

MEMO

TO Jennifer Means and Eric Gustafson

FROM Bruce E. Jankura, P.E.

DATE February 15, 2017

RE SAMMY-MAR, LLC
Clearfield County - Povlik #1
Mechanical Integrity Review
EPA UIC Application Documents

MESSAGE:

This is an assessment of the mechanical integrity, for drilling a new underground injection well, by SAMMY-MAR, LLC, the Povlik #1, in Huston Township, Clearfield County, Pennsylvania, API # 37- 033-27257.

I reviewed all the documents that were submitted by SAMMY-MAR, LLC to PADEP Office of Oil and Gas Management on May 10, 2016. 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, Underground Injection Control (UIC) Class II Well Permit Application" by Sections and Appendices, 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.

The Povlik #1 is proposed to be drilled as a new, vertical, conventional, coal area, conservation well with 24 1/2" conductor to be set at 10' and cemented to surface, 16" water protection casing to be set at 200' and cemented to surface, 11 3/4" water protection casing to be set at 375' and cemented to surface, 8 5/8" surface casing to be set at 1,250' and cemented to surface and 4 1/2" production casing to be set at 7,030' and cemented to a depth at approximately 5,000' in the annulus (as per Wellbore Diagram in Attachment "M"). This well design meets the most recent regulatory requirements for well construction and operation.

Additional information regarding the construction and operation of this proposed well is set forth below.

Attachment A – AREA OF REVIEW METHODS

- “Because the Povlik injection well is a new, proposed well, Sammy Mar does not have any measurements for reservoir pressure, porosity, permeability for the Povlik well, but used the research from the Pennsylvania Geological Survey and offset well data to provide this information; this is also in attachment G.”
- “An injection test was performed on an offset well to try and determine injection volume, rate and max injection pressure; this information is found in Attachment H.”

Comment – The analytical methods employed are reasonable. Utilizing depleted reservoirs as water disposal zones is a common practice throughout the oil & gas industry. Based on my review of the data presented, it is reasonable to consider this well and the injection formation a candidate for a brine disposal well.

Attachment B – MAPS OF WELL / AREA AND AREA OF REVIEW

Comment – The maps and historical well data presented, appear thorough and complete.

Attachment C – CORRECTIVE ACTION PLAN AND WELL DATA

- Sammy –Mar indicates if any fluid migration occurs at existing wells due to injection or problems develop with the casing of the injection well, that injection will be stopped until the situation can be remedied. (Within the AOR there are 2 wells that penetrate the injection zone and 3 wells that do not penetrate the injection zone.)

Comment – This is a reasonable approach and Sammy-Mar is committing to deal with unknown issues, if and as they arise in the future.

Attachment G – GEOLOGIC DATA ON INJECTION AND CONFINING ZONES

- “The Povlik well will be in a depleted natural gas field.”

Comment – The data from 7 wells drilled through the proposed Oriskany disposal zone, provided in this section, indicate a current field pressure of 25 psi that is significantly below and some initial rock pressures which exceeded 3,000psi. This provides adequate support for this statement.

Attachment H – OPERATION DATA

- “Injection Rates and Volumes: 1)the proposed average injection rate is 2,000 BBLs of water per day and the maximum rate should be no greater than 2,500 BBLs of water per day. Estimated average monthly injection volume will be 60,000 to 65,000 bbls.”

Comment – This is a reasonable injection volume base on the injection test on the Green Glen #1 well (Permit # 033-20228, less than 1,500’ from the proposed Povlik #1

location) where a maximum injection rate of 1,350 Bbls / day was achieved into the Oriskany formation with 1,240 psi on 10/22/2009.

- "Injection Pressures: 2) Injection pressure is expected to be below the calculated maximum injection pressure of 3,048 psi at the well head, without accounting for the estimated 150 to 200 psi of pipe friction through the 2 7/8" injection string."
- "The Maximum Injection Pressure was calculated using the formula published in 40 CFR 147.1953 [$P_m = (FG - 0.433 S_g) d$] for a column of water."

Comment - The critical parameter is the Maximum Allowable Surface Injection Pressure (MASIP) of 3,048 psi. This pressure 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. The input values provided and the calculation for the MASIP are reasonable.

- "...The fracture gradient of 0.944 was calculated using the ISIP of the closest hydro-fractured well in the area for which records are available, the Green Glen #1, P# 033-20313.

Comment - The calculated fracture gradient of 0.944 psi/ft is reasonable because it is within the range of typical gradients observed in Pennsylvania, roughly 0.7 to 1.1 psi/ft.

- "Annulus Fluid: 3) Fresh water will be in placed in the 2 7/8" annulus, mixed with Corr Plex 300 which acts as a corrosion inhibitor and bacteria growth preventer. ...Positive pressure will be maintained on the annulus to monitor mechanical integrity."

Comment - This is a common industry best management practice and reasonable to utilize.

- "Source and Analysis of Injection Fluid: 4) ...Before injection, the produced fluid and flow back water will be subjected to treatment and passed through a filter to remove large particles and suspended solids from the fluid before injection."

