



RAILROAD COMMISSION OF TEXAS

OFFICE OF GENERAL COUNSEL

June 14, 2006

OIL AND GAS DOCKET NO. 01-0246914

THE APPLICATION OF THE EXPLORATION COMPANY TO INJECT FLUID INTO A RESERVOIR PRODUCTIVE OF OIL OR GAS, CHITTIM "B" LEASE WELLS NO. 1374 AND 2374, SANER RANCH (SAN MIGUEL) FIELD, MAVERICK COUNTY, TEXAS

HEARD BY: Thomas H. Richter, P.E., Technical Examiner

APPLICANT:

George C. Neale, Attorney
Greg Cloud
Jeff Bookout

REPRESENTING:

The Exploration Company

INTERVENOR:

Fernando Deleon

Railroad Commission of Texas

PROCEDURAL HISTORY

Date of Administrative Denial:	March 22, 2006
Date of Application:	March 29, 2006
Date of Notice:	April 13, 2006
Date of Hearing:	April 28, 2006
Date of Transcript:	None requested
Date PFD Issued:	June 14, 2006

EXAMINERS' REPORT AND PROPOSAL FOR DECISION STATEMENT OF THE CASE

This is the application of The Exploration Company ("Exploration") to amend the permits for alternate injecting steam and then producing its Chittim Lease Wells No. 1374 and 2374. The application was administratively denied because the fluid to be injected would be through tubing that did not isolate the production casing with a packer and thus disabling pressure monitoring and testing procedures necessary to ensure the well(s) do not represent a threat to usable quality water.

DISCUSSION OF THE EVIDENCE

APPLICANT'S EVIDENCE

The Saner Ranch (San Miguel) Field was discovered in 1965 at 1,460' subsurface depth. The oil is very low gravity, high viscosity, i.e. a tar sand. The formation oil is immobile and thus it is necessary to introduce steam to enable the oil to flow to the wellbore. Cumulative production from the field is 419,000 BO from a total of 22 wells that have produced at different times since 1965. All the reported production is secondary recovery oil, primarily from steam injection projects.¹ There is no "primary oil production" from this field. There has been no production from the field since 1985. The San Miguel Sand has 80' of gross thickness and 40-50' of net pay with a porosity of 25-35%.

The Exploration Company filed an injection application for its Chittim "B" Lease Wells No. 1374 and 2374 in January 2006 (Project No. F 17029) to inject a maximum of 1500 barrels of fresh water as steam per day per well at a maximum surface injection pressure of 2,062 psig through the intervals from 2165' to 2179'.² The Commission approved and issued the permits February 23, 2006. However, the condition on the permit required "Injection must be through tubing set on a packer". At that time, Exploration had stated on its Injection Application that a packer would be used.

Several months later, an amended application was filed requesting a "no packer" exception and increasing the maximum volume to 3,000 barrels of fresh water steam per well per day. This is the subject of this application. The subject wells have been drilled, completed and completion papers have been submitted to the Commission.

The Chittim "B" Well No. 1374, is completed as follows:

- Surface casing (9-5/8") set at 216' and cemented from the casing shoe to the ground surface.
- Longstring casing (7") set at 2,233' and cemented from the casing shoe to the ground surface.
- Tubing (3-1/2") hanging at 2,157' and no packer.
- The perforated interval is from 2,165' to 2,170'.

The Chittim "B" Well No. 2374, is completed as follows:

- Surface casing (9-5/8") set at 240' and cemented from the casing shoe to the ground surface.

¹ One project did attempt using natural gas as the injection fluid according to records.

² The permitted surface injection pressure is greater than the normal maximum .5 psi/ft depth based on the results of a step rate formation parting test.

- Longstring casing (7") set at 2,360' and cemented from the casing shoe to the ground surface.
- The perforated interval is from 2,174' to 2,179'.
- Tubing (3-1/2") hanging at 2,160' and no packer.

Exploration states that it placed extra-heavy tubulars (tubing/casing) in the wells.

The base of the deepest freshwater is 200 feet (TCEQ Letter dated May 26, 2005).

The San Miguel reservoir contains very low gravity oil with high viscosity.³ By heating the reservoir with high temperature steam a limited portion of the oil-in-place will flow toward and into the wellbore. The proposed project is for cyclic steam injection. i.e. alternating periods of high temperature steam injection, a soak period followed by a production period. The cycle is then repeated and is adjusted according to experimentation and demonstrated results. The reasons for not using a packer:

1. Steam generated by freshwater is essentially pure, very few if any solids and is non-corrosive.
2. The surface and production casings are cemented from total depth to the surface.
3. Bottomhole temperatures are expected to exceed 700°F and packer failure is anticipated.
4. Without a packer, the operator can efficiently deliver a diluting agent, the addition of fuel oil (41° API gravity), down the annulus between the tubing and the production casing that allows the produced oil to flow to the surface.

