

OIL AND GAS DOCKET NO. 09-0236695

THE APPLICATION OF HYDRO-FX, INC., TO DISPOSE OF OIL AND GAS WASTE BY INJECTION INTO A POROUS FORMATION NOT PRODUCTIVE OF OIL OR GAS, HYDRO-FX WELL NO. 1-SWD, NEWARK EAST (BARNETT SHALE) FIELD, WISE COUNTY, TEXAS

Heard by: Margaret Allen, Technical Hearings Examiner
Mark Helmueller, Hearings Examiner

Procedural history:

Application received: September 26, 2003
Hearing held: December 15, 2003, and April 27, 2004
Proposal for decision issued: June 8, 2004

Appearances

Applicant

| | Representing |
|------------------|----------------|
| David Gross | Hydro-FX, Inc. |
| Dale Miller | " |
| Bruce Langhus | " |
| Robert R. Durbin | " |
| Mark Layne | " |
| Ray Ledesma | " |
| Kent A. Bowker | " |

Protestants

| | |
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| Jim Joling | Concerned Citizens of Wise County |
| Sue King | " |
| Kenny Shepherd | " |
| Robert Ratliff | " |
| Maynard Beck | " |
| Barbara Beck | " |
| Hughbert Collier | " |
| J.W. McKibben | Himself |
| Mikel Richardson | Wise County Commissioners Court |
| Kevin Burns | " |

Interveners

| | |
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| Brian Sullivan | Devon Energy |
| Sandra Bolz Buch | " |
| Matthew Babb | " |
| Kerry Pollard | " |
| David W. Cooney, Jr. | RRC Staff Attorney |
| Doug Johnson | Permitting Manager, RRC Environmental Services |

Observers

| | |
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| Barbara Erichson | Senator Craig Estes |
| Jerry Valdez | Cities of Chico and Alvord |

EXAMINERS' REPORT AND PROPOSAL FOR DECISION

STATEMENT OF THE CASE

Hydro-FX, Inc., ("Hydro-FX") is seeking to drill and use its Hydro-FX Well No. 1-SWD as a commercial disposal well in Wise County. The application is protested by the Concerned Citizens of Wise County ("protestants"), J.W. McKibben, and the Wise County Commissioners Court ("County Commissioners"). Representatives of Devon Energy Operating Co., LP ("Devon") appeared at the hearing as interveners. Representatives of Senator Craig Estes and the Cities of Chico and Alvord appeared at the hearing on December 15, 2003, as interested parties.

According to a memorandum from the Environmental Services Section of the Railroad Commission's Oil & Gas Division which discusses Hydro-FX's application:

...environmental Services has determined that the proposed disposal interval is exposed within the uncemented casing/borehole annulus of at least 4 of the 5 wells within ½ mile of the proposed disposal well. Another recently permitted commercial disposal well in Wise County has demonstrated a lack of confinement in wells where the disposal interval is exposed in an uncemented casing/borehole annulus in wells within ½ mile of the disposal well. In that instance, the disposal well operator has conducted remedial well plugging and cementing operations in three such wells and Environmental Services has proposed modifying the permit by reducing the maximum permitted injection rate and pressure to 5000 barrels per day and 0.25 psi/ft, respectively.

Accordingly, Environmental Services recommends that the applicant be required to demonstrate that wells within ½ mile of the proposed disposal well which do not have the proposed disposal interval isolated by cemented casing do not present a threat to usable quality water resources; and, that the maximum permitted injection rate and pressure be limited to 5000 barrels per day and 0.25 psi/ft or 350 psi.

Hydro-FX did not see this memorandum prior to the December 15 hearing. It amended its application on February 25, 2004, to request a maximum injection rate of 5000 barrels of saltwater per day ("BWPD") and a maximum surface injection pressure of 0.25 psi per foot of depth ("psi/ft").

