

THE APPLICATION OF JOHNSON SANFORD OPERATING COMPANY TO AMEND ITS PERMIT TO DISPOSE OF OIL AND GAS WASTE BY INJECTION INTO A POROUS FORMATION PRODUCTIVE OF OIL OR GAS, WHITT BAINS LEASE, WELL NO. 3, BROOKSHIRE FIELD, WALLER COUNTY, TEXAS

Heard by: Margaret Allen, Technical Hearings Examiner
James Doherty, Hearings Examiner

Procedural history

Application received: April 11, 2002
Protests received: April 22, 2002
Hearing requested: May 14, 2001
Hearing held: July 17 and October 2, 2002
Proposal for decision issued: December 12, 2002

Appearances

<u>Applicant</u>	Representing
William E. Black Rick Johnston	Johnson Sanford Operating Company
<u>Protestants</u>	
Bruce Bigelow Philip L. Randolph	Cletus Brown, Jr., and Betty Showers Brown

EXAMINERS' REPORT AND PROPOSAL FOR DECISION

STATEMENT OF THE CASE

Johnson Sanford Operating Company ("Johnson") is seeking to amend the existing permit to use its Whitt Bains Lease Well No. 3 ("subject well" or "Well No. 3") to dispose of oil and gas waste. The application is under Statewide Rule 46 because injection will be into a porous formation part of which has been productive of oil and gas.

The transmittal letter in the file from the Commission's Underground Injection Control Section ("UIC") of the Oil and Gas Division lists the following issue which should be considered at the hearing.

Surface casing in this well was not set to the base of usable quality water, as determined by the Texas Natural Resources Conservation Commission. In order to prevent potential pollution of usable quality water, the applicant should be required to check the mechanical integrity of the well by performing an annual annulus pressure test. The test must be performed and the results submitted in accordance with the instruction of Form H-5.

The applicant agreed at the hearing to comply with the requirement requested by UIC.

A permit to inject into the subject well was granted to Beta Operating Company (“Beta”) on February 4, 2002, under Permit No. 16067. Johnson has taken over operation of the well and wants to deepen the base of the disposal interval from 3255' to 3500' and to increase the surface injection pressure to 1300 psi.

Cletus L. Brown and Betty Showers Brown (“Protestants”) use nearby water wells for domestic, livestock and agricultural purposes and are concerned that the proposed increase in injection pressure will cause pollution. They have no objection to the increased injection interval.

PROTESTANTS’ STANDING

Johnson challenged the standing of Protestants to oppose the application based on the fact that the protestants are not surface owners of property on which the well is located or Commission-designated operations of wells located within one-half mile of the proposed disposal well. The examiners overrule Johnson’s objection to the protestants’ standing.

Pursuant to Statewide Rule 46(c), “affected persons” have standing. Surface owners of property on which the well is located and Commission-designated operators of wells located within one-half mile of the proposed disposal well are *included* as “affected persons,” but the rule does not contemplate that they are the *only* persons potentially affected. This is evident from the provisions of Rule 46(c)(4) which require newspaper publication of notice “in order to give notice to other local governments, interested or affected persons.” In order to have standing, a protestant need not show preliminarily that it will be entitled to prevail on the merits, only that it has an interest which may be materially affected. Generally, a person’s right to appear in an agency proceeding should be liberally recognized since an agency should be apprized of diverse viewpoints in order to determine where the public interest lies and how it should be furthered. *Texas Industrial Traffic League v. Railroad Commission of Texas*, 628 S.W.2d 187, 197 (Tex. App. - Austin) *rev’d on other grounds*, 633 S.W.2d 821 (Tex. 1982). As owners of land, on which water wells are located 3/8th of a mile from the disposal well, the Browns had standing to protest the application.

