



League of Women Voters of Tarrant County

Gas Drilling Waste-Water Disposal February 2008

The Issue

Gas drilling creates polluted water. Each gas well in the Barnett Shale uses two- to four- million gallons of fresh water for drilling and fracturing and even more if the well must be re-fractured. As little as 25 percent and as much as 100 percent of the fracture water returns to the surface for recovery depending upon the well. This water, often referred to as flow-back water, contains hydrocarbons, salts, dissolved solids, etc. The first flow-back water that is recovered has a salt content of only between 1,500 and 2,000 parts per million, but the longer the water remains in the Barnett Shale, the saltier it becomes. By the end of the first week, the salt content can reach 45,000 parts per million. Sea water averages between 10,000 and 35,000 parts per million. The high salt content makes the water highly corrosive to metals and harmful to land, vegetation, and other living organisms – including humans.

Some water continues to flow out of gas wells once they are in production. This water is referred to as produced water. Most of the produced water comes from the Ellenberger (also spelled Ellenburger) formation, which lies below the Barnett Shale. In Tarrant County, the impermeable Viola formation provides a barrier between the Barnett Shale and the Ellenberger. However, in parts of Parker and Johnson Counties, there is no Viola formation. Even in regions with the Viola barrier, fractures into the Ellenberger can occur in portions that are not solid. Seismic tests are used to identify possible existing fractures; however, in highly developed urban districts, drilling sites may be so limited that drill sites with pre-existing fractures may have to be used. The porous limestone Ellenberger formation is saturated with water that has salts at 70,000 to 100,000 parts per million. According to sources at Chesapeake Energy, some of their wells have more produced water than flow-back water.

Flow-back water can be disposed of by injecting it into the ground or by recycling. Produced water is too salty for recycling unless it is mixed with less salty water. Most of the flow-back and produced water is currently being injected into the ground. Disposal wells are used to inject salt water and other oil and gas waste, including flow-back water and produced water, into an underground formation. When available, played-out oil or gas wells of varying depths are sometimes converted to disposal wells. In Tarrant County, water disposal wells must be drilled into the Ellenberger formation, more than 8,000 feet below the surface.

Disposal Wells

A number of companies are drilling gas wells in Tarrant County. All the flow-back and produced water must be disposed of properly. Other Texas communities have stated that they do not want any part of Tarrant County's highly polluted water.

Cities have no control over well locations in their extraterritorial jurisdiction (ETJ). Counties have no control over land use in Texas and thus no control over gas wells or water wells.

Chesapeake Energy has a permit to drill a salt water disposal well along East First Street between the Trinity River and Oakland Boulevard on the East Side of Fort Worth near the Trinity River Oxbow. The company asserts that at least 15 more wells will be needed within the City to dispose of their future waste. Chesapeake has received permission from DFW Airport to drill two salt water disposal wells on airport property, one on the north end and one on the south. Walsh Ranch, a large planned development on the far west side of Fort Worth, also already has some water disposal wells. Chesapeake sources indicate that they may keep their disposal wells operational for an extended period.

The capacity of a disposal well is usually much greater volume than the amount of water produced by a single well. Thus, it is logical to dispose of water from several wells into one single disposal well. Operators would probably prefer to have as much freedom as possible to inject any produced water into a specific well - whether it is the same lease or even field.

According to the Texas Railroad Commission Web site, between January 2007 and November 2007, the following additional companies received approval for salt water disposal wells in Tarrant County: Devon Energy Production Co, L.P.; Diamondback-Disposal Texas LLC; and Proven Reserves Management, Inc.

Environmental Risks of Disposal Wells

- Both the flow-back water and the produced water from the Barnett Shale formation are highly corrosive to metals and harmful to land, vegetation, and other living organisms including humans. Millions of gallons of polluted water are produced daily.
- The fracturing process uses a very wide variety of proprietary chemicals, among which are biocides and surfactants that are similar to soap, used for reducing friction.
- Other oil and gas waste aside from flow-back and produced water could be injected into the waste-water wells for many years.
- Improper drilling or completion of a disposal well can pollute the ground water during the injection process itself or later if the polluted water migrates upward into the ground water or onto the surface. This has been a particular problem in the shallower wells in Wise County. The wells drilled into the Ellenberger formation should be more environmentally friendly, but they are not risk-free.
- Although the Texas Railroad Commission strictly regulates the construction of disposal wells, it can be difficult to completely achieve the intent of the regulations, that is: 100 percent isolation of the disposal zone and useable groundwater aquifers. It is not required to prove that this isolation actually exists, thus increasing the risk of contamination. The Upper Trinity Groundwater Conservation District (UTGCD) district intends to have several water wells near each injection/disposal well site. Regular samples will be taken from these wells in order to ensure that chemicals from the disposal zone have not migrated into the aquifer.
- Transporting the water from the gas well to the water disposal well is typically done via air-polluting, road-damaging trucks. Traffic accidents, associated spills, and driver/passenger injuries are a further risk.

