES CORP								
Complaint Id		Inspector	00061812	THOMAS, JOHN			More <input type="checkbox"/>				
Due Date		Inspection Result	NOVIO	No Violations Noted							
Date Scheduled		Scheduled By		Link Well Pads							
Agency	DEP	PA Dept of Environmental Protec	External	Joint Insp	Viol	Compliant	EPA Details				
Program	OG	IGS Code	8230	EP DOGO NWDO Dstr Off			External Details				
PF Related Info											
County	24	Elk	Municipality	24907	Highland						
			Create ENF	Back	Go To						

# Attachment- B



**TO** S. Craig Lobins *SC*  
**FROM** Harry C. Wise, P.G. *HCW*  
**DATE** February 8, 2017  
**RE** Seneca Resources – Elk County Well #38268  
Geological Review  
EPA UIC Application Documents

**MESSAGE:**

Analysis

This technical review is in response to a request from John Ryder to assess the geologic structure and setting associated with Seneca Resources' (Seneca) gas well (Well #38368) in Highland Township, Elk County, Pennsylvania, API # 37-047-23835. The well formerly served as a production well and is a candidate for conversion to an underground injection control (UIC) well. The intent of the analysis is to determine the suitability for conversion.

I reviewed all the documents submitted by Seneca to the Pennsylvania Department of Environmental Protection's Office of Oil and Gas Management (Department) as part of the UIC permit package. The permit package is titled "Change of Use – Class II Injection Well Permit Application Supporting Documents, API #37-047-23835, United States Environment Protection Agency (EPA) UIC Permit PAS2D025BELK dated November 17, 2014". Various documents were identified as having information pertaining to local geologic structure and setting.

The discussion that follows is based on my experience as a Professional Geologist and environmental regulator.

The proposed UIC well (Well #38268) served as a former gas production well targeting the Elk 3 Sandstone. Seneca has indicated that the Upper Devonian siltstones, shales and sands between 635 feet and 2354 feet below existing site grades would effectively serve as a stratigraphic seal (confining zone). In EPA's Notice of Deficiency, further clarification regarding the confining zone for the proposed injection well was requested. Seneca noted in their response that the Elk 3 Shale, at a depth interval from 2,328 feet to 2,354 feet below existing site grades, would act as the confining zone for the proposed injection well. In addition, Seneca notes additional shales, silty shales and siltstones above the Elk 3 shale that would serve as confining zones, isolating the injection zone from the interval of the subsurface bearing fresh groundwater. Seneca Resources described the Elk 3 Shale as a silty shale zone.

The Department reviewed a petrophysical log as required by § 91.51. Potential pollution resulting from underground disposal submitted via email by Seneca on June 6, 2015. The data corroborates Seneca's identification of a sandy injection zone and shows that there is a silty to shaly sequence of rocks directly above

the injection zone (between 2,352 feet and 2,404 feet). The petrophysical log also identifies confining (shaly) zones that are present between 2,144 and 2,210 feet below site grades.

The Department's analysis of Alleghanian structures confirms the presence of an anticlinal trap structure -- the Simpson Anticline is located within the quarter-mile and mile radius areas of review. The presence of anticlinal/synclinal pairs is commonly associated with structural deformation features throughout the Appalachian fold belt/plateau of Pennsylvania. (Figure 1).

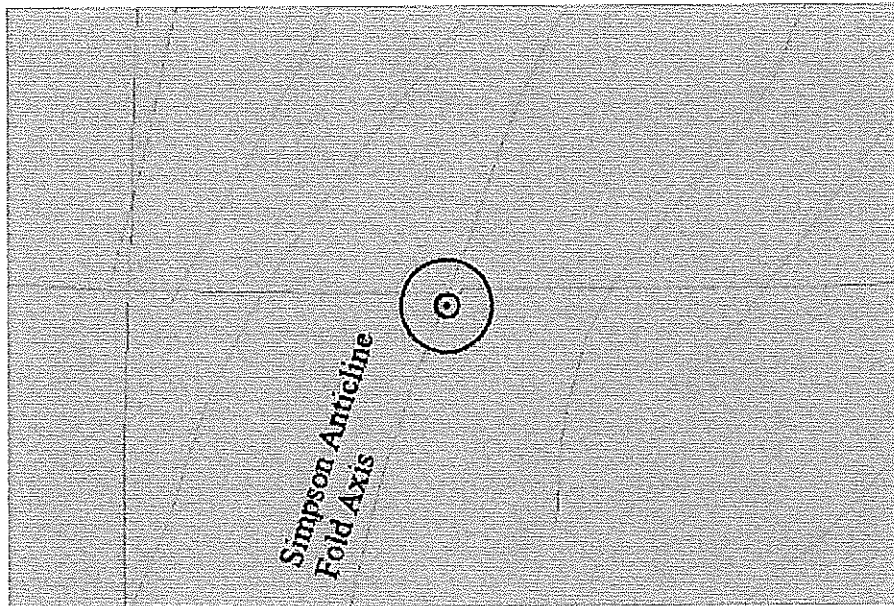


Figure 1. Alleghanian folds near well site. Well surrounded by quarter-mile and one-mile buffers.

It is my professional opinion that the injection horizon and surrounding strata result in suitable geologic structure and stratigraphy for waste disposal via underground injection. There are no concerns related to containment.

The Department's review of operating and plugged wells within a quarter-mile radial distance confirmed the information provided by Seneca in their application. The only operating well that penetrates the produced horizon is a Seneca owned well. This well is API# 047-23884, located 0.21 miles southwest of the site. This well extends to a total depth of 2,544 feet.

