State of New Mexico
Energy, Minerals and Natural Resources Department

MEMORANDUM

Date: October 27, 2017

To: David Catanach, Division Director
Case File No. 14161

From: Phillip Goetze, UIC Technical Reviewer
Engineering Bureau, OCD

RE: REVIEW AND RESPONSE TO "*SUPPLEMENTAL STATEMENT OF ALBERTO A. GUTIERREZ, RG*" DATED OCTOBER 20, 2017; COMMISSION ORDER NO. R-13052 [CASE FILE NO. 14161]

Well Name: Monument AGI Well No. 1 API No. 30-045-40002
Well Location: Unit O, Section 36, T19N, R36E, NMPM; 662' FNL and 2513' FEL
Injection Authority: R-13052 (as amended) dated November 18, 2008

At the request of Targa Midstream Services LLC ("Targa"), the operator for the referenced acid gas injection ("AGI") well, I been provided a copy of a document prepared by Mr. Alberto A. Gutierrez, president of Geolex, Inc. and consultant for Targa, for review and comment. This supplemental statement was prepared to provide clarity concerning the assessment of the well along with additional information regarding not provided into the record as part of the sundry notices. This supplemental statement is related, in part, to my testimony and the testimony of Mr. Gutierrez given before the Oil Conservation Commission on April 4, 2017. A copy of the statement is attached and, along with this memorandum, will be entered into the case file.

Having reviewed and considered the additional information provided by Targa and Geolex, Inc., I am offering the following statements:

1. My previous interpretation for the source of the casing failure due to compromised tubing is not supported in light of the supplemental information. Significant observations not verified in the well file (Sundry Notices) but provided through later communications include 1. historical monitoring that did not identify any detectable levels of injection fluid (treated acid gas) in the annular space between the casing and tubing; and 2. the presentation by Targa showing the tubing replacement as a preventative maintenance action based on injection operations of another facility and not due to a recently recognized tubing issue at the well.

2. Further assessment of the casing integrity logs along with information described above would indicate another source for the casing failure such as an external corrosion issue or casing quality issue. I can offer no opinion as to the casing quality since this is not my expertise and the operator is responsible for providing the well materials as approved in the Application for Permit to Drill. As to external corrosion as a contributor to casing the failure, the well is located within and does penetrate the North Monument Grayburg-San Andres Unit Waterflood Project (Hearing Orders No. R-9494 and No. R-9596 (as amended)). This waterflood has been in continuous operation for a quarter of a century. It should be noted that a significant source of injection fluid for the waterflood is re-injection of the production water from the operation of the waterflood. The Division has no analytical results for this injection water nor could it locate a historical analysis offered in hearing for this project, but it is common occurrence for the quality of the re-injected water to degrade with the constant reapplication.

3. I also wish to reinforce the statements made Mr. Gutierrez as to the design of the Monument AGI Well No. 1. The well was designed, at the time of its approval, based on the most current practices used in both the United States and Canada. The new features incorporated into the Monument AGI D Well No. 2, the replacement well, represent a progression in both technology and experience acquired by the operation of these types of wells. The design of Monument AGI D Well No. 2 incorporated responses specifically identified through "lessons learned" from the earlier well. The Division very cognizant that this well failure is a critical element of its continued effort to improve the overall Class II AGI program as well as the reliability of injection as the preferred alternative to flaring.

In summary, I concur with the observations and conclusions provided by Mr. Gutierrez in his supplemental statement as to the probable cause of the failure of the Monument AGI Well No. 1 and to the actions taken by Targa to address the well failure.

PHILLIP R. GOETZE, PG, CHMM, CEM
Petroleum Geologist / UIC Technical Reviewer

Supplemental Statement of Alberto A. Gutierrez, RG

Clarification to Transcript of Proceedings on Oil Conservation Commission Hearing of April 4, 2017 "Status Report of the Division and Geolex, Inc. on Events Concerning Acid Gas Injection Well Replacements at Targa Midstream's Monument Gas Processing Facility, Lea County, New Mexico"

October 20, 2017

I am Alberto A. Gutierrez, RG President of Geolex, Inc. ("Geolex"). I am a professional geologist, registered in 21 states with over 35 years of experience in the construction and operation of wells. Geolex was retained by Targa Midstream Services LLC ("Targa") in approximately 2010 for the purpose of general design and permitting of an acid gas injection ("AGI") well at Targa's Monument Gas Processing Facility in Lea County, New Mexico. The Monument AGI #1 operated from 2011 until it was shut down in 2016.

