THE APPLICATION OF EAGLE ENERGY ACQUISITIONS, L.P. FOR AN AMENDED PERMIT TO DISPOSE OF OIL AND GAS WASTE BY INJECTION INTO A POROUS FORMATION NOT PRODUCTIVE OF OIL OR GAS, MOSES-WATSON LEASE WELL NO. 1SW, SALT FLAT (EDWARDS) FIELD, CALDWELL COUNTY, TEXAS

HEARD BY: Andres J. Trevino P.E., Technical Examiner
Gene Montes, Hearings Examiner
Michael Crnich Hearings Examiner

APPEARANCES:

APPLICANT:
- Stephan Ryan
- Don Rhodes
- Jason Gieger
- James Schnieder
- Wilbur Wood

REPRESENTING:
- Eagle Energy Acquisitions, L.P.

PROTESTANTS:
- D. Davin McGinnis
- Tim Smith
- Frank Davis d/b/a OGO Refining

PROCEDURAL HISTORY

Application Filed: December 13, 2011
Request for Hearing: May 3, 2012
Notice of Hearing: May 16, 2012
Date of Hearing: June 7, 2012
Late Filed Exhibits filed: June 7, 2012
Reopened Hearing: October 29, 2012
Proposal For Decision Issued: November 1, 2013
EXAMINERS’ REPORT AND PROPOSAL FOR DECISION

STATEMENT OF THE CASE

Eagle Energy Acquisitions, L.P. (Eagle Energy) requests authority pursuant to Statewide Rule 9 to amend their existing non-commercial disposal permit to authorize the injection of produced H₂S gas in their Moses-Watson Well No. 1SW in Caldwell County. The Moses-Watson Well No. 1SW was originally permitted on July 20, 2011 to dispose of lease produced salt water. A permit was mistakenly issued on February 16, 2012 that authorized the disposal of H₂S and Flu gas, but was declared invalid as it was determined Frank Davis’ protest was timely filed. This amended application is protested by Frank Davis d/b/a OGO Refining, an adjacent operator. Mr Davis is concerned that the H₂S gas and salt water may escape through an identified well located within 200 feet of the proposed well. The well, Shale Operating Co.’s, J.P. Watson Well No. A-4 has no completion information, cementing records or plugging records on file with the Commission.

DISCUSSION OF THE EVIDENCE

Applicant’s Evidence

The subject well is a permitted non-commercial disposal well. North South Oil, LLC was initially issued an injection permit for the Moses-Watson Well No. 1SW on July 20, 2011 to dispose of lease produced salt water. The current disposal permit, Permit No. 13317 allows a maximum of 40,000 barrels per day of produced lease saltwater to be injected at a subsurface depth from 2,950 feet to 3,600 feet into the Lower Edwards formation. The maximum operating surface injection pressure authorized is 1,200 psig. Eagle Energy became the operator of record for the Moses-Watson Lease on September 1, 2011. Eagle Energy applied for the current permit amendment to inject produced H₂S gas on December 13, 2011. Eagle Energy was issued (in error) a permit amendment to inject H₂S gas on February 16, 2012. On April 17, 2012 a letter from Doug Johnson, Manager for Injection - Storage Permits and Support, declared the permit invalid as a protest received from OGO Refining, adjacent operator, was determined to be timely filed. Eagle Energy wishes to amend the permit to allow the injection of produced H₂S gas in their Moses-Watson Well No. 1SW at a maximum rate of 500 MCF/D and at a maximum gas injection pressure of 1,200 psig. The H₂S gas is found in solution with the produced water from oil wells in the Salt Flat (Edwards) Field.

The Moses-Watson Well No. 1SW was drilled and completed in August 5, 2011 as an injection well. The well has an open hole completion in the Lower Edwards formation at a depth between 3,015 feet and 3,600 feet. The well has 854 feet of 13¾" surface casing cemented to surface. The subject well has 3,015 feet of 9¾" casing, cemented with 938 sacks of cement with a top of cement at approximately 2,491 feet. A DV tool was set
at a depth of 906 feet cemented with 223 sacks of cement set from 906 feet to surface. The current injection is through 7\% tubing set on a packer at 2,897 feet which is set 53 feet above the top of the approved injection interval. The permitted injection interval will remain the same, between 2,950 feet to 3,600 feet. The Texas Commission on Environmental Quality recommends that usable-quality ground water be protected from the surface to a depth of 750 feet.