A plugged well, API# 047-00449/Seneca Well #01328; (the Department's eFACTS operator is listed as National Fuel Gas Supply Corporation) is located 0.21 miles east-southeast of the site. This well was plugged in February 1991 and the plugging certificate was approved by DEP in March 1991. Ninety (90) sacks of cement were used to plug the gas-bearing zone from 2,100 feet to 2,431 feet (Figure 2).

Seneca did not perform a one-mile radial review of wells in their application to EPA. EPA did not comment in their Notice of Deficiency that this was necessary. The Department's review identified 31 additional wells within a 1-mile radial search area. These wells include 14 active wells, 8 plugged wells, 4 DEP Orphan list

wells and 5 wells that were reported as proposed but never drilled by the operator (Figure 2). Some wells just outside the quarter-mile radial review area are noted in Seneca's Preparedness, Prevention, and Contingency (PPC) Plan and Seneca's Response to Request for Additional Information dated May 8, 2013.

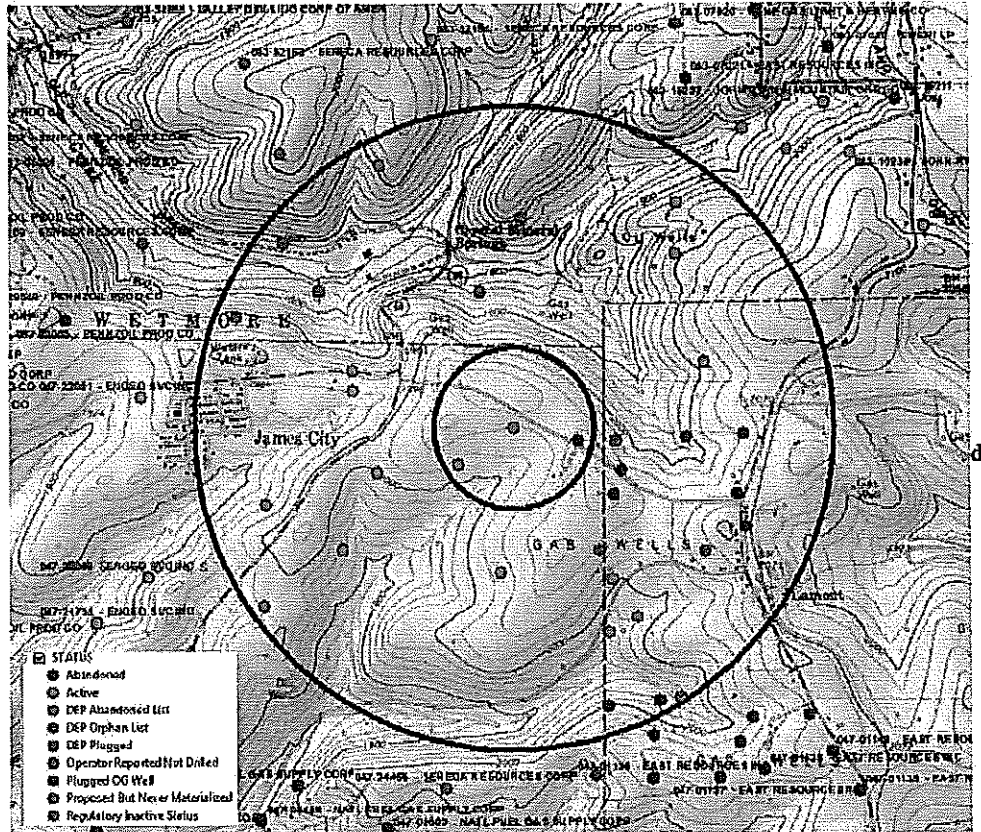


Figure 2. Surrounding conventional wells with the quarter-mile and one-mile buffers depicted.

A search was completed for historic and other well sites not in the Department's eFACTS database. No wells not already listed in eFACTS are located within the quarter mile-radial distance around the proposed injection site. There are four wells not listed in eFACTS that are within the one-mile radial distance of the proposed well site (Figure 3). Three of these wells (red symbols) are listed as plugged and abandoned (API #'s 047-21639, 047-21442 and 047-20609). The other well is listed as active (blue symbol) and the API# is 047-21054. This well is listed as belonging to Seneca.

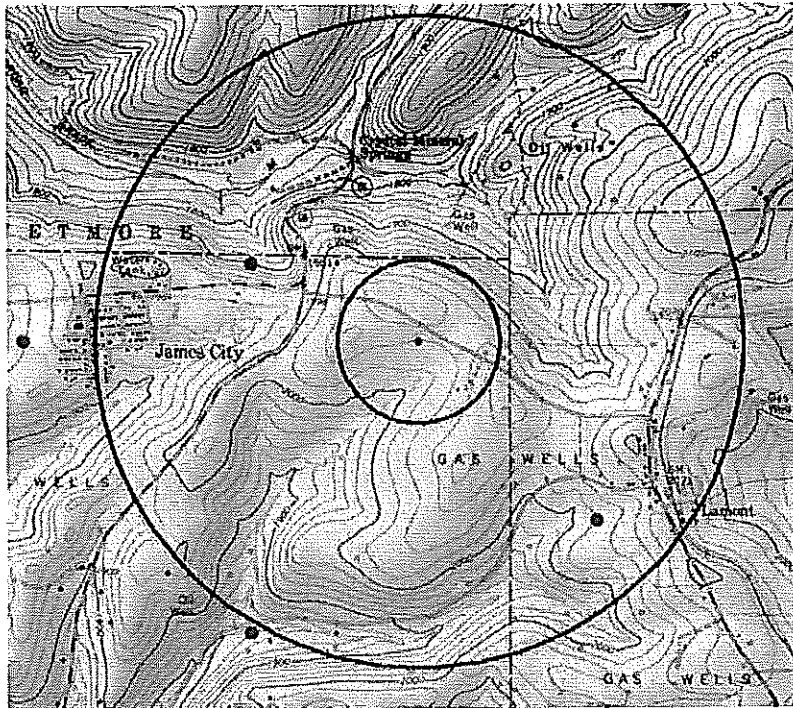


Figure 3. Historical well information with the quarter- and one-mile buffers depicted.

