



pennsylvania

DEPARTMENT OF ENVIRONMENTAL
PROTECTION

MEMO

TO Eric A. Gustafson *EG 3/16/17*
FROM: Bruce E. Jankura, P.E. *[Signature]*
DATE September 13, 2016
RE PGE – Indiana County Yanity Well #1025
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 PGE's existing Yanity #1025 gas well in Grant Township, Indiana County, Pennsylvania, API # 37-063-31807-00.

I reviewed the documents that were submitted by PGE under cover letter dated 3/30/15 to PADEP Southwest District Office/Bureau of District Oil & Gas Operations for a well permit to reclassify the Marjorie C. Yanity well. "Section 11: EPA UIC Well Permitting Documents" included the documents which 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 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 drive pipe to 17', conductor pipe set at 28' with sand and three (3) additional strings of casing cemented in place; surface casing set at 569' and cemented to surface, intermediate casing set at 1540' and cemented to surface and production casing set at 7786' and cemented to 6960'. This well meets the most recent (2011) regulatory requirements for well construction and operation. Based on the Mechanical Integrity data reported for 2015 and 2014 (See Table #1) and a review of DEP'S eFACTS database (most recent inspections on 5/27/15 and 12/09/15, see Table #2), this well appears to have no outstanding issues or violations. Additional information regarding the construction and operation of this well is set forth below.

11b. EPA-UIC Permit Application & Attachments (As Submitted by PGE to EPA dated 5/2/13)

– The Yanity #1025 "has produced from the Huntersville Chert formation since 1997. The reservoir is nearing depletion and is an excellent candidate for conversion to water disposal."

Comment – Converting depleted reservoirs to water disposal zones is a common practice throughout the oil & gas industry. The well started producing from the Huntersville Chert in 1997, more than 18 years ago, which is enough time for the formation to be considerably depleted. For this reason it is reasonable to consider this formation a candidate for conversion.

B. MAP OF WELL AND AREA OF REVIEW

– “There are three producing shallow gas wells in the area of review, none of which penetrate the zone of injection. The deepest of the producing wells in this area is 3,560 feet at TD. This is about 3,984 feet above the shallowest (proposed) injection perforation.”

Comment – The 3,984 feet of vertical separation between the shallow producing wells in the area and the depth of the proposed disposal zone makes it reasonable to consider the formation a candidate for conversion.

C. CORRECTIVE ACTION PLAN (CAP) & WELL DATA

– PGE indicates that there are no other known wells that penetrate the proposed injection zone, so “...no corrective action plans are required.” Also, “In the event that old, unplugged and unreported wells are located as a result of the injection process these wells will be plugged and abandoned,....”

Comment – This is a reasonable approach for the CAP because the injection zone is isolated and PGE is committing to deal with unknown issues, if and as they arise in the future. Note that the wellbore diagram has a typographical error for the permit number. It should be 063-31807.

– PGE submitted Well Data for the Yanity #1025 well, including The Well Record dated 8/25/97, the Well Record Book dated 6/30/97 and 7/2/97 and a Well Construction Diagram.

Comments – The data indicates;

1. The hole sizes drilled for each casing string are adequate or exceed regulatory requirements.
2. The size of casings installed are adequate.
3. The casing shoe set depths to protect fresh water sources are adequate.
4. The cement blends used to cement all the three (3) casing strings were adequate.
5. The 30 and 20 barrels of cement returns to surface during the surface and intermediate casing string cement jobs, respectively, are indicators of good cement jobs.
6. The estimated top of cement (TOC) indicated at 6,850 feet for the 4 ½” casing appears to be a typographical error. Based on my review and interpretation of the Cement Bond Log dated 4/16/13 the TOC is at approximately 6,950 feet. Using the 6,950’ depth for the TOC and my log interpretation indications of good quality cement bond below the TOC, there is an adequate cement sheath length (594 feet) above the top injection perforation (7,544 feet) to provide pressure and zonal isolation in the 4-1/2” casing annulus during injection.
7. The data provided in this section supports that PGE’s approach for the CAP is adequate.