The hearing was reopened on April 23 to hear further evidence as to whether the proposed disposal well poses a threat to usable-quality water resources. Representatives of the Commission's Environmental Services Section ("ES") appeared as interveners.

DISCUSSION OF THE EVIDENCE

Applicant's evidence

Hydro-FX is proposing to drill a new well on its tract to use for disposal of produced saltwater. The proposed disposal interval is in the Strawn Formation between 1400' and 3000'. According to the

Texas Commission on Environmental Quality (“TCEQ”), usable-quality ground water should be protected to a depth of 300' in this area, and Hydro-FX plans to set and cement surface casing to 500', the maximum depth allowed without an exception from the Commission (FOOTNOTE: According to Statewide Rule 13(b)(2)(A)(i): In no case, however, is surface casing to be set deeper than 200 feet below the specified depth without prior approval from the commission.). The long string casing will be cemented from the base of the well at 3000' to the surface.

The applicant testified that it researched numerous locations for a disposal well and selected the proposed site for several reasons. One reason was the fact that there is only one wellbore within 1/4 mile and it has over 300' of surface casing. Another factor was the condition of the wellbores between 1/4 and one mile from the proposed site and the amount of surface casing in these wells. A third factor was the thickness of sandstone available for disposal.

Hydro-FX reviewed Commission records on all wells within one mile and all have at least 300' of surface casing, except one well 5000' away that had only 203' of surface casing. Commission personnel witnessed that well being plugged in 1997, and it was plugged in a manner that will prevent it from being a conduit for injected fluid to migrate upward. Commission records on most of these wells show cement was circulated to the surface. A few of the wells between 1/2 and one mile away were drilled before Commission forms required information of surface casing cement. However, all of these older wells were drilled in the Boonesville (Bend Congl., Gas) Field which had a rule requiring at least 300' of surface casing be cemented to the surface.

The applicant also reviewed the logs available from wells within one mile to confirm that the depth of usable-quality water was less than 300'. All of the logs available run from the base of surface casing downward and the shortest surface casing set in this area was 309'. All of the sandstones below the surface casing contained saltwater rather than usable-quality water. Hydro-FX's review of water well records from the Texas Water Development Board (“TWDB”) showed the deepest fresh water well in the area to be 285' below the surface.

The applicant originally requested approval to dispose of up to 8000 BWPD at a maximum surface pressure of 700 psi. Hydro-FX has amended its request to a maximum of 5000 BWPD, at a maximum surface pressure that corresponds to a gradient of .25 pst/ft. Devon, who operates the closest wells to the proposed disposal well, requested that Hydro-FX conduct a step-rate test and that it inject only into the massive (thicker and more continuous) sands within the disposal interval. Hydro-FX expects the top of the first massive sandstone to be at 1700', which would correspond to a maximum surface injection pressure of 425 psi.

The disposal interval contains sandstones and shales within the Strawn Formation and is overlain by a thick shale. The overall interval has five series of thicker sandstones that the applicant believes can accept fluid. Hydro-FX has categorized these intervals as the Upper and Lower Brannon, the Upper and Lower Meeks Bend and the Caughlin sandstones. Isopachs of these intervals show the following sandstone thicknesses in the area:

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|----------------------|---------|
| Upper Brannon Bridge | 20+' |
| Lower Brannon Bridge | 30'-40' |
| Upper Meeks Bend | 20'-30' |

| | |
|------------------|---------|
| Lower Meeks Bend | 30' |
| Caughlin | 20'-30' |

The applicant estimates that the major sands at the proposed location will have an aggregate thickness of about 110'. The Strawn is productive of hydrocarbons at deeper depths but Hydro-FX testified that the sandstones at this depth are non-productive. There are few porosity logs, but the data available indicates sandstone porosity is 21%.