On April 4, 2017, at the request of the New Mexico Energy, Minerals and Natural Resources Department's Oil Conservation Division ("OCD"), I testified in front of the Oil Conservation Commission ("OCC") during the hearing entitled "Status Report of the Division and Geolex, Inc. on Events Concerning Acid Gas Injection Well Replacements at Targa Midstream's Monument Gas Processing Facility, Lea County, New Mexico."

I understand that Targa met with the New Mexico Environment Department ("NMED") on September 12, 2017 and that NMED raised certain concerns regarding my testimony. Upon recent review of the transcript from my testimony, I have concluded that additional context and clarification of my testimony are necessary in order to avoid misinterpretation of my position and to address NMED's concerns regarding Targa's design, construction, and operation of Monument AGI #1 and the cause of the Monument AGI #1 failure.

Background

On November 18, 2008, the OCC approved the completion of the Monument AGI #1 at Targa's Monument Gas Processing Facility. Geolex completed the general design of Monument AGI #1, which was incorporated into Targa's approved C-108 application and the OCC order approving the well. Cambrian Management Ltd. ("Cambrian") completed the detailed design and construction of the Monument AGI #1. Cambrian drilled and completed the Monument AGI #1 in 2011.

After a failed mechanical integrity test ("MIT") in July 2016 and a significant effort to diagnose and determine the well condition and casing integrity, Cambrian obtained approval to perform an industry standard cement "squeeze job" to repair the casing. However, in August 2016, in a completely unanticipated and unusual event, the casing collapsed on the cementing string in the Monument AGI #1. At this point, Targa promptly obtained approval to plug and abandon the well. On November 10, 2016, the OCC administratively approved the drilling of replacement well, Monument AGI #2.

Context of April 4, 2017 OCC Hearing

In January 2017, I was contacted by Mr. Phillip Goetz with the OCD Engineering Bureau. Mr. Goetz informed me that the OCD intended to present a summary of the OCD's actions undertaken in connection with Targa's AGI wells to the OCC. My primary intent during the hearing was to explain the design and construction of Monument AGI #2. This explanation necessarily included a description of certain events that occurred, or events that I believed had occurred, at Monument AGI #1; however, it was not my intent

to imply that these events were caused by operator error, negligence, or the like. Additionally, it was not my intent to characterize Targa's design, construction, or operation of Monument AGI #1 as a contributing factor to the casing collapse that caused the failure of Monument AGI #1. As further discussed below, external corrosion caused by water in the formations and potential undetectable metallurgical flaws in the casing led to a collapse of the casing during the cement squeeze job in the Monument AGI #1. The casing collapse was the ultimate cause of the failure of Monument AGI #1.

Design, Construction, and Operation of Targa's Monument AGI #1

Targa informed me that during its Sept. 12, 2017 meeting with NMED, NMED raised specific concerns based on my testimony relating to Targa's design, construction, and operation of Monument AGI #1. As set forth in more detail below, none of these concerns contributed to the cause of the failure of Monument AGI #1.

First, NMED questioned Targa's selection of packer fluid in light of Targa's change of operations at Monument AGI #1 from the injection of both wastewater and acid gas to solely acid gas. *Transcript 7:13 – 8:1; 8:8 – 15.* It was reasonable for Targa to shift to the injection of only acid gas based upon the effects Targa observed of the wastewater on the reservoir. The packer fluid used, corrosion inhibited brine, would not have been the packer fluid of choice after Targa modified operations since it could have potentially created a corrosive environment in the annulus in the event of an acid gas leak from the tubing. However, based on the absence of acid gas in the annulus, as further described below, it is clear that this did not occur.