Baker-Hughes Industry literature pertaining to packer use in high pressure and/or high temperature applications substantiate the potential adverse effects that high temperatures have on packers that include shorter performance life of elastomers and derating of yield strength of metals used in packers and seals and tubing stresses caused by thermal cycling.⁴

Several steam projects have been initiated since 1965 in the Saner Ranch (San Miguel) Field. These include the Exxon Company, Waukesha Pearce Lease Steam Injection Project (1982-1985);

³ Application of Conoco, Mary Saner in 1984 reported -2.0° API and viscosity of 520,000 centipoise (cp) at 175°F. Application of Conoco, Street Ranch in 1977 reported -1.8° API and viscosity of 1930cp at 250°F. Application of Exxon, Waukesha Pearce in 1981 reported -2.0° API and viscosity of 1,000,000cp at 100°F. Application of Texas Tar Sand, Inc., R. Bennett/Texas Osage in 1982 reported -2.0° API and viscosity of 317,000cp at 150°F.

⁴ Baker Oil Tools' HP/HT systems are designed to perform in combined conditions of 15,000 psi and 400°F -substantially above the industry standard. Baker Hughes website, The Exploration Company Exhibit No. 18.

Conoco, Mary Saner Lease Steam Injection Project (1981-1984); Conoco, Street Ranch Lease Steam Injection Project (1976-1981); and ENPEX, Richard Bennett Lease Steam Injection Project (1984-1984). These projects were 5-spot patterns (4 producing wells surrounding a single steam injection well). All these projects were granted permits for steam injection without the requirement of a packer installed on the steam injection well. These applications were all accompanied by supporting data stating that the industry in general has had extremely poor performance with thermal packers for steam service at temperatures $+600^{\circ}\text{F}$.

There are no other wells within $1/4$ mile of the 1374 well or 2374 well and there are no other operators within $1/2$ mile. Source freshwater will be from the Carrizo Formation which occurs at 150' subsurface depth and has a gross thickness of 30'. Exploration has the exclusive fresh water rights to 1280 acres for the subject project. This volume equates to over 83 million barrels of water. The rate of recharge of the formation underlying the acreage is 2700 BWPD. Water analysis of the Carrizo measures ± 240 ppm total dissolved solids. The subject wells will not be injecting oil and gas waste, but, in effect, injecting distilled water.

Exploration states annual mechanical integrity pressure testing would be expensive, time consuming including the loss of production. The subject wells would have to be shut down at least a month or so for the formation to cool off around the well bore allowing the casing to cool for a reliable packer setting. Upon re-start of the cyclic process, it would take months for the formation to regain the 600°F temperature.

It is necessary that fuel oil be delivered to the formation through the tubing-casing annulus at a 1:1 ratio (1 barrel of fuel oil for each barrel of water steam). This is necessary for the produced oil to flow from the formation to accomplish a blended increased liquid gravity of approximately 19°API product. Additionally, the fuel oil is required as once the product is produced into the stock tank and cools off below 200°F , the oil becomes an immobile fluid.

COMMISSION'S CONCERNS

Environmental Services states that Statewide Rule 46 requires that injection must be through tubing set on a packer. The steam projects that were approved in the 70's and early 80's were before the adoption of the Federal Safe Water Drinking Act and newer restrictions added into Statewide Rules 9 and 46 in 1982. This is the point in time when tubing and packer requirements became the standard.

The mechanical integrity testing (Form H-5 Testing) was initiated in 1985. Depending on the casing completion of a well, the mechanical integrity testing is required every 5 years with tubing and packer, but for other special or problem wells, the requirement is annual mechanical integrity. Without a packer, the tubing-casing annulus cannot be monitored.

Steam at high temperature and pressure is corrosive to downhole steel tubulars. Without a packer, the production casing is exposed, a tubular that was not meant to come into contact with the injection fluid, would now be exposed to a corrosive environment.

Exploration has further stated that fuel oil would be poured down the tubing-casing annulus, which is considered a pollutant to fresh water if a breach in the casing were to occur.