E. NAME AND DEPTH OF USDWs

– “The deepest water well identified in the area of review is 190 ft.” “...the deepest USDW may be up to 520 feet below the ground surface.” “Thus, the casing program provides adequate protection of USDW’s in the area of review.”

Comment – Because of the construction of this well, as described in the permit application documents, PGE’s analysis is reasonable and the casing program is adequate to provide protection of USDW’s in the area of review.

G. GEOLOGIC DATA ON INJECTION & CONFINING ZONES

– “The Frac gradient in the Huntersville is 0.9188 psi/ft calculated using the ISIP from the Yanity well 1025 stimulation.”

Comment – The value for the ISIP is reasonable, as shown on the Yanity Acid Frac pressure curve dated 7-25-1997 in the following Section H – Operating Data. If the acid frac displacement fluid has a hydrostatic gradient of fresh water (which is typical for acid frac work), then the fracture gradient value is reasonable.

H. OPERATING DATA

– Various parameters are listed for the proposed injection operation.

Comment – The critical parameter listed here is the Maximum Surface Injection Pressure of 2,934 psi. The input data and calculated pressures to arrive at this value are reasonable.

I. FORMATION TESTING PROGRAM

– “A five day step-rate test was conducted ...”

Comment – PGE’s proposed injection rates are reasonable based on the results of the November 2012 testing. Note that the controlling factor will be the maximum surface injection pressure, not the injection flow rate. As the pressure increases toward the maximum, the rate will have to be reduced for the pressure to stay below the maximum.

J. STIMULATION PROGRAM

– “Additional perforations will be added..., Periodic acid washes will be performed..... If necessary to increase future injectivity, the well may be hydraulically fractured in the Huntersville Chert.”

Comment – All of these treatments are common for injection wells and are reasonable to implement. They can typically be performed routinely without damaging the wellbore's mechanical integrity. Any treatment plan of this nature should be reviewed by the Department prior to implementation, see Recommendations below.

K. INJECTION PROCEDURES (Also see Sec. 11.d.K.)

– “The positive displacement pump will be equipped with an automatic shutdown set to maximum tubing and casing pressures.” “Tubing and production casing pressures, ... will be continuously monitored with a SCADA system that can be accessed remotely.”

Comment – There is not a specific comment regarding monitoring the production casing annulus pressure (4-1/2" x 8-5/8"). The intermediate casing pressure should be continuously monitored and have an automatic shutdown set to a maximum surface pressure. See Recommendations below.

L. CONSTRUCTION PROCEDURES

– Downhole electric logs are provided in this Attachment.

Comment –

1. The “Litho-Density/Compensated Neutron/Gamma Ray Log was not available for review, but it is not necessary for my review of mechanical integrity because it does not reveal any mechanical integrity information.

2. The 4/16/13 Temperature log shows a smooth gradient profile and no anomalies. This is a good baseline log for comparison to any logs performed in the future.

3. The 4/16/13 Cement Bond Logs were run with a surface pressure of 0 psi and 2,500 psi on the 4 1/2" production casing. I interpret the top of cement at 6,950 feet. PGE has indicated in their documents that the TOC is at 6,850 feet. I believe this is a typographical error (see comments regarding this interpretation above in 11.b.C) and should be verified by PGE, see Recommendations below.

M. CONSTRUCTION DETAILS

– “Included in this section..... –Wellbore schematic, Wellhead diagram”

Comment –

1. Both documents are good depictions of the wellhead and casing program. Note that the wellbore diagram has a typographical error for the permit number. It should be 063-31807.

2. The wellhead and casing strengths appear adequate to contain the proposed injection pressures.

3. Published pipe strength data for the internal yield pressure ratings of the tubing, production casing and intermediate casing, all exceed the proposed maximum injection pressure of 2,934 psi.