Second, NMED raised concerns regarding my reference to "inappropriate completion techniques." *Transcript 7:3 – 9.* My testimony regarding the inappropriate completion techniques was referring to the incorrect seal rings utilized in the couplings of the Monument AGI # 1. Since the seal rings, which were shipped to the site by the manufacturer, were installed in the couplings by the manufacturer's onsite representative when running the tubing into the well, there was no way for Targa to have known of this error. Targa purchased the tubing string, including the seal rings and couplings, from Duoline Technologies ("Duoline"). At the time of purchase, a similar tubing string had been successfully used in Targa's Sandhills AGI well; however, a subsequent failure of the lined tubing in the Sandhills well prompted Targa to switch to a different brand of lined tubing. The replacement of the tubing string was expedited based on Targa's discovery of the incorrect seal rings. Although the incorrect seal rings were used in the original tubing string in the Monument AGI #1, which could potentially have resulted in leaks, when the tubing was pulled and seal rings replaced, there was no evidence that any acid gas from the tubing had leaked into the annulus. This was subsequently confirmed because a) no H2S was detected in the annulus when the tubing was pulled to replace the seal rings, b) no evidence of corrosion existed on the outside of the tubing which was visually inspected when it was pulled and seal rings replaced, and c) the well had not failed any MIT or had any other evidence of a leak at that time.

Third, NMED indicated that tubing leaks during the early operation of AGI #1 could have contributed to the failure of Monument AGI #1. *Transcript 7:3 – 9.* While I testified that "minor leaks from the tubing into the annular space" occurred, this testimony was in error. Based on the seal rings and tubing replacement described above, I erroneously assumed that the tubing in the Monument AGI #1 had leaked into the annulus. After further investigation, I have confirmed that there were no leaks from the tubing into the annulus of the Monument AGI #1 at any time during its operation, even when the well failed the

MIT in July 2016. I understand that Targa completed the seal ring replacement and tubing replacement as preventive maintenance actions.

Fourth, NMED raised issues with my references to the need for "better quality control" and to Targa's "less than optimal operation" of the well. *Transcript 13:8 – 14; 22:12 – 16.* I do not agree that Targa's quality control or operational activities contributed to the issues at Monument AGI #1. In discussing the need for better quality control over drilling and completion companies, I was referring to Duoline's use of the incorrect seal rings, an error which I acknowledge that Targa could not have identified or prevented. My reference to "penny wise and pound foolish" refers only to Targa's decision to spend the additional money to repair the well, as opposed to just plugging and abandoning it upon learning of the casing integrity issues. *Transcript 13:8 – 14.* I now more fully understand that the decision to attempt to repair the casing leak in the Monument AGI #1 was made by Targa in an effort to prevent and/or minimize emissions to the greatest extent possible by getting the Monument AGI #1 back online even after it was determined that it would not be viable for long-term injection, while continuing to drill a new AGI well. Furthermore, upon recent review of the events and conditions at Monument AGI #1, I have concluded that my reference to Targa's operation of Monument AGI #1 as less than optimal is not accurate. Targa operated the well in compliance with any and all applicable requirements and industry standards as a prudent operator.

Finally, my testimony covered the design parameters of Monument AGI #2. I did not intend for my discussion regarding the "superior design" of Monument AGI #2 to imply that Monument AGI #1 was designed improperly. *Transcript 9:9 – 24.* My reference to a superior design than what was originally used for the Monument AGI #1 refers to Targa's implementation of a design for the Monument AGI #2 that had progressed based on improved industry knowledge and experience from Monument AGI #1. The design was also in part dictated by the need to drill into a reservoir which had already received acid gas for several years in the immediate vicinity of the Monument AGI #1. Targa and I worked collaboratively on the Monument AGI #2 design, including on the decision to case the well with intermediate casing all the way down to the top of the injection zone, which added an estimated $1 million in construction costs. Furthermore, Targa requested two strings of cement between the casing and the formation with potentially corrosive water. Therefore, AGI Well No. 2 was constructed with an outer cement barrier, a secondary casing string, an inner cement barrier, and then the primary casing. During the April 4, 2017 hearing, Mr. Goetz acknowledged that the Monument AGI # 1 was an earlier well and that "[t]he design of it was – was done correctly at best technology at that time." *Transcript 24:4 – 5.*

Cause of Monument AGI #1 Failure

None of the above conditions regarding Targa's design, construction, and operation of Monument AGI #1 were contributing causes of the Monument AGI #1 failure. The Monument AGI #1 failure was caused by external corrosion from water in the formations and potential undetectable metallurgical flaws leading to a collapse of the casing during the cement squeeze job in the Monument AGI #1. A summary of the events surrounding the discovery and cause of the Monument AGI #1 leak is set forth below.