There is one well about 1/4 mile from the proposed well, and three additional wells between 1/4 and 1/2 mile away, all producing wells operated by Devon. All four wells have at least 300' of surface casing, but none have cement in the production casing/borehole annulus throughout the disposal interval. Hydro-FX presented evidence to show that disposed fluid would not move laterally to these wells then migrate upward in the production casing/borehole annulus of these offset wells. This evidence showed, according to the applicant, that the maximum possible increase in pressure in the disposal interval would not be enough to push disposed fluid up to the level of usable-quality water in the offsetting wells.

For its calculations, Hydro-FX assumed, conservatively, that porosity in the disposal interval was only 15%. If 5000 barrels were injected every day for 20 years, the pressure increase in the Strawn at the nearest wellbore was calculated to be 66 psi. The nearest well was drilled with 9.1 pound drilling mud which fills the annulus outside the production casing. According to Hydro-FX, this mud exerts an extra 68 pounds of downward pressure, which is greater than the pressure increase would be after 20 years, even assuming the maximum injection rate every day.

Hydro-FX admitted that if it confines injection to only the thickest Strawn sands, the pressure increase at the nearest well could be greater. However, even 30 years of injection at the maximum rate, would increase bottom-hole pressure at the nearest well by less than 20%. According to Hydro-FX, a pressure increase of this amount could not push saltwater high enough to reach the base of fresh water at a depth of 300'. Hydro-FX believes its calculations show, therefore, that the disposal formation is thick enough and the offset wellbores without cemented production casing are far enough away that they do not present a threat to usable-quality water.

The proposed disposal well will be located on a 41.76 acre tract near the center of Wise County, adjacent to State Highway No. 114. Most of the Barnett Shale development in Wise County is in the southeastern quarter of the county. There are no disposal wells now in southeastern Wise County for the estimated 75,000 to 80,000 barrels of saltwater produced daily from Barnett Shale wells. Most of the saltwater is now being trucked to existing disposal wells in the northwest quarter of the county, and these disposal wells are nearing capacity, according to Hydro-FX.

According to the applicant, much of the saltwater trucked from southeastern to northwestern Wise County travels past the proposed site along Highway 114. Most commercial disposal facilities in Wise County are near the cities of Bridgeport and Chico, and are seven to fifteen miles northwest of the proposed well. Hydro-FX believes use of its proposed facility is in the public interest as this well will allow disposal much closer to the sites where saltwater is produced. This reduces the miles waste-hauling trucks must travel and the resulting expense, encouraging further oil and gas development in the Barnett Shale and other formations.

If this disposal well is approved, all of the waste to be disposed of will be from oil and gas production and is not considered hazardous. Most of the saltwater will be produced by Star of Texas Energy Services wells from the Newark, East (Barnett Shale) Field. The Barnett Shale is one of the most active plays in the country now, with over 2000 existing wells and several new wells being added weekly. Barnett Shale wells require recurrent hydraulic fracture stimulation and the water used in these fracture treatments must be disposed of, preferably by underground injection.

The proposed well will be a commercial disposal well and the applicant will comply with all Commission requirements for commercial wells. Prior to beginning operations, collecting and other pits will be permitted separately under the requirements of Statewide Rule 8. A catch basin will be installed to collect waste which may spill as a result of connecting or disconnecting hoses from hauling trucks. All fabricated storage and pretreatment facilities will be constructed of steel, concrete, fiberglass or other approved material and will be maintained to prevent waste discharges. All facilities will be surrounded by dikes which are capable of containing the maximum holding capacity of all such facilities, and any wastes that do accumulate will be removed within 24 hours. Access to the facility will be secured by an attendant, with a fence and locked gate when unattended. Each storage tank will be equipped with a device to alert drivers when the tank is within 130 barrels of being full.