It is my professional opinion that there are no concerns related to the suitability of the caprock, or seal, created by ongoing and legacy oil and gas production activities in the vicinity of the proposed UIC well location.

The Department's review indicates there are no mapped faults or structural fronts in the quarter- and mile-radius areas of review (Figure 4). The Department could not find a review of the geologic structure in Seneca's application to EPA. The nearest fault is identified as an "Unnamed Structural Fault", approximately 13 miles to the southeast of the site. It appears the faulting is roughly coincidental with the folding classified as an anticlinal axis. Faulting is often noted in association with structural deformation features such as the anticline/syncline pairs common throughout the Appalachian fold belt/plateau of Pennsylvania.

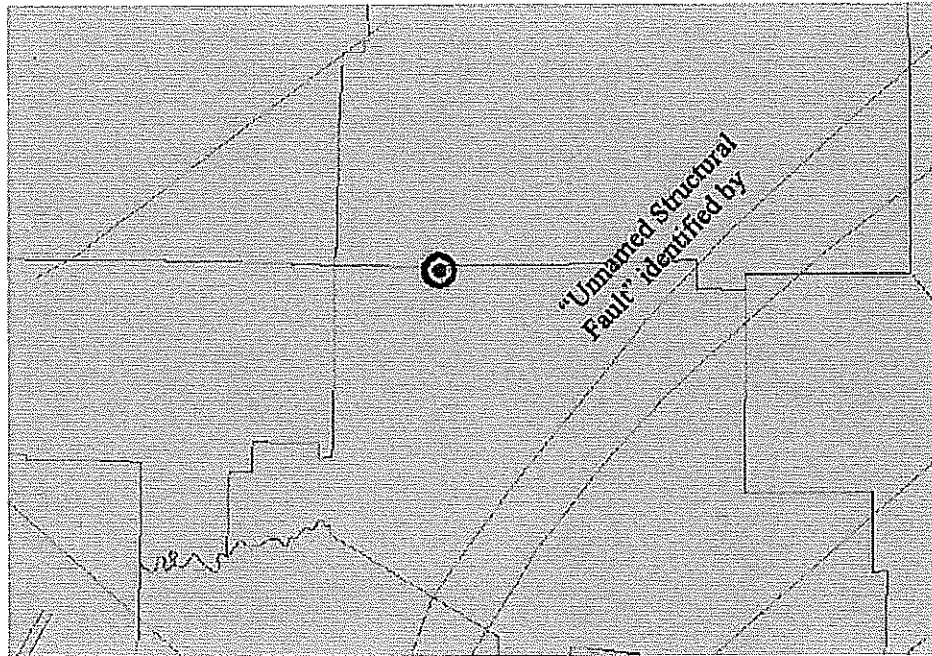


Figure 4. Faults located near the proposed well site.

The Department's review indicates there are no historical seismic events within the quarter- and one-mile radius area of review (Figure 5). There have been no recorded earthquakes of 2M or greater within Elk and McKean Counties.

It should be noted that EPA reports induced seismicity associated with injection wells in Ohio resulted from injection into Precambrian basement rock. These rocks are often cross-cut by blind faults and are crystalline in nature. Additional studies by the state of Oklahoma (<http://earthquakes.ok.gov/>) and within the geologic community appears to corroborate the belief that injecting fluid into brittle, crystalline basement rock can induce seismicity. The Department could not find where Seneca's application addressed any seismic concerns and the EPA did not address this in the Notice of Deficiency. As part of its review, the Department analyzed maps showing the basement rock (depth of approximately 12,000 feet to 13,000 feet) and the injection zone (depth of 2,328 feet to 2,354 feet) for this well and estimated a vertical offset distance of approximately 9,600 to 10,600 feet (Figure 6).

Induced seismicity relating to the operation of injection wells results from the interrelationship of factors such as depth to basement rock, distance to existing faults, fault plane orientation and pore pressure regimes. This geologic analysis has not revealed indicators suggestive of a heightened potential for induced seismicity. Based upon the review of all available information, it is my professional opinion that injection activities at this well pose a low risk with regard to induced seismicity. It is recommended that this risk be managed through the application of permit conditions addressing seismic monitoring and mitigation.