A ¼ mile area of review is not required as the injection interval was not being amended in this application. A review of wells within a ¼ mile of the Moses-Watson Well No. 1SW was conducted at the time the original disposal application was applied for in the July 2011 permit. The review of the initial application indicates there are approximately 119 oil or gas wellbores within a ¼ mile radius of the disposal well. Eagle Energy used the log of an adjoining well and identified the top of the Kiamichi Shale at a depth of 2,814 feet. With the Kiamichi Shale's 30 foot thickness, the top of the Lower Edwards is estimated to be at approximately 2,844 feet. The majority of the wells in the area produce from the Upper Edwards in the Salt Flat (Edwards) Field at a depth 2,700 feet. Approximately 94% of the wells do not penetrate the 2,844 foot top of the Lower Edwards formation. The majority of the wells that did penetrate the Lower Edwards are disposal wells.

The Moses-Watson Well No. 1SW began the disposal of saltwater in September 2011. Eagle Energy plans to use the proposed well to dispose of produced saltwater and H₂S gas generated as a result of the current and future development of the Moses-Watson Lease. The Upper Edwards, found in the Salt Flat (Edwards) Field, at a depth of 2,700 feet, is the predominant producing zone in the area and is the source of the produced salt water and produced H₂S gas. Currently, Eagle Energy has two horizontal wells completed on their Moses-Watson lease in the Salt Flat (Edwards) Field at a depth of approximately 2,700 feet. Along with the oil production, the wells produce between 1,500 and 6,620 BWPD each. In addition to the saltwater, H₂S gas is being produced that is in solution with the saltwater. The volume of H₂S gas is estimated to be between 4.4 and 19.6 MCF/D per well. Currently, Eagle Energy is flaring the H₂S gas. Eagle Energy needs the disposal authority to dispose of the H₂S gas produced associated with the saltwater to economically produce the oil wells. Flaring could continue with limited TCEQ approval; however, long term, Eagle Energy would need to construct and permit an H₂S sour gas pipeline to run along the surface to an adjacent disposal well that is authorized to dispose of the H₂S gas into the same Lower Edwards formation. Without the efficient and economical means of H₂S disposal provided by the requested disposal authority, any further drilling or oil production in the Salt Flat (Edwards) Field could be negatively affected.

Eagle Energy Acquisitions, L.P. has an active P-5 on file with the Commission, with $250,000 financial assurance. There are no pending enforcement actions against Eagle Energy.

A copy of the application was mailed on February 15, 2012 to the Caldwell County Clerk's Office and the surface owner and operators within ½ mile of the Moses-Watson Well No. 1SW.
Protestants’ Evidence

Frank Davis d/b/a OGO Refining, an adjacent operator, has concerns that there were discrepancies with the original review of wells within a ¼ mile of the Moses-Watson Well No. 1SW. Mr. Davis’ representative identified two wells which appeared to be incorrectly identified and found one well, the Shale Operating Co., J.P. Watson Well No. A-4 as having no completion information, cementing records or plugging records on file with the Commission. Without the completion information, cementing records or plugging information, Mr. Davis believes there is no certainty the fluids injected into the Lower Edwards could remain in the injected formation. The saltwater and the injected H₂S gas could rise through the unplugged wellbore and contaminate subsurface and surface water. Additionally, the H₂S gas could pose a risk to individuals on the surface.

Mr. Davis’ representative identified two well locations identified as No. 16 and No. 75 on the table of wells within the ¼ mile area of review that appear to be incorrectly located on the map. Mr. Davis’ representative presented a drilling permit, Commission records and an affidavit for the Shale Operating Co., J.P. Watson Well No. A-4. The drilling permit granted on December 21, 1989 authorized the drilling to a depth of 3,300 feet. The remarks section states the well will be an Edwards test only. Commission wellbore records indicated the well was drilled with a spud date of December 28, 1989, and a longstring set date of January 3, 1990. There is no completion date or plugging date for the well. There are no cementing records or casing setting depths for the well. The affidavit, dated May 14, 2007 and given by Mr. Robert Grantham, was used to establish the J.P. Watson Well No. A-4's well records for the administrative approval of North South Oil’s disposal permit issued on July 20, 2011. At the current hearing, the affidavit was objected to because it is hearsay, and the declarant was unavailable for cross examination. He was not at the hearing and, in fact, passed away. The affidavit was determined to be inadmissible as evidence.