Protestants' evidence

The protestants and County Commissions are very concerned about any increased truck traffic along Highway 114 that this disposal well will bring. They testified that Hydro-FX can be dispassionate about the safety issues but the people who live nearby cannot afford to be. This proposed location is on a dangerous section of a heavily traveled two-lane road, and the protestants believe there will be insufficient distance for traffic to stop for a tank truck that is turning off or onto the highway. The current driveway at the proposed site is inadequate for the 60 to 70 large tank trucks that will be necessary to move waste to the proposed disposal well. The protestants have requested a study from the highway department on the safety of the proposed site and are asking the Railroad Commission to consider public safety in addition to the prevention of pollution.

The protestants and County Commissioners believe this disposal well poses too great a risk of contaminating the Trinity aquifers which are the major sources of ground water in Wise County. They testified that many of the landowners near the proposed well have water wells for domestic and livestock use, and believe the protection depth of 300' recommended by TCEQ is inadequate. The protestants pointed out that Hydro-FX studied only the official records of water wells, which do not include many domestic water wells.

The protestants were able to locate at least nine domestic water wells, which Hydro-FX did not know about, within ½ mile. One of these domestic wells is 292' deep. The protestants also submitted a list of wells and test holes provided by TWDB that covers all of Wise County, and many of these wells are between 300' and 1000' deep. They pointed out that TCEQ recommends protection depths from 350' to over 450' a mile or two to the southeast of the proposed site.

The protestants submitted a Railroad Commission memorandum, dated February 10, 2004, from the Oil and Gas Division that noted:

The dense concentration of Wise County disposal wells, many utilizing the same shallow injection interval, has created conditions that increase the risk that injected fluids could escape the injection interval and result in environmental problems....

According to this memorandum, there are documented instances in northern Wise County where disposal fluid has broken out on the surface, due largely to undocumented and/or improperly plugged wellbores. Disposal wells have caused problems in wells farther away than the standard 1/4 mile area of review. Therefore, the memorandum recommends, *inter alia*, that disposal wells in Wise, Denton and Tarrant Counties that will inject fluids at less than 2000', "[d]emonstrate disposal zone isolation in all wellbores within a 1/2-mile area of review."

The protestants believe that the lack of cement behind the production casing in the four producing wells within 1/2 mile of this proposed well means there is no isolation in disposal zone. The protestants testified that saltwater broke out on the surface due to a disposal well near the city of Chico. Unplugged and producing wells near that disposal well had become conduits for injected fluid to migrate upwards.

A geologist testified for the protestants that the geology underneath the aquifers in much of the Barnett Shale play is unusual in Texas. The aquifers are in the southeastward-dipping Trinity Group of formations of Cretaceous age. The base of the Trinity is an angular unconformity, and the sandstones and shales of the underlying northwestward-dipping Strawn Formation of Pennsylvanian age are truncated against the Trinity. The shallowest Strawn sandstone in this area, the Hog Mountain, subcrops against the Trinity around the proposed disposal well. According to the protestants, disposal fluid could rise around the outside of the production casing of the offset wells, leak into the Hog Mountain sandstone, then move laterally into the Trinity aquifer where the Hog Mountain is truncated against the Trinity.

The protestants also urged the Commission to treat the five wells between 1/2 and 1 mile away, that were drilled before the Commission required cementing affidavits, as if they had no cement. The Commission should treat these wells as if the surface casing were uncemented, and uncemented wells can provide a conduit for disposal fluid to reach the fresh water.

The protestants pointed out that logs show a few Strawn sandstones below 1700' have somewhat higher resistivity than would be expected for a saltwater-bearing formation. This higher resistivity shows these sandstones contain fresh water or possibly hydrocarbons, or could indicate lower permeability than Hydro-FX predicted. This could invalidate the maximum pressure increase calculations submitted by Hydro-FX.

J.W. McKibben is an oil driller who testified that to his knowledge, this part of the Strawn Formation in southeastern Wise County will not take fluid because it has low porosity. He does not believe that the Brannon Bridge, Meeks Bend and Caughlin sandstones will accept the injected fluid at any feasible pressure.