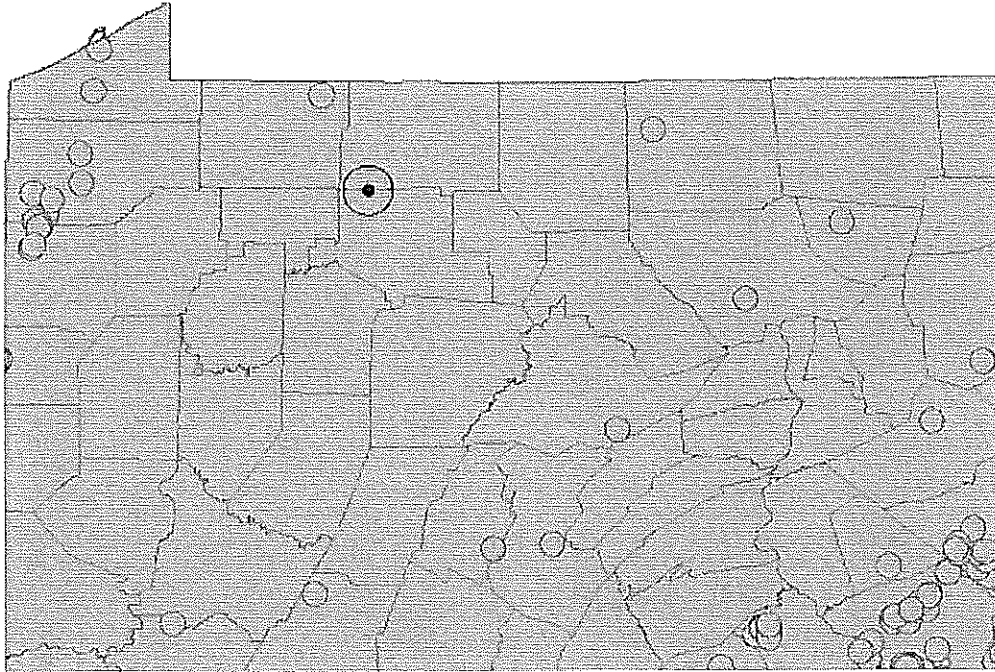


Figure 5. Seismic activity map showing 3-mile buffers around Magnitude 2 or greater earthquakes.

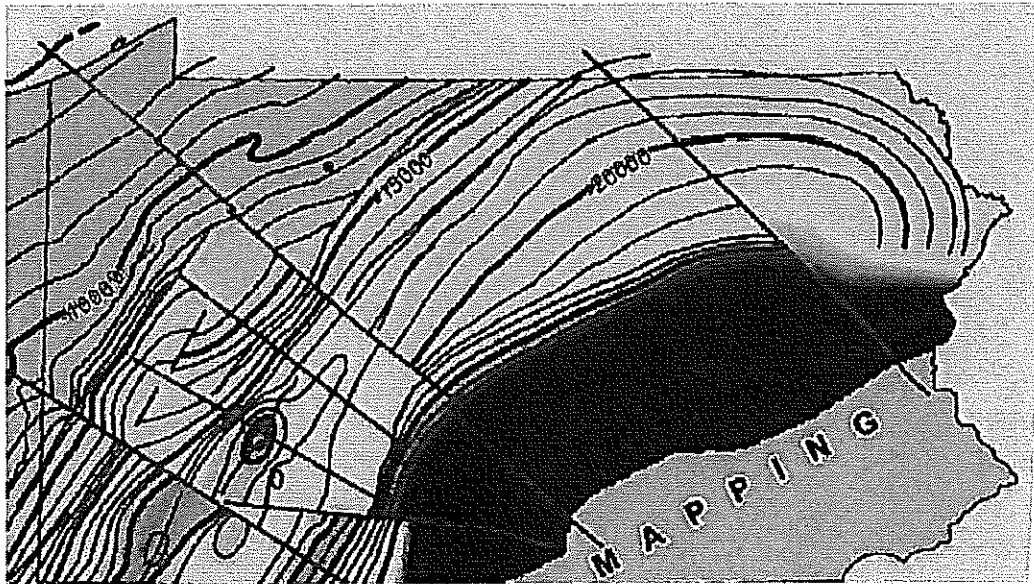


Figure 6. Depth to Precambrian crystalline basement rock. UIC well site (pink circle)

The Department's review indicates the closest storage well (API # 083-04492) is located approximately 5.7 miles northwest of the proposed injection well site. There is an active storage field (East Branch A) located approximately 6 miles northwest of the site and an abandoned storage field (McKinley) approximately 3 miles

southwest of the site (Figure 7). Since the East Branch A Storage Field is approximately 6 miles northwest of the site, and outside the ¼ mile radius of review, it is not expected to be of concern. The Department's review indicated a proposed injection well within the 1-mile radius of review; however, this well is listed as proposed but was reportedly never drilled.

The Department's review indicates there is no surface or underground mining within the quarter- and one-mile radius area of review (Figure 8).

The Department's review indicates there are active municipal water wells/springs associated with Highland Township Municipal Authority within the 1-mile radius of review which were identified in Seneca's Addendum to Permit Application to EPA, dated October 2, 2012. These wells are located north to northwest of the site (Figure 9). In Seneca's application to EPA, two (2) alleged water wells were identified within the 1-mile radial area of review. The first of these was documented by Seneca as the deepest USDW well and it is completed at a depth of 130 feet below existing site grades and serves as a domestic water supply well belonging to Randy Klaiber. The second well, which is completed at a depth of 2,389 feet below existing site grades, belongs to National Fuel Gas Supply Corporation. Seneca identifies the latter well as a gas test well, and not a drinking water well. Additional private water wells were identified in Seneca's PPC Plan within the one-mile radial area of review. The Department could not find any discussion on these wells within the application or addendum. Seneca does note in the Addendum to Permit Application that they have reviewed water well depths throughout Highland and Jones Township of Elk County and Wetmore Township of McKean County and found the deepest groundwater well to be approximately 320 feet below site grades. The surface casing set depth for the proposed injection well is 553 feet below site grades. The Department concurs with Seneca's assessment that the casing set depth is adequate provided the casing and cementing requirements of 25 Pa. Code Chapter 78, Subchapter D are met.

Regarding local water supplies:

- It is recommended that the location, depth and use of any additional private water wells detailed in Seneca's PPC Plan be confirmed by the Department.
- It is recommended that the location and usage of the well identified by Seneca as belonging to National Fuel Gas Supply Corporation be confirmed by the Department as a test gas well and not a water well.

Once the location, depth and usage of the aforementioned wells are confirmed, the Department should ensure the casing and cementing design of the proposed injection well satisfies the requirements of 25 Pa. Code Chapter 78, Subchapter D by completing an engineering assessment of the well's construction characteristics and integrity. If no issues are noted during the review, it is my professional opinion that there is no expected risk to surrounding water supply wells provided injection well integrity is maintained per the requirements of EPA's UIC Program. This belief is due to the required construction of the well, the geology, and the distance of these features to the well and its injection horizon.