DISCUSSION OF THE EVIDENCE

Applicant’s evidence

Beta initially requested that it be allowed to use a maximum surface injection pressure of 1625 psi in the Whitt Bains Lease Well No. 3, but was told by UIC that it would be limited to a maximum injection pressure of 1325 psig unless a fracture-pressure step-rate test showed that a higher pressure would not fracture the formation. Protestants had objected to Beta’s original application but withdrew that protest after Beta agreed to limit surface injection pressure to 700 psi. The Whitt Bains Lease Well No. 3 is now permitted to disposal of up to 3000 barrels of fresh water¹ daily into the Frio Formation

¹ The produced water to be disposed of has a chloride content less than 5000 ppm and is considered fresh to brackish water. Usable-quality water has less than 3000 ppm total dissolved solids, while fresh water has less

between 2650 and 3255' at a maximum pressure of 700 psi.

Johnson operates five wells on the Brookshire salt dome, including the subject well. The Whitt Bains Lease Well No. 3 was drilled to 3255 feet in December of 2000. The four wells currently active on the lease are producing 700 to 800 barrels of water per day from the Frio Formation between 2100' and 2300'. The produced water has a chloride content less than 5000 ppm and is considered fresh to brackish water. Under the currently permitted pressure, Well No. 3 can dispose of only 500 to 600 barrels of water per day. The well will not take approximately 200 barrels of the water produced each day and this water will have to be trucked to other disposal wells.

Johnson testified that pressure in the interval now permitted for disposal may be charged up, slowing the disposal rate. It is also possible that the surface of the formation at the perforations has been damaged, lowering the permeability at the wellbore. When the well is deepened to 3500', Johnson hopes it will encounter additional sandstones. More sandstone may be able to accept fluid more rapidly than the current disposal interval in Well No. 3 is capable of. Johnson also believes that increasing the injection pressure will allow it to dispose of more water.

Trucking water costs an additional \$1.40 per barrel of produced water, raising the lease operating expenses by \$8400 per month. The applicant estimates that reducing the operating expenses will allow the wells to produce longer because the economic limit will be lower. The incremental amount produced during the longer operation period is estimated to be 8180 barrels. Johnson also plans to drill two new wells on the Whit Bains Leases, one by the end of the year. These new wells can be expected to also produce significant amounts of water. The offsite disposal wells are 50 miles away and transporting 200 barrels per day will require 58,400 truck/miles per year.

According to the Texas Natural Resources Conservation Commission, usable-quality water occurs to a depth of 2200 feet and the interval from the surface to 1000 feet contains superior quality water that must be isolated from water in the underlying beds. The log of the subject well shows about 300' of impervious shale in the 450' gross interval between the base of usable quality water and top of the injection interval.

The subject well has 8-5/8 inch surface casing, cemented from a depth of 363 feet to the surface. The well's 5-1/2 inch production casing is set to 3244 feet and cemented from the base of the production casing to the surface. Injection will be through tubing set on a packer at 2590 feet.

The applicant calculated that an injection volume of 3000 BWPD, at a surface injection pressure of 1300 psi, would result in injection pressure of 2212 psi at the perforations. This is a gradient of 0.83 psi per foot, which Johnson believes to be less than the fracture pressure of the formation. The cement used to place the casing has already shown that significant pressure can be placed on the formation without causing the rock to fracture. Cementing caused a static bottomhole pressure of 2340 psi without fracturing the rock. If the rock had fractured the cement could not have been circulated back to the surface. At a depth of 3244', this is a pressure gradient of 0.721 psi/ft. The bottomhole pressure created during cementing operations on the other wells on the lease shows the fracture pressure gradient on these wells to be at least 0.72 to 0.734 psi/ft.

Protestant's evidence

than 1000 ppm. This water is produced along with oil and is not potable due to benzene and toluene content regardless of its total dissolved solids.

Protestants' property has eight water supply wells and is about 3/8th of a mile from the disposal well. They have requested other operators to limit the injection pressure in 19 other disposal wells in the Brookshire Field to a gradient of 0.7 psi per foot of depth. The other operators agreed to this pressure limitation and Protestants testified that there have been no indications of problems for any of these other operations. Protestants also believe that there may be commercial disposal wells less than 50 miles from the Whitt Bains Leases which could reduce if not eliminate the cost of trucking produced water from the applicant's wells.