4. The surface casing dimension description is not a common casing size: 11- $\frac{3}{4}$ ", 42 #/ft, J-55. This should be confirmed, see Recommendations below. If this is accurate, then the internal yield pressure rating for this casing should be between 2,000 – 3,000 psi. This is adequate for the surface casing.

5. The TOC depth on the wellbore diagram needs to be verified by PGE, see Recommendations below.

O. PLANS FOR WELL FAILURES

– This attachment describes planned actions for well shut down and regulatory notifications, following a mechanical well failure or noncompliance. Also, "Note: As shown in Attachment M: Construction Details, there are four levels of protection between the injected water and surface sources of drinking water."

Comment –

1. This plan outline is generally reasonable and appropriate.

2. The "four (4) levels of protection" is an accurate statement considering the path from the perforations up through the tubing/packer/wellhead system (1), production casing (2), intermediate casing (3) and surface casing (4). A secondary path exists with three levels of protection, vertically through the 4 $\frac{1}{2}$ " production casing cement sheath (1), the intermediate casing (2) and the surface casing (3). Both pathways provide adequate protection. Although, in both cases, it is important for the production by intermediate casing annulus to be a primary monitoring point. A shut down alarm would be appropriate to prevent significant pressure build up inside the intermediate casing, see Recommendations below.

P. MONITORING PROGRAM

– "No monitoring program beyond maintaining records of the surface injection pressure is proposed." "The injection facility will be closely monitored through the assistance of a supervisory control and data acquisition (SCADA) system."

Comment –

1. Since the Yanity #1025 gas well, API # 37-063-31807-00, began operation in 1997, no violations have been recorded for it in the PADEP eFACTS system.

2.The Monitoring Program is not adequate. I recommend the addition of an emergency shutdown device on the intermediate casing as a continuous pressure monitoring point, see Recommendations below. This is the production by intermediate casing annulus (4-1/2" x 8-5/8").

3.I recommend the addition of maintaining records for the 4-1/2" and 8-5/8" casing pressures, see Recommendations below.

4.An inspection of the well site and well should be conducted by the PADEP Oil & Gas Inspector to confirm the well status and mechanical integrity, prior to initiation of injection, see Recommendations below.

Q. PLUGGING & ABANDONMENT PLAN

– "...and the well plugged per the included EPA Plugging & Abandonment Plan in accordance with Pa Code Title 25 Ch78.95."

Comment – The Plugging and Abandonment Plan meets the regulatory requirements and appears to be adequate. A wellbore diagram of the proposed plan should be provided by PGE. See Recommendations below.

11c. EPA's Notice of Deficiency to PGE

– The Deficiency questions posed here by EPA are repeated in the next section 11d. with PGE's responses. See comments there.

11d. PGE's Response to EPA's Notice of Deficiency (Dated March 4, 2013)

Comment –

PGE provided the original EPA questions and their responses in this section. Only the EPA questions applicable to mechanical integrity with responses that prompted additional comments are addressed below.

K.INJECTION PROCEDURES

– The Maximum Allowable Casing Pressure (MACP) procedure described for the 4-1/2" production casing to arrive at 300 psi, should be applied to the 8-5/8" casing also. The base operating pressure on the 8-5/8" casing should be 0 psi, so the 8-5/8" MACP should be about 200 psi based on the same procedure. The intermediate casing is rated for 2,950 psi. Therefore, MACP for the production and intermediate casing are each well below planned injection pressures. So, downhole leaks or failures should trigger pump shut down and protect these casing strings by keeping the pressure significantly below their rated pressures.

11o. Final EPA UIC Permit

– In Part II, D.2.b. PGE 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 need to duplicate this demonstration prior to initiating injection. I recommend that, prior to commencing injection, PGE provide DEP with the documentation showing how it complied with this provision of the EPA UIC Permit, see Recommendations below.

Mechanical Integrity Information Clarifications

1. Verify the top of cement depth in the 4-1/2” casing annulus and revise documents if necessary, i.e. the wellbore diagrams (11b.C #6 and L.3, M.5). The estimated top of cement (TOC) indicated at 6,850 feet for the 4 1/2” casing appears to be a typographical error. Based on a review and interpretation of the Cement Bond Log dated 4/16/13 the TOC appears to be at approximately 6,950 feet.