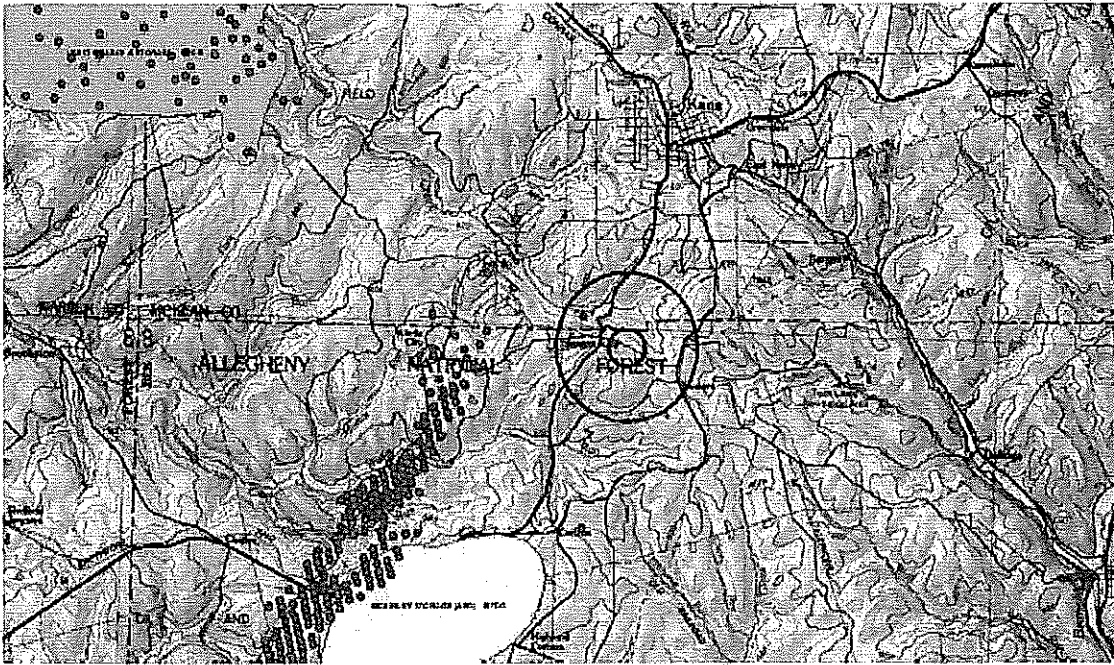


Figure 7. Map showing storage well locations. Quarter-mile and one-mile buffers depicted.

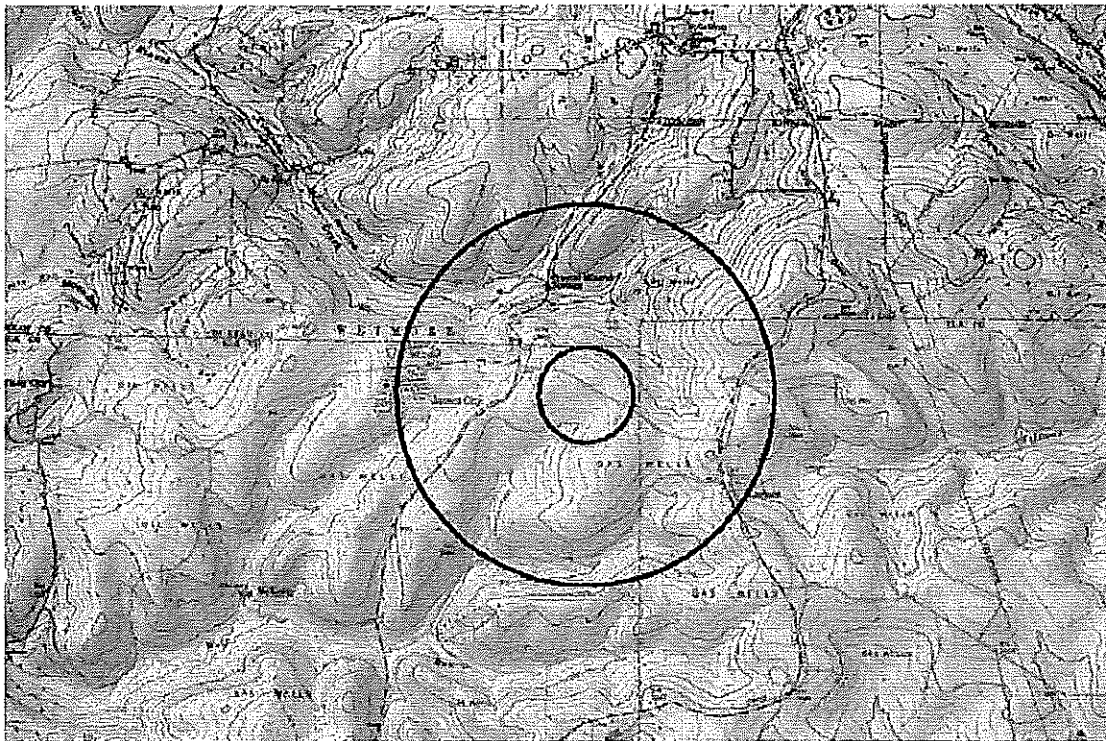


Figure 8. Map showing surface and underground mining activities in the area. Quarter-mile and one-mile buffers depicted.