Environmental Services submits that if Exploration is allowed to operate the subject wells without the benefit of a packer, it is recommended that the wells be subject to annual casing mechanical integrity testing. However, Environmental Services recognizes that the instant case does represent a low risk situation and that a mechanical integrity test every 2-3 years may be appropriate. It should be pointed out that the Commission's computer system is only set to issue Form H-5 Mechanical Integrity Testing Notices on only a yearly basis or 5 year basis.

EXAMINERS' OPINION

The examiner recommends that the application be approved for increasing the volume of 3000 barrels of freshwater steam per day per well, a no packer exception and mechanical integrity pressure testing on a 5 year cycle. Environmental Services stated that this is a low risk project. The safe guards of sufficient new surface casing fully cemented protecting the usable quality water, new longstring casing fully cemented, extra thick/heavy tubulars and the injection of fresh water in the form of steam makes this indeed one of the lowest risk enhanced oil recovery projects via injection.

Statewide Rule 46 pursuant to §§(g)(3) provides for the Commission to grant exception to the provision concerning special equipment i.e. packer/pressure valves for monitoring:

(g) Special equipment.

(1) Tubing and packer. Wells drilled or converted for injection shall be equipped with tubing set on a mechanical packer. Packers shall be set no higher than 200 feet below the known top of cement behind the long string casing but in no case higher than 150 feet below the base of usable quality water. For purposes of this section, the term "tubing" refers to a string of pipe through which injection may occur and which is neither wholly nor partially cemented in place. A string of pipe that is wholly or partially cemented in place is considered casing for purposes of this section

(2) Pressure valve. The wellhead shall be equipped with a pressure observation valve on the tubing and for each annulus of the well.

(3) Exceptions. The commission or its delegate may grant an exception to any provision of this paragraph upon proof of good cause (emphasis added). If the commission or its delegate denies an exception, the operator shall have a right to a hearing upon request. After hearing, the examiner shall recommend a final action by the commission.

Good cause has been presented. The subject cyclic steam project may potentially resurrect a field that has not produced in over 20 years. It is a variation of a steam flood process technology used in excess of 20 years ago to recover oil reserves that are otherwise unrecoverable. The increase in the volume of freshwater steam from 1500 barrels to 3000 barrels per well perday may enhance

the ultimate drainage area. It is necessary that the fuel oil dilutant be delivered in an efficient and effective manner for the recovery of the oil reserves from the wellbore and is essential for surface storage of the produced oil. The most effective manner is that outlined by the applicant which necessitates that a packer assembly not be used. The information from Baker Hughes concerning thermal packers and the information from the previous operators in the field substantiate that more problems may potentially result from the use of a packer than not using one.

The subject wells meet the qualifications for the five year mechanical integrity testing pursuant to Statewide Rule 46 §§(j):

(j) Testing.

(1) Purpose. The mechanical integrity of an injection well shall be evaluated by conducting pressure tests to determine whether the well tubing, packer, or casing have sufficient mechanical integrity to meet the performance standards of this rule, or by alternative testing methods under paragraph (5) of this subsection.

(2) Applicability. Mechanical integrity of each injection well shall be demonstrated in accordance with provisions of paragraphs (4) and (5) of this subsection prior to initial use. In addition, mechanical integrity shall be tested periodically thereafter as described in paragraph (3) of this subsection.

(3) Frequency.

(A) Each injection well completed with surface casing set and cemented through the entire interval of protected usable-quality water shall be tested for mechanical integrity at least once every five years.

(C) An injection well that is completed without surface casing set and cemented through the entire interval of protected usable-quality ground water shall be tested at the frequency prescribed in the injection permit.

The subject wells have sufficient surface casing to meet the 5 year frequency requirement pursuant to (3)(A) above. In addition, Exploration asserted that it placed extra heavy duty tubulars in the well. Subsequent to the hearing, the examiner requested substantiating information from Exploration to confirm the quality of the casing placed in the wells. Without a packer, the production casing is exposed to steam and pressure and any resulting corrosion effects that may occur. However, the corrosion would be the result of oxidation only and not the caustic effects of chemical compounds such as CO₂ or H₂S, other alkalis, acids, etc. that may or may not be present in injection of saltwater or gases.

The previous steam projects (4 submitted) in the subject field of the late 70's and early 80's appear to have had a maximum life span of 5 years (the Conoco, Street Ranch Lease Steam Injection Project operated from 1976-1981 and the other projects operated a lesser amount of time). Though Exploration did not predict how long this cyclic project would be in effect (indeed this program could be designated more as a research project), but 2 wells cycling steam for 5 years and remaining economic would be impressive.