- Transportation of the polluted water through pipelines has its own risks, including pipe leaks or ruptures. Leaks are difficult to track, and much environmental harm can be done before the leak is found.
- Storage of polluted water on site prior to disposal into the disposal well is also a potential hazard. According to an October 16, 2007, article in the *Fort Worth Star-Telegram*, a man was injured near Keene in Johnson County when a salt water disposal pit caught fire at a plant that disposes gas well flow-back water.

Texas Railroad Commission (TRC)

The TRC regulates the drilling and operation of gas, oil, and water wells throughout the state of Texas. Cities govern their land surfaces; the TRC governs the subsurface.

TRC rules require an operator to take precautions to prevent pollution of surface and subsurface water, but do not include specific requirements for plastic liners in drilling pits or fracture water pits. Many operators use liners in areas where the soil is permeable. Local governments can require the use of lined pits and presumably pit covers to prevent wildlife from getting into the polluted water.

TRC specifies construction standards for salt water disposal wells, requiring three layers of protection, consisting of two sets of properly cemented casing and tubing isolated with a packer. A mechanical integrity test is required to prove no leaks prior to first injection and every five years after that.

TRC regulations seem to assure that the quality of waters (and land) will not be impacted by a gas operator's activity. However, the assurance is weak, for current TRC rules define "pollution of surface or subsurface water" broadly: "The alteration of the physical, thermal, chemical, or biological quality of, or the contamination of, any surface or subsurface water in the state that renders the water harmful, detrimental, or injurious to humans, animal life, vegetation, or property, or to public health, safety, or welfare, or impairs the usefulness or the public enjoyment of the water for any lawful or reasonable purpose."

TRC staffing levels have not kept pace with the rise in gas drilling. According to the State Auditor's August 2007 audit of the Texas Railroad Commission, TRC has no formal approach for ensuring that all oil and gas facilities are inspected regularly. Nearly half – 46.6 percent – of the state's oil and gas leases had not been inspected in the five years ended October 31, 2006. Commission district offices did not consistently perform timely follow-up inspections to determine whether operators have remedied the violation. For example, one Houston case of groundwater pollution was not re-inspected until 279 days after the compliance date. Staffing cannot be increased appreciably without legislative action, and the 2007 State Legislature did not authorize significant increases in TRC inspection staff.

Commercial salt water disposal wells are inspected by TRC annually. TRC does not have a set schedule for inspecting non-commercial disposal wells, but the wells must be inspected every five years.

Well inspectors work out of their homes with limited supervision. The audit found no gift policy; inspectors were allowed to take gifts from the companies they were inspecting. Further, the TRC did not require staff to submit annual financial disclosures. As a result, inspectors and their supervisors could have financial interest in the companies they were paid to regulate. In their answer to the State Auditor's Office, the TRC agreed to institute a gift and financial disclosure policy and to better supervise inspectors. But inspectors here in the Barnett Shale will continue to work out of their homes since the nearest TRC Offices are in Kilgore and Wichita Falls.

City Policies Covering Water Disposal

Texas Administrative Code defines a commercial waste-water well as a well that takes wastes from several sources for profit. There are also private, non-commercial wells used by one entity for its own wastes. The Fort Worth Gas Drilling Ordinance prohibits commercial wells within the City. The ordinance allows private disposal wells provided the following requirements are met:

- Site location only in an I, J, or K (industrial) zoned land
- Notification procedure (of some sort) not delineated in the ordinance
- Approval of a TRC permit to dispose of non-hazardous oil and gas waste by injection into a porous formation not productive of oil and gas
- Inspector review prior to permit issuance
- Water disposal into the Ellenberger Formation (below Barnett Shale)
- Well cased and cemented to the surface
- City Council approval for wells within 1,000 feet of a protected use
- City permit

With 30 days' notice of non-compliance, the City can terminate the permit and require that the well be plugged and abandoned. Unfortunately, a lot of damage can be done in 30 days. Cities should be able to shutdown immediately to stop damage.