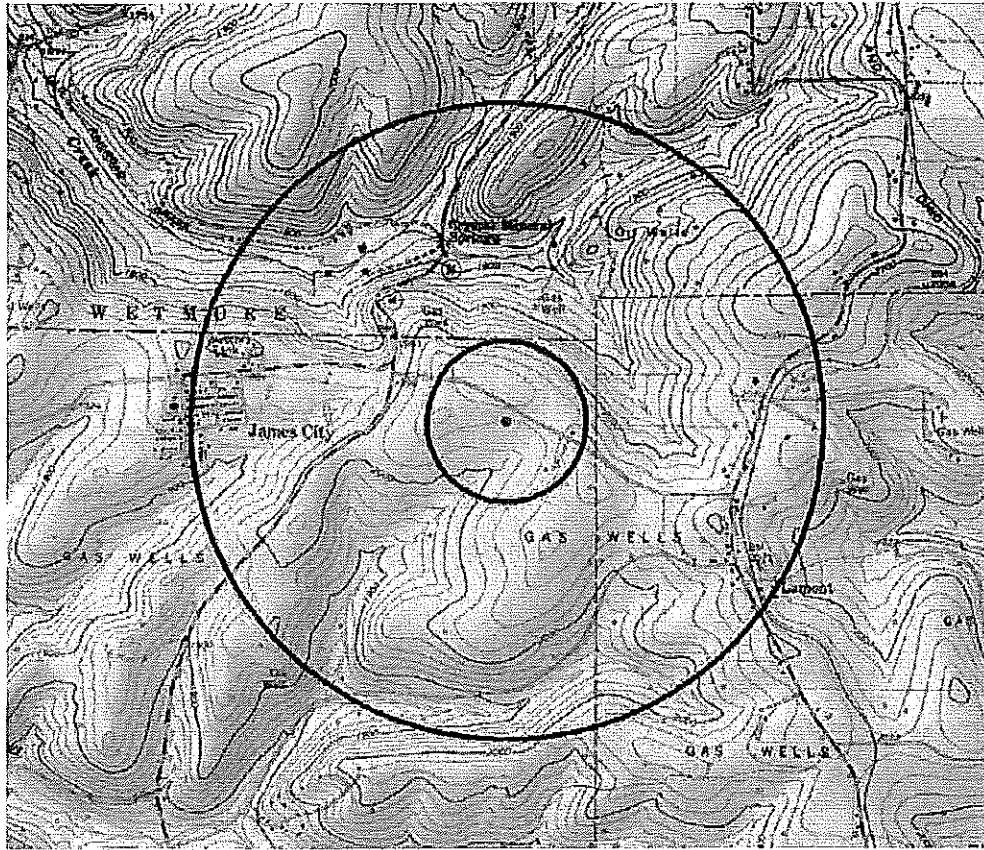


Figure 9. Map showing public water supply wells (municipal water wells shown as blue symbols and private supply wells as gold symbols). Quarter-mile and one-mile buffers depicted.

Summary of Geological Review/Assessment and Recommendations

Geological Assessment for the Seneca – Elk County Well #38268 gas well:

In my professional opinion, based on the data reviewed, the geological structure and setting associated with the Seneca – Elk County Well #38268 makes it a suitable candidate for conversion from a production well to an underground injection well.

The following recommendations are suggested:

(1) It is recommended that the location, depth and use of any additional private water wells detailed in Seneca's PPC Plan be confirmed by the Department.

(2) It is recommended that the location and usage of the well identified by Seneca as belonging to National Fuel Gas Supply Corporation be confirmed by the Department as a test gas well and not a water well.

Once the location, depth and usage of the aforementioned wells are confirmed, the Department must take steps to ensure the casing and cementing design of the proposed injection well satisfies the requirements of 25 Pa. Code Chapter 78, Subsection D. If this is the case, it is my professional opinion that there is no expected risk to these wells provided injection well integrity is maintained per the requirements of EPA's UIC Program.

cc: John Ryder  
Douglas Moorhead  
Keith Salador

End

# Attachment- C

[Producer/Wells](#)  
 [Disbursements](#)  
 [Public](#)  
 [Reports \(../Reports/Reports.aspx\)](#)  
 [Administration](#)

[Logout \(../Security/Logout.aspx\)](#)

### Filter Payments

Producer Name

Filter

### Outstanding Payments

Producer Name	Client ID	Amount	Paid Amount	Owed Amount
GUARDIAN EXPLORATION LLC	237396	\$50,050.00	\$0.00	\$50,050.00
XTREME ENERGY CO	317770	\$70,600.00	\$0.00	\$70,600.00

### Producer Reports

[Statement Of Account \(../Reports/ReportViewer.aspx?rptPath=/Act13/ProducerStatementOfAccount&params=/wASbQn4xyQ=\)](#)

[Privacy Policy \(http://www.pa.gov/privacy-policy/\)](http://www.pa.gov/privacy-policy/)

[User's Guide \(http://www.puc.pa.gov/naturalgas/doc/act13/act13\\_users\\_guide.docx\)](http://www.puc.pa.gov/naturalgas/doc/act13/act13_users_guide.docx)  
 Producer User's

[Guide \(http://www.puc.pa.gov/naturalgas/doc/act13/act13\\_producers\\_users\\_guide.docx\)](http://www.puc.pa.gov/naturalgas/doc/act13/act13_producers_users_guide.docx)  
 Local

Government User's Guide

[\(http://www.puc.pa.gov/naturalgas/doc/act13/act13\\_government\\_users\\_guide.docx\)](http://www.puc.pa.gov/naturalgas/doc/act13/act13_government_users_guide.docx)

# Attachment- D



### Administrative and Compliance Monitoring and Reporting

1. Pursuant to § 78.125, submit to the Department, a copy of the annual monitoring report submitted to the EPA summarizing the results of the monitoring as required by 40 CFR Part 146 (relating to underground injection control program) when these reports are submitted to the EPA. This summary, at a minimum, shall include the following:
  - a. Monthly records of major changes in characteristics or sources of injected fluids.
  - b. Reports of volumes and pressures of injection fluids.
  - c. Reports of mechanical integrity testing.
  - d. Other information or reports required to be submitted to the EPA under 40 CFR Part 146.
2. Submit, to the Department, copies of the periodic monitoring reports or reports of failures, releases, accidents or other incidents required to be submitted to the EPA under 40 CFR 146 when these reports are submitted to the EPA.
3. Prior to initiation of injection of waste into the disposal well, ensure an inspection is conducted by the Department's Oil and Gas Inspector for the well, which includes pressure readings of the annulus, to confirm compliance.
4. Prior to initiation of injection of waste into the disposal well, submit, to the Department, a copy of the EPA form 7520-10 that was submitted to the EPA, indicating completion of construction.