FINDINGS OF FACT

1. Notice of this hearing was given to all persons required to be given notice by the provisions of Statewide Rule 46 and there was no public protest.
2. The Exploration Company received injection authority for the Chittim "B" Lease Wells No. 1374 and 2374 in January 2006 (Project No. F 17029) to inject a maximum of 1500 barrels of fresh water as steam per day per well at a maximum surface injection pressure of 2,062 psig through the intervals from 2165' to 2179'.
 - a. Sufficient surface casing (9-5/8") was set and cemented from the casing shoe to the ground surface.
 - b. Longstring casing (7") was set and cemented from the casing shoe to the ground surface.
 - c. The base of the deepest freshwater is 200 feet (TCEQ Letter dated May 26, 2005).
 - d. Extra-heavy tubulars (tubing/casing) were installed in the subject wells.
3. The Saner Ranch (San Miguel) Field was discovered in 1965 at 1,460' subsurface depth. The oil is very low gravity, high viscosity, i.e. a tar sand. The formation oil is immobile and thus it is necessary to introduce steam to enable the oil to flow to the wellbore.
 - a. Several steam projects have been initiated since 1965 in the Saner Ranch (San Miguel) Field: [the Exxon Company, Waukesha Pearce Lease Steam Injection Project (1982-1985); Conoco, Mary Saner Lease Steam Injection Project (1981-1984); Conoco, Street Ranch Lease Steam Injection Project (1976-1981); and ENPEX, Richard Bennett Lease Steam Injection Project (1984-1984)].
 - b. All these projects were granted permits for steam injection without the requirement of a packer installed on the steam injection well.
 - c. These applications were all accompanied by supporting data stating that the industry in general has had extremely poor performance with thermal packers for steam service at temperatures +600°F.

4. It is necessary the subject cyclic steam injection/production wells be completed without the benefit of a packer for the orderly delivery of dilutant to the formation between the longstring casing and tubing.
 - a. The proposed project is for cyclic steam injection, i.e. alternating periods of high temperature steam injection, a soak period followed by a production period.
 - b. Steam generated by freshwater is essentially pure, very few if any solids and is neither alkaline or acidic.
 - c. Bottomhole temperatures are expected to exceed 700°F and packer failure is anticipated.
 - d. Industry literature and past operations pertaining to packer use in high pressure and/or high temperature applications substantiate the potential adverse effects that high temperatures have on packers that include shorter performance life of elastomers and derating of yield strength of metals used in packers and seals and tubing stresses caused by thermal cycling.
5. Increasing the volume of freshwater steam to 3000 BWPD per well will allow for an increase in the area affected by the cyclic steam project.
6. Mechanical integrity testing on a five (5) year rotation basis is appropriate and will provide sufficient assurance the longstring casing meets the performance standards of the Commission rules. The subject wells qualify for the 5 year frequency pursuant to Statewide Rule 46(j)(3)(A).
7. There are no other wells within 1/4 mile of the 1374 well or 2374 well and there are no other operators within 1/2 mile.
8. Use of the proposed cyclic steam injection/production wells is in the public interest by increasing ultimate recovery of hydrocarbons from a reservoir.
9. The Exploration Company is an active P-5 organization recognized by the Commission and has financial security in place in the form of a \$250,000 Bond with an expiration date of February 1, 2007.

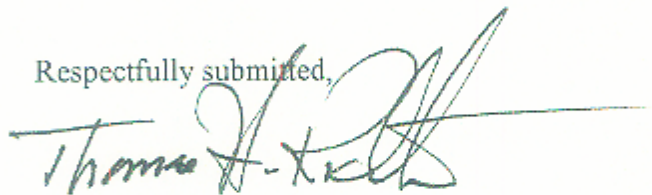
CONCLUSIONS OF LAW

1. Proper notice was timely given to all parties entitled to notice pursuant to applicable statutes and rules.
2. All things have occurred and have been accomplished to give the Commission jurisdiction in this case.
3. The use of the subject cyclic steam injection/production wells will not endanger oil, gas, or geothermal resources or cause the pollution of surface water or fresh water strata.
4. The applicant has complied with the requirements for approval set forth in Statewide Rule 46 and the provisions of Sec. 27.051 of the Texas Water Code.
5. The use of the proposed disposal well is in the public interest pursuant to Sec 27.051 of the Texas Water Code.