Reopened Hearing

The hearing was reopened on October 29, 2012 to allow Wilbur Wood the opportunity to testify on the depth of the J.P. Watson Well No. A-4 (matters in the Affidavit). Mr. Wood is a semi retired oil and gas consultant that worked for Shale Operating Company in the late 1980’s and early 1990’s. He worked as a consultant on the J.P. Watson Well No. A-4 along with Bob Grantham, a geologist for the well. He stated they were there to test the Edwards (Upper Edwards) and report back to Shale Operating if the Edwards was viable as a commercial oil well. Mr. Wood was on the rig floor when the Edwards was penetrated at a depth of 2,700 feet, and when they circulated Edwards rock cutting samples and set the production casing. The well was completed and placed on a pump to produce. The well only produced saltwater. After calling Shale’s office, Mr. Wood was given the go ahead and set a bottom plug to a depth of 2,500 feet. He was present when the bottom plug was set and had independent memory of this occurring. The well was plugged back with a bottom plug so that the Austin Chalk formation (found at a depth of 2,200 to 2,400 feet) could be produced in the future. Mr. Wood testified he did not know if the well was ever recompleted into the Austin Chalk or was plugged completely, but he did recall a bottom plug was set above the Edwards. Additionally, Eagle Energy concurs with the Railroad Commission’s Mapping section that the J.B.Tiller No. 19 should be
respotted at Map Index No. 5A and not Map Index No. 16. The Commission's staff agrees and has respotted the well on the Commission's maps.

The Protestant objected to the testimony of Mr. Wood on the grounds that Mr. Wood had consulted daily drilling reports when he was at the drill site of the JP Watson A-4 and that these reports were hearsay. The objection essentially was a challenge to the requirement that the witness have personal knowledge; the Protestant claimed that Wood was basing his testimony entirely on hearsay documents instead of personal knowledge. Wood's testimony is admitted over the objection of the Protestant. The examiners find that Wood has personal knowledge of the depth to which the well was drilled and at which a plug was set. The Appellant established that as an oil and gas consultant who was present during drilling operations, Wood gained firsthand knowledge of these matters. Wood testified that he was present on the rig floor when drilling reached the Edwards Formation, present when the well reached its total depth, and present when the plug was set.

EXAMINERS' OPINION

The examiners believe that this application to amend the existing permit to allow the disposal of produced H₂S gas should be approved. The Moses-Watson Well No. 1SW is completed in a manner which will confine disposal fluids to the existing disposal interval in the Lower Edwards. Surface casing is set and cemented through the usable quality water found between the surface and a depth of 750 feet. The longstring production casing is cemented up to a depth of 2,491 feet to prevent migration from the injection interval. A DV tool was set at a depth of 906 feet and cemented with 223 sacks of cement set from 906 feet to surface.

A ¼ mile area of review is not required for this amended application as the injection interval will not be changed. There are no oil or gas wells within the ¼ mile radius of the disposal well that will have the potential to serve as a conduit for injected fluids to reach the base of the usable quality water. It is more likely than not that the J.P Watson Well No. A-4 has not penetrated to Lower Edwards. The drilling permit application on file states in the remarks that the proposed A-4 well was an "Edwards test" referring to the productive Upper Edwards found at a depth of 2,700 feet, which is the only productive Edwards formation in the area and has produced since the 1920's. The permit was approved to a drilling depth of 3,300 feet, but it is common practice to apply for a depth that comfortably exceeds the expected depth of the target formation, in this case the Upper Edwards at 2,700 feet, commonly referred to as the Edwards. The 3,300 foot authorized drill depth would give Shale Operating an additional 600 feet of drilling authority should the Edwards not be found at the expected depth of 2,700 feet. When Shale Operating asked for 3,300 feet it was to drill to the Edwards at 2,700 feet with the authority to drill to 3,300 feet if the Edwards was not encountered at 2,700 feet. The common practice in completing into the Edwards is to stop drilling once the Edwards is encountered to prevent drilling into the water zone found within the productive Edwards. The Lower Edwards, found below the Kiamichi shale, has always been known as a non-productive, water saturated zone commonly used as a preferred disposal zone in the area. With the objective of the W.P Watson A-4 well to be a producing oil well and not a disposal well, it is unlikely Shale Operating would have taken on the additional expense and risk to drill past their objective, the Edwards, and drill into the Lower Edwards, a known non-productive, water saturated
interval. Wilbur Wood stated that he recalls only drilling to the Edwards and not the Lower Edwards. He stated that after the Edwards was reached and tested, the casing was set in the well and was completed. Although early data indicated that the well would be a commercial success, over time the well “watered out” and was later plugged. He does not know why the plugging reports were not filed, but does have independent memory of setting the bottom plug.