The gas drilling ordinances of most Tarrant County cities resemble Fort Worth's. The one exception is the City of Bedford. According to the *Fort Worth Star Telegram*, Bedford's new ordinance allows gas and oil well drilling, but the set-back requirements leave only one site in the entire city suitable for gas drilling. The City of Arlington at present prohibits water disposal wells within its jurisdiction.

Cities can control the placement of gas and water wells only through their land use powers such as a Gas Drilling Ordinance. At its October 23, 2007, meeting, the Fort Worth City Council approved a six-month moratorium on the permitting of additional private disposal wells. On February 12, 2008, the Fort Worth City Council charged industry representatives and City staff with proposing regulations for waste water disposal wells. We recommend that the location of these wells take into consideration impacts on residential neighborhoods which would include minimizing truck traffic issues.

The City of Fort Worth has what is called a grant of privilege for commercial trash collection. This allows the City to license commercial trash haulers within the City and to levy a fee on the trucks to cover road wear. Such a fee could potentially be levied on companies that haul

wastewater within the City. Operators of common carrier gas pipelines and gas utility companies have the power of eminent domain whereas waste-water pipeline operators do not.

Waste-Water Recycling

At least two technologies exist to treat the waste water at the drill site; reverse osmosis and evaporation.

In a reverse osmosis water recycling unit, the polluted water is passed through a series of specialized filters that remove the pollutants. Texas A&M has developed a portable unit suitable for use at a gas well site.

The evaporator system vaporizes water to steam from the wastewater, which is then condensed into clean distilled water. The remaining concentrated wastewater (blowdown) is removed for disposal or to a crystallizer for further recovery. Natural gas from the gas well is used to heat the water. The recovery rate with the evaporation/distillation equipment ranges from approximately 80 percent to 85 percent.

With present technology, the evaporation method has proved superior because it can purify water with salt content up to 45,000 parts per million while the reverse osmosis method only works on water with no more than 35,000 parts per million.

According to sources at Devon Energy, water recycling is still slightly more expensive than water disposal, but the price gap continues to decline. Devon currently operates nine Fountain Quail Management recycling units in four locations in the Barnett Shale producing area, none of which are in Tarrant County.

DTE Gas Resources, Inc. used a reverse osmosis recycling unit for a pilot project in Jack County. They have no further plans to recycle flow-back water because it is much cheaper to utilize existing relatively shallow water-disposal wells in rural areas.

Even if water disposal is cheaper for the gas driller, recycling may be cheaper for the community that has to deal with not only the environmental hazards and risks of the injection process but also the loss of water to the regional water system. No matter what recycling process is used, at least 20 percent of the waste water will be a hazardous residue or concentrate that still must be disposed of properly in a hazardous waste disposal facility such as an disposal well or a specialized land fill.

According to Dr. David Burnett of Texas A&M, gas producers are experimenting with chemicals that would allow them to reuse some of the produced water for fracturing to reduce gas production costs. Burlington Resources and Stroud Energy were authorized by the Texas Railroad Commission in 2003 and 2005, respectively, to reuse flow-back water from fractures in the Barnett Shale without a permit for use in future fractures or drilling new wells. We understand this to mean that these companies are allowed to use the untreated flow-back water as fracturing water for other wells. Presumably they would be utilizing the flow-back water with salt content in the 1,500 to 2,000 parts per million range.

Conclusion

Water disposal is a huge issue for the gas producers, as well as for the Tarrant County communities within which the gas and waste-water are generated. Given the environmental risks associated with salt water disposal wells, and given the limited fresh water in this drought-prone region, the gas producers and cities within the Barnett Shale should do all they can to encourage the recycling of fracture flow-back water. It is essential to reduce the volume of water lost from the Trinity River water basin. Since all the polluted water cannot be recycled, cities must insure that the remaining polluted water is disposed of in the most environmentally friendly manner possible. State and local government should also encourage the development of new technology to enable the recycling of produced water.