EXAMINERS' RECOMMENDATION

Based on the above findings and conclusions, the examiners recommend that the application of The Exploration Company to amend the injection permits for the Chittim "B" Lease Wells No. 1374 and 2374 in the Saner Ranch (San Miguel) Field to increase the injection volume to 3000 barrels per day per well of fresh water steam, the wells be allowed to inject without the installation of a packer on the tubing, and mechanical integrity testing every five years be approved as set out in the attached Final Order.

Respectfully submitted,

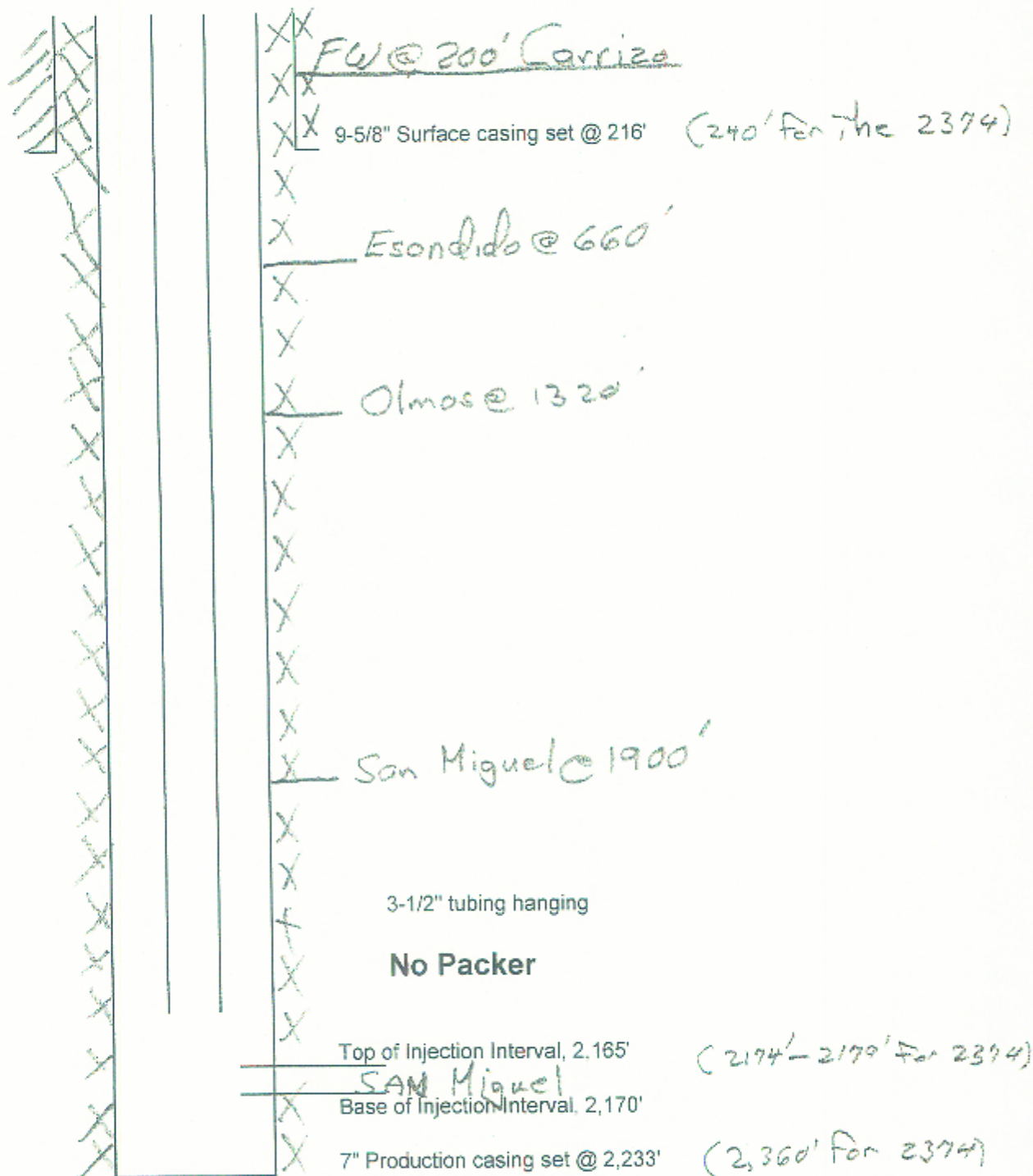


Thomas H. Richter, P.E.

Technical Hearings Examiner

Office of General Counsel

Proposed Permit
The Exploration Company
Chittim B No. 1374



indicates cement

Exhibit No. 6
Docket No. 01-0246914
Date: April 28, 2006
The Exploration Company