(1) Identification of Leak

In July 2016, Targa conducted an MIT on Monument AGI # 1 and identified a leak at an unknown location. Targa notified OCD that it could not pass a scheduled MIT; therefore, the OCD's witnessing of the MIT was canceled. Evidence of H2S/acid gas was not detected in the annulus during the MIT. In an

attempt to determine the location of the leak, Targa initiated a series of steps reported to and approved by OCD through C-103s, verbally and over emails. Due to the fact that there was no evidence that acid gas had leaked into the annulus and there was no increase in pressure in the annulus, we concluded that there was either a packer seal leak or a casing leak. After completing further diagnostic steps, Cambrian identified a casing leak in the well. Cambrian subsequently identified a hole in the casing that, based on a reading of the casing integrity log, had been caused by external corrosion of the casing. Further discussion of this external corrosion is set forth below.

(2) Squeeze Job

In August 2016, Targa commenced a standard squeeze job on the well. The work was planned and conducted correctly by Halliburton, in conjunction with Cambrian, and with review and approval by the OCD. It was not possible for Targa to predict or prevent the well collapse that occurred during this standard squeeze job. This was a completely unpredictable and unpreventable failure, which occurred while performing a standard and industry-accepted approach to repair a hole in the casing. It was this catastrophic failure of the casing during the squeeze job that required that the well be replaced.

(3) Corrosive Waters and Potential Undetectable Metallurgical Flaws in the Casing as the Ultimate Cause of the Failure

As identified in my testimony and Targa's correspondence to the agency regarding the Monument matter, the Monument AGI #1 failure was caused by external corrosion leading to a collapse of the casing during the cement squeeze job. I recently re-reviewed the casing integrity log which shows that several areas of the casing, both in the Glorieta and the Drinkard formations, were corroded from an external source. The only external source of potential corrosion is the waters contained in these formations. There are some significant waterfloods in these zones, which were initiated after the Monument AGI #1 was installed. While I believe it is possible that undetectable metallurgical flaws in the casing could have made the casing more susceptible to the corrosive waters, it would have been impossible for Targa to know of or prevent the existence of any such casing flaws when completing the Monument AGI #1.

Prior to designing the Monument AGI #1 and during the permitting of the well, Geolex conducted a detailed review of all wells within the area under my supervision. The records did not identify any evidence of the presence of corrosive waters in the formations through which the Monument AGI #1 would be drilled. I re-reviewed these records in September 2017 and re-confirmed that no such evidence of corrosive waters was included in the documentation.

Conclusion

In summary:

- The design, mechanical, and operational conditions I mentioned during my testimony were not contributing causes to the Monument AGI #1 failure. The ultimate cause of the failure was external corrosion from water in the formations and potential undetectable metallurgical flaws in the casing.

- I mistakenly referenced tubing leaks during my testimony. My error was based on an assumption regarding the motivation for the seal rings and tubing replacement which Targa performed during the early operation of the Monument AGI #1. I now know that these replacements constituted

preventative maintenance of the well conducted by Targa to prevent potential tubing leaks into the annulus. I have since confirmed that no such leaks occurred.

- I agree with the statement in Targa's Nov. 15, 2016 submission to the NMED, "Targa Monument Gas Plant, Acid Gas Injection Well Status Update," regarding the Monument AGI #1 that "Targa's AGI well was properly designed by Geolex, an expert in the industry, and was operated and maintained consistent with industry standards." The well was approximately five years old so this failure was completely unexpected. Data from existing wells in the area that were used to design and drill the Monument AGI #1 in 2011 did not indicate the presence of unusually corrosive formation water. Potential metallurgical flaws in the casing could not have been detected. Therefore, the external corrosion was unforeseeable and beyond Targa's control.

- As a professional geologist, registered in 21 states, and with over 35 years of experience in the construction and operation of wells, I am confident that the casing collapse, which caused the failure of the Monument AGI #1, did not stem from any activity or event that could have been foreseen, avoided, or planned for and could not have been avoided by better design, construction, or operation and maintenance practices.

I declare under penalty of perjury under the laws of the State of New Mexico that this statement is true and correct.

Alberto A. Gutierrez, RG
President, Geolex, Incorporated