Clarification – 5/15/15 Revised well bore diagram provided by PGE indicating TOC at 6,960’.

2. The surface casing dimension description is not a common casing size: 11 3/4”, 42 #/ft, J-55. The description should be confirmed, dimension and strength data provided and documents revised if necessary, i.e. text and the wellbore diagram (11b.M).

Clarification – 5/15/15 The surface casing is 11-3/4” 42 lb/ft H-40; Internal Yield 1,980 psi, Collapse Resistance 1,070 psi. See attached drawing.

3. A wellbore diagram of the proposed Plugging and Abandonment Plan should be provided (11b.Q).

Clarification – 2/17/16 A diagram was provided by PGE that appears adequate.

Overall Mechanical Integrity Review Assessment

Mechanical Integrity for the Yanity #1025 gas well:

In my opinion, based on the data reviewed and with the implementation of the Recommendations below, the mechanical integrity of the Yanity #1025 is adequate for conversion from a production well to an underground injection well.

With some monitoring additions, PGE’s operation and monitoring plan is adequate to maintain mechanical integrity during the injection life of the well.

The Yanity #1025 is currently in compliance with the well construction and operating requirements of Pa Code Title 25 Ch78.

The intermediate casing was installed at a depth deeper than required by regulation, which is environmentally beneficial.

Mechanical Integrity Recommendations

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

1. Any stimulation treatment plan should be reviewed by the Department prior to implementation (11b.J).
2. The intermediate casing vent (the production by intermediate casing annulus, 4-1/2" x 8-5/8") should be continuously monitored and have an automatic shutdown set to a maximum surface pressure of about 200 psi, based on using PGE's Maximum Allowable Casing Pressure (MACP) procedure described for the tubing by 4-1/2" production casing annulus to arrive at 300 psi (11b.K).
3. Addition of PGE maintaining records for the 4-1/2" production and 8-5/8" intermediate casing pressures (11b.P).
4. 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.
5. 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 (11b.P).
6. Prior to commencing injection, PGE 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 (11.o).
7. 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.

The above review concludes the Department's review of the mechanical integrity of the Yanity #1025 well.

cc: John Ryder

Table #1 – Yanity #1025 Mechanical Integrity Report – 2015 and 2014

OPERATOR	O G O	PERMIT _API	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
PA GEN ENERGY CO LLC	#	063- 31807	2015		2/10/2016	B	DEP Integrity Form B				
XXXXXXXXXX											
PA GEN ENERGY CO LLC	#	063- 31807	2014	12/26/14	2/2/2015	A	DEP Integrity Form A	1300		NA	
PA GEN ENERGY CO LLC	#	063- 31807	2014	10/2/14	2/2/2015	A	DEP Integrity Form A	1300		NA	
PA GEN ENERGY CO LLC	#	063-3180	2014	41820	42037	A	DEP Integrity Form A			NA	
PA GEN ENERGY CO LLC	#	063-3180	2014	41729	42037	A	DEP Integrity Form A			NA	

MAX_ ALLOWABLE_ PRESSURE_ EXCEEDED	WATER_ LEVEL_ OR_ OTHER	WATER_ _LEVEL_ OR_ _OTHER_ _UNIT_ VARIOUS	PRODUCTION_ _ANNULUS_ _OPEN_FLOW_ _OR_SHUT_ _IN_ PRESSURE	PRODUCTION_ _ANNULUS_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_ _INTERMEDIATE_ CASING	OPEN_FLOW_ _OUTSIDE_ _INTERMEDIATE_ CASING_UNIT_ CFPD	SURFACE_ WELLHEAD_ EQUIPMENT_ EMISSION_ _RATE	SURFACE_ WELLHEAD_ EQUIPMENT_ EMISSION_RATE_ _UNIT_CFPD
NA		NA	1300	psig	N	0	cfpd	0	cfpd		NA
NA		NA	1300	psig	N	0	cfpd	0	cfpd		NA
NA		NA			N	0	cfpd	0	cfpd		
NA		NA			N	0	cfpd	0	cfpd		