Comment - This is a common industry best management practice and should contribute to the long-term maintenance of well integrity.

Attachment J - STIMUALTION PROGRAM

- "There are no plans to stimulate the Povlik #1."

Comments -

1) This is reasonable considering the rock properties of the Oriskany formation in the AOR.

2) Although, any stimulation treatment plan should be reviewed by the Department prior to implementation. See Recommendations Below.

Attachment K – INJECTION PROCEDURES

– The Injection procedures describe control of fluid specific gravity, filtration, pumping, injection pressure monitoring, tubing annulus monitoring, annular pressure automatic shutdown control and quarterly monitoring-well fluid level checks.

Comment – The injection procedures described are reasonable practices. Sammy Mar should provide the injection rate, injected volumes and pressure monitoring data to the Department on a monthly basis in a digital format acceptable to the Department, while including the monitoring-well fluid level checks the month after they are obtained. This is necessary for the Department to routinely monitor injection activity and potential for induced seismicity. See Recommendations Below.

Attachment L – CONSTRUCTION PROCEDURES

– A general description is provided for the “Drilling Program...Deviation Checks...Logging Program”.

Comments –

1)The detailed pipe strength data provided indicates the oilfield tubulars planned for this well are expected to have adequate properties, including internal yield pressure ratings for the tubing and production casing that would contain the proposed maximum injection pressure of 3,048 psi.

2)A routine site inspection should be conducted on the Povlik #1 well by the PADEP Oil & Gas Inspector to confirm the well status prior to initiation of injection. See Recommendations below.

Attachment M – CONSTRUCTION DETAILS

– “Construction Details-Subsurface: Wellbore Schematic”

Comment – These diagrams are reasonable depictions of the wellbore, casing program, wellhead and retrievable packer.

Attachment O – PLANS FOR WELL FAILURES

– This attachment describes planned actions for well shut down and regulatory notifications, following an equipment or mechanical integrity well failure.

Comment – This plan outline is reasonable.

Attachment P – MONITORING PROGRAM

– “There will be two (2) monitoring wells whose locations are shown on the attached map and a possible third well if the well which was previously plugged (outside the AOR), can be adapted for use as a monitoring well.”

Comments –

1) On the map provided, the two (2) monitoring wells indicated are permit #033-20228 and #033-20263. The plugged well indicated is permit #033-20047P, which is just outside of the AOR. The plan described is reasonable. It should be noted that a DEP inspection of the plugged well, dated 6/16/2016, confirmed the presence of methane gas at the vent pipe on the monument.

2) I recommend obtaining an accurate methane percentage reading and flow measurement at the monument vent of well #033-20047P prior to the start of injection and on a quarterly basis thereafter. This data should be reported to DEP the month after they are obtained. See Recommendations below.

Attachment Q – PLUGGING & ABANDONMENT PLAN

– “Sammy-Mar will plug the Povlik in accordance with the Pennsylvania Bureau of Oil and Gas Management and the EPA regulations in place at the time of abandonment.”

Comment – The Plugging and Abandonment Plan, cost estimate, procedure and final plugged well schematic showing cement plug set depths, appear reasonable to meet regulatory requirements.

EPA Notice of Final Permit Decision / EPA UIC Permit & Responses to Comments following closure of the final public comment period on September 10, 2015.

– In Part II, D.2.b. of the UIC Permit, Sammy-Mar 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. Prior to commencing injection, Sammy-Mar should provide DEP with the documentation showing how they complied with this provision of the EPA UIC Permit. See Recommendation Below.

– EPA’s Response to Comments #4, 6, 7, 10, 13, 18, 20 and 24 were related to well construction, formation fracturing, plugged/abandoned wells and proposed plugging of the injection well.

Comment – EPA’s responses effectively addressed the issues raised by the comments.

Overall Mechanical Integrity Review Assessment

Mechanical Integrity for the Povlik #1 injection well:

In my opinion, based on the data reviewed and with the implementation of the Recommendations below, the mechanical integrity of the proposed Povlik #1 well should be adequate to meet DEP regulations for an underground injection well.

Recommendations

1. Any stimulation treatment plan should be reviewed by the Department prior to implementation (Att. J).
2. Provide, on a monthly basis to the DEP, injection pressures, annular pressures, injection rates and cumulative volume; in both digital and graphical formats, while including the monitoring-well fluid level checks the month after they are obtained (Att. K).
3. A routine site inspection should be conducted by the PADEP Oil & Gas Inspector to confirm the well status, including annular pressure readings, prior to initiation of injection (Att. L).
4. Obtain an accurate methane percentage reading and flow measurement at the monument vent of well #033-20047P prior to the start of injection and on a quarterly basis thereafter. Provide results to DEP the month after they are obtained.(Att. P).
5. Prior to commencing injection, provide DEP with the documentation showing how Sammy-Mar complied with provision Part II, D.2.b. of the EPA UIC Permit, demonstrating that the well has mechanical integrity.
6. 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. This requirement is in addition to and does not alter notification requirements in DEP regulations.

cc: John Ryder