Railroad Commission staff confirmed that ES has adopted the following standards for administrative approval of commercial disposal wells in Wise, Denton and Tarrant Counties:

- (1) Demonstrate disposal zone isolation in all wellbores within a ½ mile area of review,
- (2) Maximum permitted injection volume of 5000 bbl/day, and
- (3) Maximum permitted pressure gradient of 0.25 psi/ft.

According to the Permitting Manager for Underground Injection and Storage, the pressure calculations submitted by Hydro-FX would be sufficient to demonstrate disposal zone isolation in offsetting wells if this application had not been protested.

ES staff testified that the surface breakout of saltwater near Chico was related to the large amount of water that was being disposed of in a specific well. Remedial action, including restricting injection volume to 5000 BWPD and surface pressure to a gradient of 0.25 psi/ft, appears to have prevented further problems. The additional criteria for administrative approval of applications in Wise County were adopted partly to encourage operators to look for locations away from other wells. One of the goals of ES is to spread out disposal wells and prevent the concentration of disposal such as has occurred around Chico. Another goal is to encourage disposal into deeper zones, particularly those below the Barnett Shale.

Offsetting wells can be conduits to allow the migration of disposal fluid upward. ES staff pointed out that such wells, however, also serve to give early warning of possible subsurface problems. It is unlikely that injected fluid could rise in a wellbore offsetting a disposal well without increasing pressure on the casing annulus at the surface. Statewide Rule 17 requires an operator properly equip the annulus of a well at the surface and to notify the Commission if pressure develops between two strings of casing.

EXAMINERS' OPINION

The examiners believe that this application should be granted. The proposed disposal well will not harm usable-quality water nor oil and gas resources in the area. The casing and cementing program proposed for this well will ensure that injected waste is confined to the sandstones between 1700 and 3000'. Usable-quality water appears to be 300' deep or less, though surface casing should routinely be set at least 350' deep in this area to provide a margin of safety. The proposed 500' of surface casing will be adequate to protect fresh water in the Trinity aquifer.

The sandstones in the Strawn Formation appear adequate to accept the volumes of water to be injected. The thick shale above these sandstones will form a good seal. The protestants are correct that an aquifer located over an angular unconformity where other porous formations subcrop is not typical for Texas. However, they also admitted that this condition is present almost everywhere the Barnett Shale produces. In fact, the aquifers of the Cretaceous-age Trinity and Edwards Formations provide groundwater in much of north and west-central Texas and are usually located over an angular unconformity .

The applicant has demonstrated that the proposed disposal well is in the public interest because it will reduce trucking costs and thereby encourage the recovery of additional hydrocarbons.

Oil and gas production generates waste saltwater and usually the best means of disposing of that waste is injecting it back into the ground as close to the place generated as reasonably possible. Trucking this saltwater to disposal wells more distant from the producing wells in southeastern Wise County will not reduce the environmental risk.

The water that will be disposed of in Hydro-FX's well is already being generated. It is being trucked past this location to disposal wells that may not be as well situated. The proposed well is located away from other injection wells which will reduce the load of fluid disposed of into the Strawn Formation. The farther apart disposal wells are, the less pressure will be increased in the disposal formation. This satisfies one of ES' goals for administrative approval of disposal wells in Wise County.

Because this well will dispose into sandstones at least some of which are shallower than 2000', Hydro-FX will comply with ES' request to keep injection volume below 5000 BWPD and injection pressure at a gradient below 0.25 psi/ft. Because Hydro-FX testified that it expects the shallowest sandstone its well will encounter in the Strawn to be at 1700', the permit should specify a disposal interval from 1700 to 3000'. The maximum surface pressure should be 425 psi.

The proposed site is also well-situated with respect to producing wells. The nearest producing well is almost 1/4 mile away and there are only three additional wells within 1/2 mile. These wells have adequate surface casing and will be monitored for any pressure increase in the casing annulus. The maximum disposal rate will not cause a significant rise in pressure at the closest producing well even after 20 years. A study of wells between 1/2 and one mile away was not required, but the evidence submitted shows that none of these wells will be a problem.