Extensive injection into the Lower Edwards by adjacent permitted disposal wells further indicates the J.P Watson Well No. A-4 is not a conduit for fluids to migrate out of the Lower Edwards. There are four disposal wells within a ¼ mile radius authorized to dispose of up to 120,000 BWPD in total. As of November 2012, Commission records indicate over 37 million barrels of water have been injected into the Lower Edwards within a ¼ mile of the Moses-Watson Well No. 1SW. There have been no recorded issues of surface break outs from the J.P Watson Well No. A-4, operational issues from adjacent operators or ground water contamination issues. The Moses-Watson Well No. 1SW is authorized to inject 40,000 BWPD and has injected 15 million barrels of water in the last 15 months. Wilbur Wood, the oil and gas consultant on the rig, stated the J.P. Watson well did not penetrate the Lower Edwards (disposal zone) and has a bottom plug set above the Edwards that prevents fluids from the Edwards from migrating up the wellbore.

H₂S gas disposal authority should be approved as it will decrease the public’s potential exposure to H₂S gas. Without the disposal authority for the Moses-Watson Well No. 1SW, produced H₂S gas will need to travel via a 2.5 mile sour gas pipeline, to be permitted and built by Eagle Energy, to the nearest possible disposal well, the Davis well. The sour gas line will run along the surface and could expose the public to H₂S gas. With approval, the surface exposure to H₂S gas will be limited to the existing gathering and flowlines from the producing well to the injection well.

Further, the act of producing the native H₂S gas which exists in solution with the produced water from the Edwards formation found at a depth of 2,700 feet and disposing it into the deeper Lower Edwards at a depth of 3,015 feet removes H₂S gas found naturally at the shallower interval and disposes it into a deeper zone. Placing the H₂S gas into a deeper zone over time will reduce the amount of H₂S gas in the shallower Edwards which has a high number of wells which have penetrated the shallower Edwards.

H₂S gas is heavier than air, and it is unlikely to rise to the surface. H₂S gas exists in solution with the water under pressure and not as a free gas in the reservoir at a depth of 2,700 feet. To separate the H₂S gas from the water, the water must be brought to the surface, and agitated at the reduced pressure environment of the surface, as it occurs when the produced water is transported and pumped through surface horizontal separators, manifolds, gun barrels and storage tanks. A well with Edwards water containing H₂S gas in solution is not likely to release the H₂S gas in the wellbore and the heavier H₂S gas is unlikely rise above the lighter air molecules in the wellbore and escape to the surface. The injected H₂S gas will be mixed with the produced water. As the H₂S and saltwater are injected into the Lower Edwards formation at a depth of 3,015 to 3,600 feet, the H₂S gas will enter into solution with the disposal saltwater. There are currently 13 other wells within a five mile radius, injecting H₂S gas and saltwater into the Lower Edwards.
Approval of the requested permit is in the public interest given it is in the public
interest to promote the development of the Edwards horizontal play in Caldwell County.
The horizontal wells that are drilled in the nearly depleted Edwards formation produce large
quantities of water along with minor quantities of H₂S gas. Costs to produce the high water
cut wells are high such that all costs including disposal costs need to be minimized. The
most cost effective means to dispose of the produced H₂S gas is to inject it with the
produced water where the H₂S gas originated from and dispose of it into the Lower
Edwards formation. Drilling and production is increasing in the Edwards horizontal play
which requires disposal of large volumes of water and the small amounts of H₂S gas
produced with the oil. Having the existing permit amended to include the disposal of H₂S
gas at the existing disposal well will reduce disposal costs for the operator and will
minimize the risk to the public from building and operating a H₂S sour gas pipeline at the
surface.