Protestants believe that injection pressure should never exceed a gradient over 0.7 psi per foot of depth (1855 psi at 2650'). A column of low salinity liquid exerts a pressure of 0.44 psi per foot of depth. A water column standing 2650 feet high has a pressure of 1166 psi at its base. Therefore the surface injection pressure which is exerted on the column of liquid should be 689 psi or less. According to Protestants, any greater pressure may result in vertical fracturing of the rock. A vertical fracture would allow the injected fluid to migrate upward to their water.

Protestants' engineer believes that rock saturated with fluid generally exerts a downward force of 0.9 to 1.0 psi per foot of depth. He testified that the high permeability Gulf Coast formations can be expected to have fracture gradients of 0.92 to 0.93 psi per foot. In addition, the Brookshire field is on a salt dome which is gradually rising. This may have caused changes in the stress field of the rock around the dome, which could reduce fracture pressure even further. To be on the safe side, Protestants believe that an injection gradient less than 0.7 psi per foot of depth should be used everywhere in the state.

EXAMINERS' OPINION

The examiners believe that this application should be approved. The well is cased and cemented to protect usable-quality water, and annual testing will detect any casing leaks. The applicant has demonstrated that the proposed disposal well is in the public interest because it will allow production of oil which would not otherwise be recovered. The injected waste will be confined to the disposal sandstones at the requested surface injection pressure of 1300 psi.

Before the well was drilled, the lithostatic and hydrostatic pressure at a depth of 2650' was 0.9 to 1.0 psi per foot of depth or at least 2385 psi. This was also the pressure on the rock that was 10' or 100' from the bottom of the well in any direction. The combined lithospheric and hydrostatic pressure did not cause the rock to spontaneously fracture before the wellbore was drilled.

When the well was drilled, the lithostatic pressure on the bottom of the well was removed. When the wellbore is filled with water at a gradient of 0.44 psi per foot of depth, the hydrostatic pressure on the perforations would be 1166 psi. At the same time, the lithostatic and hydrostatic pressure on the rock surrounding the wellbore would remain at least 2385 psi.

A combined hydrostatic and surface injection pressure less than 2385 psi at the bottom of the hole where the rock has been removed will not cause the surrounding rock to fracture. The lithostatic pressure can be assumed to have been at least 1219 psi. Surface pressure of 1219 psi on the injected fluid will not exceed the fracture pressure of the surrounding rock. In fact, a surface pressure greater than 1219 psi will not exceed the fracture pressure. Because of the loss of energy due to friction in the tubing and at the perforations, surface pressure will not be transmitted perfectly through a column of water 2650' high.

There is empirical evidence that a pressure at the bottom of the wellbore with a gradient of 0.72 psi per foot did not cause fracturing in the surrounding rock. Other wells in the field have showed that pressure gradients as high as 0.743 psi per foot have not caused fracturing. The applicant testified that friction in the tubing and through the perforations would reduce the 1300 psi of surface pressure to 1050 psi of pressure. Adding this pressure to the hydrostatic pressure at 2650', results in a total pressure at the formation of 2212 psi which will not cause the formation to fracture.

In general, shallower rocks, particularly less consolidated ones such as are found near the Gulf of Mexico, will only fracture at higher pressures than most rock. At depths of less than 3000', induced fractures tend to be horizontal and extend out into a formation rather than up toward the surface. Such a fracture would seal as soon as the pressure was reduced. Also, less consolidated rock, and shale in particular, has a tendency to deform or flow slightly when under increased pressure and will seal a fracture that would remain open in more lithified, more brittle, rock.