### Seismic Monitoring and Mitigation

The permittee shall prepare and implement a seismic Monitoring and Mitigation Plan. The seismic Monitoring and Mitigation Plan shall be submitted to the Department of Environmental Protection ("Department") at least 30 days prior to the anticipated start date of disposal activities in an existing well. This plan, or the plan as modified by the Department, shall be fully implemented at the time disposal activities begin and thereafter shall include the following components:

1. Installation of a seismometer that includes the following:
  - a. One 3-component velocity sensor (X, Y, and Z axes), high-frequency seismometer **or** a local network consisting of a **minimum** of four high-frequency seismometers that have 3-component velocity sensors.
  - b. For purposes of this seismic Monitoring and Mitigation Plan, a "seismic event" shall mean circumstances which reflect tectonic seismic activity above the thresholds and within the distances set forth in Paragraphs (11) or (12) below.
  - c. For purposes of this seismic Monitoring and Mitigation Plan, an "Injection-Induced Seismic Event" shall mean circumstances which reflect seismic activity that may be directly attributable to the permitted injection activities. Raw seismic data gathered by the seismometer(s) described in (1) a. will be processed to calculate event location (epicenter/hypocenter) and magnitude. Events attributable to surface activities (such as, but not limited to, mining or blasting) or system

noise, or events with hypocenters deeper than the top of the Salina Salts will not be considered potential Injection-Induced Seismic Events.

- d. If the one sensor option is chosen, and an Injection-Induced Seismic Event occurs at or above the thresholds specified in (11) c and d below, the operator will mobilize a local network consisting of a minimum of four (4) high-frequency seismometers that have 3-component velocity sensors within 48 hours of the event.
  - e. All seismometers shall be installed in accordance with the manufacturer's instructions prior to operation of the disposal well.
2. A description of and specification sheet for the seismometer(s) installed at the disposal well site.
  3. The installation of a recorder that, at a minimum, continuously records 100 samples per second using a data logger with 24-bit digitizer and Global Positioning System (GPS) timing, in accordance with the manufacturer's instructions prior to operation of the disposal well.
  4. A description of and specification sheet for the seismic recorder installed at the disposal well site.
  5. A description of the protocol for operating and completing calibration of the seismometer and seismic recorder installed at the disposal well site demonstrating that it conforms with the standards employed by the Pennsylvania State Seismic Network (PASEIS) and the manufacturer's instructions.
  6. A description of the routine maintenance and service checks that will be implemented to monitor the operability or running condition of the seismometer and seismic recorder installed at the disposal well site. The description should detail how the checks satisfy the manufacturer's instructions.
  7. Verification that Seismic Event data will be captured at the disposal well site electronically and in a manner that is suitable for Seismic Event recordation and analysis.
  8. Verification that seismic data will be provided to the Incorporated Research Institutions for Seismology (IRIS) Network in real time and that the continuous, real time data conforms to the data format required by IRIS for archiving under PASEIS' network code (PE) and open distribution. If data transmission is interrupted notification will be provided to the Department verbally within 24 hours and in writing within seven (7) days.
  9. A description of measures that will be taken to install the seismometer in a manner that will minimize interference from background sources and allow for optimal Seismic Event identification and location (epicenter and hypocenter). This shall include a plan view map of proposed seismometer location(s).
  10. Contact information for the responsible person in charge of conducting seismic monitoring activities at the disposal well site.
  11. If the one sensor option is chosen, an Injection-Induced Seismic Event contingency plan that includes monitoring, reporting and mitigation provisions consistent with the following:
    - a. Immediate electronic notification to the Department and the Department of Conservation and Natural Resources' Bureau of Topographic and Geologic

- Survey (BTGS) of detection of any measurable event, within six (6) miles measured radially from the disposal well.
- b. Notification within 10 minute via email to the Department and within 1 hour via telephone to the Department's statewide toll free number in the case of seismic activity referenced in a. above will include filtering/processing of raw seismic data to identify and remove non-tectonic events (e.g. mine blasts or system noise) and events hypocenters deeper than the top of the Salina Salts.
  - c. Should an Injection-Induced Seismic Event occur (i.e., not a surface-related event, system noise or seismic events with hypocenters deeper than the top of the Salina Salts), the Operator will reduce the well's operating injection rates. Reduction of the disposal well's operating injection rates in use at the time of the Injection-Induced Seismic Event by 50% within 48 hours of the occurrence of 3 or more consecutive Injection-Induced Seismic Events greater than 1.0 and less than 2.0 on the Richter Scale over a seven (7) day period occurring within three (3) miles measured radially from the disposal well. The seven (7) day period is defined as starting with the occurrence of any Injection-Induced Seismic Event of magnitude 1.0 or greater. Reduced operating injection rates shall be maintained until the Department provides written notice addressing injection rates.
  - d. Termination of all injection activities within 48 hours of the occurrence of an Injection-Induced Seismic Event of magnitude 2.0 or greater within three (3) miles measured radially from the disposal well until receipt of a written notice from the Department addressing continued well usage and operating conditions. The assessment of continued usage will include, but not limited to, the following criteria:
    - i. Magnitude and frequency of events detected;
    - ii. Operational history prior to the event and operating conditions at the time of the event (rates, volumes, pressures);
    - iii. Any mitigation/intervention attempts made prior to termination of activities;
    - iv. Ability of permittee to identify another potential source for the event based on data processing and analysis of conditions.
12. If the network option is chosen, an Injection-Induced Seismic Event contingency plan that includes monitoring, reporting and mitigation provisions consistent with the following:
- a. Immediate electronic notification to the Department and the Department of Conservation and Natural Resources' BTGS of detection of any measurable event, within three (3) miles measured radially from the disposal well.
  - b. Notification within 10 minute via email to the Department and within 1 hour via telephone to the Department's statewide toll free number in the case of seismic activity referenced in a. above will include filtering/processing of raw seismic data to identify and remove non-tectonic events (e.g. mine blasts or system noise) and events hypocenter deeper than the top of the Salina Salts.
  - c. Should an Injection-Induced Seismic Event occur (i.e., not a surface-related event, system noise or seismic events with hypocenters deeper than the top of the Salina Salts), the Operator will reduce the well's operating injection rates. Reduction of the disposal well's operating injection rates in use at the time of the Injection-