The evidence indicates that the operation of the subject disposal well with the
amended permit condition of adding H₂S gas will not adversely impact any surface or
subsurface useable quality water.

FINDINGS OF FACT

1. Notice of this hearing was given to all persons entitled to notice at least ten (10)
days prior to the hearing. A copy of the application was mailed on February 15,
2012 to the Caldwell County Clerk’s Office and the surface owner and operators
within ½ mile of the Moses-Watson Well No. 1SW.

2. North South Oil, LLC was initially issued an injection permit for the Moses-Watson
Well No. 1SW on July 20, 2011. The current permit authorizes daily injection of a
maximum of 40,000 barrels of produced saltwater at a surface pressure of up to
1,200 psig into the Lower Edwards formation at a subsurface depth from 2,950 feet
to 3,600 feet.

3. The Moses-Watson Well No. 1SW was drilled and completed in August 5, 2011 as
an injection well. The well has an open hole completion in the Lower Edwards
formation at a depth between 3,015 feet and 3,600 feet.

4. Eagle Energy Acquisitions became the operator of record for the Moses-Watson
Lease on September 1, 2011.

5. The Moses-Watson Well No. 1SW currently is a noncommercial disposal well
authorized to dispose of produced saltwater from Eagle Energy’s Moses-Watson
Lease. Since 2011 the well has disposed of approximately 15 million barrels
saltwater into the Lower Edwards.

6. On February 16, 2012, Eagle Energy Acquisitions LP was issued a permit
amendment to add H₂S and Flu gas as permitted disposal fluids. Eagle Energy was
authorized to dispose of a maximum of 500 MCF/D of the original H₂S and Flu gas
at a maximum injection pressure of 1,200 psig.
7. On April 17, 2012 a letter from Doug Johnson, Manger for Injection - Storage Permits and Support declared the permit invalid as a protest received from OGO Refining, adjacent operator, was determined to be timely filed.

8. Eagle Energy proposes to add H₂S gas as permitted disposal fluids at a maximum rate of 500 MCF/D of H₂S gas at a maximum injection pressure of 1,200 psig.

9. The Moses-Watson Well No. 1SW is cased and cemented in a manner to protect usable quality water and insure that injected fluids will be confined to the injection interval.
   a. The Texas Commission on Environmental Quality recommends that usable quality water be protected to 750 feet in the area of the proposed well.
   b. The subject well has 854 feet of 13 3/8" surface casing cemented to surface.
   c. The subject well has approximately 3,015 feet of 9 3/4" casing, cemented with 938 sacks of cement with a calculated top of cement at approximately 2,491 feet.
   d. A DV tool was set at a depth of 906 feet cemented with 223 sacks of cement set from 906 feet to surface.
   e. The current injection is through 7 3/4" tubing set on a packer at 2,897 feet which is set 53 feet above the top of the approved injection interval.
   f. The Lower Edwards is the preferred disposal formation in the area and has sufficient layers of shale and imperious rock strata to confine the injected fluids to the Lower Edwards.

10. A ¾ mile area of review is not required for this amended application as the injection interval is not being amended.

11. A review of wells within a ¼ mile of the Moses-Watson Well No. 1SW was conducted at the time the original disposal application was applied for in the July 2011 permit. The review of the initial application indicates there are approximately 119 oil or gas wellbores within a ¼ mile radius of the disposal well. Approximately 94% of the wells did not penetrate the 2,844 foot top of the Lower Edwards formation.

12. An affidavit, dated May 14, 2007, given by Mr. Robert Grantham was used by the Commission to establish the J.P. Watson Well No. A-4's well records for the administrative approval of North South Oil's original salt water disposal permit issued on July 20, 2011.