LIQUIDS_TO_SURFACE_OR_OUTSIDE_FRESHWATER_CASING	CORROSION_PROBLEMS	COMMENTS	STANDARD_COMMENTS_FOR_NO_INSPECTION	FILE_NAME	REGION	COUNTY	MUNICIPALITY	UNCONVENTIONAL	WELL_TYPE
			Status validation underway	Updated_R	EP DOGO SWDO Dstr Off	Indiana	Grant	No	GAS
NA	N	DEP removed well from Inactive list when Change in Use Well Permit was submitted in August 2014.		2014_MIA	EP DOGO SWDO Dstr Off	Indiana	Grant	No	GAS
NA	N	DEP removed well from Inactive list when Change in Use Well Permit was submitted in August 2014.		2014_MIA	EP DOGO SWDO Dstr Off	Indiana	Grant	No	GAS
N	NA	Well was on Inactive Status during 2nd Quarter		2014_MIA	EP DOGO	Indiana	Grant	No	GAS
N	NA	Well was on Inactive Status during 1st Quarter.		2014_MIA	EP DOGO	Indiana	Grant	No	GAS

Table #2 – DEP eFACTS Inspection Reports Dated 5/27/15 and 12/09/15.

File Edit Application Client Site Facility Compliance Fee Collection Bonding Views Reports Admin Complaints Help Window									
Inspections									
Inspection Id	2373401	Insp Type	RTNC	Routine/Complete Inspection	Date Inspected	05/27/2015			
Inspected Entity	Cal PF	Entity	491786	063-31807	MARJORIE C YANITY 1025	Program Specific Id	063-31807		
Type	OGL	Oil & Gas Loc	Kind	COAL	Coal	Status	ACTIV	Active	
More SF	SF	369733	063-31807	MARJORIE C YANITY 1025	Type	OGW			
SF Status	ACTIV	Active	Documents		Launch Inspection Report				
General Insp SF Viol Rel Insp Comp Asst Cover Area Admin P21-2 Summary									
Owner/Operator	213205	OGO-63025	PA GEN ENERGY CO LLC						
Complaint Id		Inspector	00357721	STILES, BRENT			More	<input checked="" type="checkbox"/>	
Due Date		Inspection Result	NOVIO	No Violations Noted					
Date Scheduled		Scheduled By		Link Well Pads					
Agency	DEP	PA Dept of Environmental Protect	External	Viol	Compliant	EPA Details			
Program	OG	ICS Code	8220	EP DOGO SWDO Dstr Off	External Details				
PF Related Info									
County	32	Indiana	Municipality	32921	Grant				
Create ENF Back Go To									

File Edit Application Client Site Facility Compliance Fee Collection Bonding Views Reports Admin Complaints Help Window

Inspections

Inspection Id: 2438985 Insp Type: RTNC Routine/Complete Inspection Date Inspected: 12/09/2015

Inspected Entity

Cal PF Entity: 491788 063-31807 MARJORIE C YANITY 1025 Program Specific Id: 063-31807

Type: OGL Oil & Gas Loc Kind: COAL Coal Status: ACTIV Active

More SF: SF: 369733 063-31807 MARJORIE C YANITY 1025 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: 213205 OGO-63025 PA GEN ENERGY CO LLC

Complaint Id More Inspector: 00663913 WYRWAS, PAUL More

Due Date Inspection Result: NOVIO No Violations Noted

Date Scheduled Scheduled By Link Well Pads

Agency: DEP PA Dept of Environmental Protect External Joint Insp Viol Ind Compliant Ind EPA Details

Program: OG ICS Code: 8220 EP DOGO SWDO Dstr Off External Details

PF Related Info

County: 32 Indiana Municipality: 32921 Grant

Create ENI Back Go To

Enter the Owner/Operator Record ID: *080*