FINDINGS OF FACT

1. Notice of the amended application to use the Whitt Bains Lease Well No. 3 for disposal was mailed to all operators of wells within 1/2 mile radius of the well, to the surface owner and offset surface owners and to the Waller County Clerk on April 10, 2002.
2. On May 11, 2002, notice of the hearing, was issued by the Commission to all affected persons.
3. Notice of this application was published by Johnson Sanford Operating Company in the Waller County News Citizen, a newspaper of general circulation in Waller County, on April 18, 2002.
4. The original permit was granted to Beta Operating Company, LLC, on February 4, 2002, to allow disposal of up to 3000 barrels of fresh water per day into the Whitt Bains Lease Well No. 3 between 2650' and 3255', at a maximum pressure of 700 psi.
5. Usable-quality water occurs to a depth of 2200 feet, and the water to a depth of 1000' is of superior quality and must be isolated from water in underlying beds.
6. Surface casing in the Whitt Bains Lease Well No. 3 is set and cemented to a depth of 363'.
7. Production casing in Whitt Bains Well No. 3 is set at 3244' and cemented to the surface.
8. There are 300 feet of impermeable rock above the disposal interval which will confine oil and gas waste to the injection interval.
9. The top of the Frio injection interval is at 2650' and deepening the base from 3255' to 3500' may allow the well to encounter more sandstone and to dispose of water more quickly.
10. The existing wells on the Whitt Bains Lease produce 700 to 800 barrels of water per day, and the applicant intends to drill additional wells which are expected to also produce water that must be disposed of.
11. The requested surface injection pressure of 1300 psi will allow more produced water to be disposed of and will not fracture the overlying rock.

- a. Under the current limitation of 700 psi, the Whitt Bains Lease Well No. 3 has not been able to dispose of all of the waste water produced each day.
 - b. The requested surface injection pressure of 1300 psi will be reduced by friction in the tubing and through the perforations to 1050 psi at the formation.
 - c. The hydrostatic pressure of the fluid column is 1166 psi at 2650'.
 - d. The maximum pressure on the formation at 2650' will be 2212 psi, for a gradient of 0.83 psi per foot of depth.
 - e. The lithostatic and hydrostatic pressure on the rocks at 2650' around the wellbore is at least 2385 psi, under a gradient of 0.9 psi per foot of depth.
 - f. Cementing operations have already showed that pressure gradients over 0.7 (up to 0.734) psi per foot of depth do not fracture the surrounding formation.
12. Granting this application is in the public interest because it will reduce the amount of produced water that will have to be trucked to other disposal wells and allow the operator's Whitt Bains Leases to be produced longer.
 13. Granting this application will allow the operator's Whitt Bains Leases to be produced longer and recover an additional 8180 barrels of oil.
 14. Testing the mechanical integrity of the Whitt Bains Lease Well No. 3 by an annual annulus pressure test will help prevent potential pollution of usable quality water.

CONCLUSIONS OF LAW

1. Proper notice was given to all necessary parties as required by Statewide Rule 46(c) [Tex. R.R. Comm'n, 16 TEX. ADMIN. CODE § 3.46(c)] and other applicable statutory and regulatory provisions.
2. All things necessary to give the Commission jurisdiction to decide this matter have been performed or have occurred.
3. Granting the application to dispose of oil and gas waste into the Whitt Bains Lease Well No.3, under the terms and conditions set forth in the attached final order, will not endanger fresh water resources nor endanger oil or gas resources in the area.
4. No existing rights will be impair by the use the Whitt Bain Lease Well No. 3 to dispose of up to 3000 barrels of fresh water at a maximum surface pressure of 1300 psi.
5. Granting the application is in the public interest.

6. The application to dispose of oil and gas waste into the Whitt Bains Lease Well No. 3 meets the requirements for approval pursuant to Statewide Rule 46 and the Texas Water Code §27.051 and §27.073.
7. The terms and conditions set forth in the attached Final Order are reasonably necessary to protect usable-quality water from pollution.

EXAMINERS' RECOMMENDATION

Based on the above findings and conclusions, the examiners recommend that the application of Johnson Sanford Operating Company to use its Whitt Bains Lease Well No. 3 to dispose of oil and gas waste into the interval from 2650' to 3500', at a maximum surface pressure of 1300 psi be approved. To help prevent potential pollution of usable quality water, the applicant should be required to check the mechanical integrity of the well by performing an annual annulus pressure test. The test must be performed and the results submitted in accordance with the instruction of Form H-5.

Respectfully submitted,

James Doherty
Hearings Examiner

Margaret Allen
Technical Hearings Examiner

Date of Commission Action _____