Devon, the operator of the closest wells, is cognizant of possible risks from a disposal well in the area. Statewide Rule 17(a) states: "All wells shall be equipped with a Bradenhead. Whenever pressure develops between any two strings of casing, the district office shall be notified immediately." Devon stated at the hearing that it intends to comply with this rule and indeed will look to the Commission to suspend disposal operations at Hydro-FX' well should it discover increased pressure on the Bradenhead (Bradenhead (also known as casinghead) is a heavy steel fitting attached to the surface casing. It provides a place to install a gauge to detect pressure between the surface and production casing. of its wells.)

The protestants' concerns about increased traffic may be valid but are outside the jurisdiction of the Railroad Commission.

FINDINGS OF FACT

1. Notice of hearing on this application to inject into the proposed well was issued to all interested persons at least ten (10) days prior to the hearing.
 - a Notice of the application (Form W-14) was mailed to operators of all offset wells within 1/2 mile, offset surface owners, and the Wise County Clerk on September 26, 2003.

- b. Notice of the application was published in *The Wise County Messenger*, a newspaper of general circulation in Wise County, on September 14, 2003.
 - c. Notice of the hearing was published in *The Wise County Messenger*, a newspaper of general circulation in Wise County, on November 12, 20 and 27 and December 4, 2003.
 - d. Notice of this hearing was issued by the Commission to all persons who expressed interest on October 24, 2003.
2. The Hydro-FX, Inc., Well No. 1-SWD will be used for disposal of oil and gas waste produced mostly by Barnett Shale wells in this part of Wise County.
 3. Hydro-FX, Inc., will inject only into the thickest and most continuous sandstones within the disposal interval and there are five such intervals within the Strawn Formation between 1700' and 3000'.
 4. The maximum injection volume will be limited to 5000 barrels per day, and the maximum surface injection pressure will be 425 psi.
 5. Hydro-FX will conduct a step-rate test prior to beginning injection operations.
 6. According to the Texas Commission on Environmental Quality, the base of usable-quality water is at 300'.
 7. The Hydro-FX Lease Well No. 1 will have surface casing cemented from 500' to the surface and production casing cemented from 3000' to the surface.
 8. The only wellbore within one quarter mile is currently producing and has surface casing set to 315'.
 9. All of the wellbores within one mile have at least 300' of surface casing except one well that has been plugged in accordance with current Commission standards.
 10. Use of the proposed disposal well is in the public interest as it will reduce disposal costs, thus encouraging further oil and gas development.
 11. There is a need for disposal facilities in southeastern Wise County because of the active development of Barnett Shale wells nearby.

CONCLUSIONS OF LAW

1. Proper notice was given to all necessary parties as required by Statewide Rule 9(5) [Tex. R.R. Comm'n, 16 TEX. ADMIN. CODE § 3.9(5)] 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 Hydro-FX Well No. 1-SWD 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 impaired by the use the Hydro-FX Lease, Well No. 1-SWD to dispose of up to 5000 barrels of saltwater at a maximum surface pressure of 425 psi.
5. Granting the application is in the public interest.
6. The application to dispose of oil and gas waste into the Hydro-FX Well No. 1-SWD meets the requirements for approval pursuant to Statewide Rule 9 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 Hydro-FX, Inc., to dispose of up to 5,000 barrels of saltwater per day by injection at a maximum surface pressure of 425 psi, into the interval between 1700' and 3000' in its Well No. 1-SWD, near the Newark, East (Barnett Shale) Field in Wise County, be **GRANTED**, with the conditions proposed in the attached Final Order.

Respectfully submitted,

Mark Helmueller
Hearings Examiner

Margaret Allen
Technical Hearings Examiner