13. The Grantham affidavit was not admitted as evidence in this hearing because it is hearsay the declarant is unavailable for cross examination as he was not at the hearing and in fact has passed away. The affidavit was determined to be
14. Wilbur Wood, an oil and gas consultant, was hired by Shale Operating in 1989 to oversee the drilling and completion of the J.P. Watson Well No. A-4.

a. Mr. Wood testified the J.P. Watson Well No. A-4 was to test the Edwards (Upper Edwards) for oil production and did not penetrate the Lower Edwards.

b. Mr. Wood testified the J.P. Watson Well No. A-4 was completed as an oil well in the Edwards formation at a depth of approximately 2,700 feet after initial testing indicated the well would be commercially viable.

c. Mr. Wood testified the J.P. Watson Well No. A-4 began producing water after a short period of time and was shut in.

d. Mr. Wood testified he had independent memory that Shale Operating set a cement bottom plug, above the Edwards, to a depth of 2,500 feet and left the well unplugged as a possible candidate to recompletethe well in the Austin Chalk formation in the future.

e. Mr. Wood testified he does not know if Shale Operating recompleted the J.P. Watson Well No. A-4 in the Austin Chalk or if they plugged the well.

15. The success of the Salt Flat (Edwards) horizontal play requires the economical disposal of large quantities of produced salt water and associated H₂S gas. The wells produce with a high water cut, in excess of 97% water which requires disposal.

16. It is in the public interest to promote this development by providing a safe and economic means of disposal of produced water and H₂S gas associated with the oil production.

17. Without the Moses-Watson Well No. 1SW to inject H₂S gas, Eagle Energy would be required to construct and operate a sour gas pipeline at the surface to dispose of H₂S gas at a second location 2.5 miles away at the Davis lease permitted to dispose of H₂S gas.

18. Escape of H₂S gas from the J.P. Watson Well No. A-4 is unlikely even if it had penetrated the Lower Edwards.

a. H₂S gas exists in solution (under pressure) in the saltwater found in the Upper Edwards and not as a free gas.

b. H₂S gas has a specific gravity (SG) of 1.19 therefore is heavier than air (SG of 1.0).

c. The injected H₂S gas will be mixed with the produced water, as the H₂S and saltwater are injected into the Lower Edwards formation at a depth of 3,015 to 3,600 feet where the H₂S gas will enter into solution with the disposal saltwater.
d. To release the H₂S gas, pressure must be reduced on the produced water and must be agitated at the surface.

e. Within a five mile radius approximately 13 saltwater and H₂S gas disposal wells have been permitted by North South Oil and Eagle Energy.

19. Extensive injection into the Lower Edwards by adjacent permitted disposal wells further indicates the J.P Watson Well No. A-4 is not a conduit for fluids to migrate out of the Lower Edwards.

a. There are four disposal wells authorized to dispose of up to 120,000 BWPD in total within ¼ mile of the Moses-Watson Well No. 1SW.

b. As of November 2012, Commission records indicate over 37 million barrels of water have been injected into the Lower Edwards.

c. There have been no recorded issues of surface break outs from the J.P Watson Well No. A-4, operational issues from adjacent operators or ground water contamination issues.

20. No groundwater contamination or damage to oil, gas, or other mineral formation has occurred as a result of operations at the Moses-Watson Well No. 1SW since the disposal permit was first issued in 2011 and injection began in 2012.

21. Eagle Energy Acquisitions, L.P. has an active P-5 on file with the Commission, with $250,000 financial assurance. There are no pending enforcement actions against Eagle Energy.

**CONCLUSIONS OF LAW**

1. Proper notice was issued in accordance with the applicable statutory and regulatory requirements.

2. All things have occurred to give the Railroad Commission jurisdiction to consider this matter.

3. The use of the proposed injection well is in the public interest.

4. The use of the proposed injection well will not endanger or injure any oil, gas, or other mineral formation.

5. With proper safeguards, as provided by terms and conditions in the attached final order which are incorporated herein by reference, both ground and surface fresh water can be adequately protected from pollution.

6. Eagle Energy Acquisitions, L.P. has made a satisfactory showing of financial responsibility to the extent required by Section 27.073 of the Texas Water Code.
7. Eagle Energy Acquisitions, L.P. has met its burden of proof and satisfied the requirements of Chapter 27 of the Texas Water Code and the Railroad Commission's Statewide Rule 9.

EXAMINERS' RECOMMENDATION

Based on the above findings and conclusions, the examiners recommend that the application be approved as set out in the attached Final Order.

Respectfully submitted,

Andres J. Trevino  
Technical Examiner

Michael Crnich  
Hearings Examiner

Gene Montes  
Hearings Examiner