Induced Seismic Event by 50% within 48 hours of the occurrence of 3 or more consecutive Injection-Induced Seismic Events greater than 1.0 and less than 2.0 on the Richter Scale over a seven (7) day period occurring within two (2) miles measured radially from the disposal well. The seven (7) day period is defined as starting with the occurrence of any Injection-Induced Seismic Event of magnitude 1.0 or greater. Reduced operating injection rates shall be maintained until the Department provides written notice addressing injection rates.

- d. Termination of all injection activities within 48 hours of the occurrence of an Injection-Induced Seismic Event of magnitude 2.0 or greater within two (2) miles measured radially from the disposal well until receipt of a written notice from the Department addressing continued well usage and/or addressing injection rates. The assessment of continued usage will include, but not limited to, the following criteria:
  - i. Magnitude and frequency of events detected;
  - ii. Operational history prior to the event and operating conditions at the time of the event (rates, volumes, pressures);
  - iii. Any mitigation/intervention attempts made prior to termination of activities;
  - iv. Ability of permittee to identify another potential source for the event based on data processing and analysis of conditions.
13. Provisions for submitting an updated seismic Monitoring and Mitigation Plan, as needed or as may be required by the Department. Updates may be necessary in cases where the risk profile associated with injection activities changes. A signed and certified statement by a qualified professional person responsible for preparing the seismic Monitoring and Mitigation Plan that the plan is true and accurate and includes the components outlined above. The certification shall provide: "I, (insert name), hereby certify, under penalty of law as provided in 18 Pa.C.S. § 4904 (relating to unsworn falsification to authorities) that I prepared the seismic Monitoring and Mitigation Plan for (insert facility name) and the information provided is true, accurate and complete to the best of my knowledge and belief."
14. Upon commencement of disposal activities at the disposal well, the permittee shall record Injection-Induced Seismic Event data electronically in an appropriate format for analysis (event location and magnitude) and maintain daily records of Injection-Induced Seismic Event data electronically for review at the request of the Department. Injection-Induced Seismic Event records must be maintained for one (1) year.
15. The permittee shall maintain all calibration, maintenance and repair records for the seismometer for at least five (5) years.
16. The permittee shall maintain all calibration, maintenance and repair records for the seismic recorder for at least five (5) years.
17. The operator may submit a summary report and plan for modification or discontinuation of the seismic Monitoring and Mitigation Plan five (5) years after injection activities commence. The Department's review will be completed as soon as practicable after receipt of the summary report and a written response will be provided to the operator. DEP's assessment of the report will be dependent on, but not limited to, the following criteria:
  - a. Magnitude and frequency of any events during the monitoring period;

- b. Operational history during the monitoring period (rates, volumes, pressures);
- c. Planned operational conditions moving ahead (rates, volumes, pressures);
- d. Demonstration through pressure fall-off that system is at equilibrium and behaving in as a homogenous reservoir;
- e. Need for any mitigation/intervention during the monitoring period.

#### Mechanical Integrity Special Permit Conditions

- 18. At least 30 days prior to any formation stimulation, the permittee shall submit a treatment plan to the Department.
- 19. The permittee shall provide on a monthly basis an electronic and graphical record of injection pressures, annular pressures, injection rates, and injection volumes and cumulative volumes in a format acceptable to the Department. All pressures and rates shall be monitored continuously with digital devices. The permittee shall also maintain records of this information for review at the request of the Department, for one (1) year.
- 20. Prior to the initial injection of fluids into the disposal well, the permittee shall coordinate and conduct an inspection of the well site, including the seismometer and recorder, with the Department's Bureau of Oil and Gas Management.
- 21. Prior to operation of the disposal well, the permittee shall provide the Department with documentation showing how it complied with provision Part II, D.2.b. of the EPA UIC Permit, demonstrating that the well has mechanical integrity.
- 22. The permittee shall notify the Department verbally within 24 hours and in writing within seven (7) days of obtaining information showing evidence of compromised mechanical integrity and immediately cease injection operations.

#### Other Conditions

- 23. This permit modification is conditioned upon the existence of the Class II-D brine disposal Injection Well dated November 17, 2014, U.S. EPA permit #PAS2D025BELK ("EPA Permit")
- 24. A wellbore diagram of the proposed Plugging and Abandonment Plan shall be provided to the Department with a "Notice of Intention by Well Operator to Plug Well" form (8000-FM-OOGM0005) prior to plugging the well.
- 25. The statements in the November 12, 2014 permit application and updates for this modification are incorporated into this permit.