

# Chapter 15

## Effects of Oil and Gas Production on Groundwater

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### Introduction

The Railroad Commission of Texas (RRC) has the statutory authority and duty to regulate a wide range of oil and gas operations for the purpose of conserving resources, protecting correlative rights, and protecting the state's water resources.

Section 91.101 of the Texas Natural Resources Code provides the RRC with jurisdiction over the full scope of oil and gas exploration, development, and production operations and activities, including the drilling of wells associated with oil and gas activities, gas plants, natural gas or natural gas liquids processing plants, pressure maintenance plants, underground hydrocarbon storage facilities, and activities associated with the storage, handling, reclamation, gathering, transportation, or distribution of oil or gas. In addition, under Section 26.131 of the Texas Water Code, the RRC is solely responsible for the control and disposition of waste and the abatement and prevention of pollution of surface and subsurface water resulting from oil and gas activities.

To meet its statutory responsibilities, the RRC has adopted regulations to prevent contamination of surface water and groundwater from oilfield activities and has established programs to abate such contamination when it does occur.

### Regulatory History

Texas has been producing oil for more than 100 years and has had regulations applicable to oilfield pollution prevention since 1899.<sup>1</sup> Such regulations include requirements and standards for well construction, integrity testing, and plugging, as well as pollution prevention, spill response, and oil and gas waste management. The RRC's pollution regulations have evolved significantly since those early days, even before the elevation of our national environmental conscience, which some say began with the 1962 publication of Rachel Carson's *Silent Spring*.

For example, Texas once allowed disposal of produced water in earthen evaporation pits and surface waters. The State recognized this as a potential problem back in the 1950s, and the RRC

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began prohibiting such pits and discharges on an area-wide basis starting in 1955.<sup>ii</sup> In 1969, the RRC prohibited such pits and discharges statewide.<sup>iii</sup>

Another example of the RRC's evolving environmental regulations is the history of the RRC's well plugging requirements and programs. Although legislation was passed in 1899 concerning the plugging of oil and gas wells, the Texas Legislature gave no agency specific responsibility for enforcing the plugging of inactive oil and gas wells until 1919, when it authorized the RRC to enforce the laws.<sup>iv</sup> Since 1919, the RRC has had rules on plugging abandoned wells to confine oil, gas, and associated saltwater to the strata in which they originated. The drought of the 1950s focused Texas' attention on the need to better protect clean water. In 1957, with more knowledge of the nature of subsurface water, standards for plugging were revised to ensure greater protection of groundwater.<sup>v</sup>

Today, the RRC has even greater control of the proper plugging of abandoned wells and waste management practices through enhanced inspection and enforcement mechanisms and personnel, an ability to administer administrative penalties of up to \$10,000 per day per violation, a greater ability to track the status of wells and other operations through computer databases, and financial security requirements for operators.<sup>vi</sup>

Additional RRC programs serve to ensure protection of groundwater. In 1982, the U.S. Environmental Protection Agency (EPA) delegated to the RRC the Underground Injection Control program under the federal Safe Drinking Water Act for that portion of activities under the RRC's jurisdiction. Currently, there are approximately 49,911 Class II permitted and active injection and disposal wells, 359 active hydrocarbon storage wells, and 84 Class III active brine mining wells in Texas. The RRC tracks injection pressures and volumes for each of these wells annually. The RRC also receives and reviews approximately 17,000 mechanical integrity pressure tests annually from oilfield operators.

In 1984, the RRC further strengthened its environmental regulations by adopting major amendments to its regulations concerning pit and surface waste management standards (Rule 8), including standards for short-term pits such as drilling pits and completion/workover pits.<sup>vii</sup> The rule authorizes some short-term, relatively low risk waste management practices and requires permits for other waste management practices. The rule prohibits a person conducting activities subject to RRC regulation from causing or allowing pollution of surface or subsurface water in the state.

The RRC has an extensive monitoring and enforcement program, which acts to detect and correct problems in the field. The RRC's Field Operations section is responsible for ensuring statewide compliance by oil and gas operators of the regulations of the RRC. The state is divided into nine districts, with an office located in a key city in each district. The RRC's district personnel are the first responders to spills, blowouts, fires, sour gas releases, and other oilfield-related emergency operations. Approximately 88 field inspectors and lead technicians are responsible for a total of 358,746 wells. Field Operations performs inspections based on a priority system that places an emphasis on jobs and activities that pose the greatest risk to public safety or the environment. In fiscal year 2005, Field Operations performed over 115,000 jobs consisting of inspections and/or monitoring of oilfield activities.

## **Oil Field Cleanup Program Review**

However, as in any industrial activity, equipment can fail and employees may err, and groundwater pollution may result. Under the Oil Field Cleanup Program, the RRC has established multiple pollution abatement programs that complement each other. These programs include a Well Plugging Program to plug abandoned wells, a State Managed Cleanup Program to assess and clean up abandoned oil and gas sites, an Operator Cleanup Program to oversee responsible operator cleanup, and a Voluntary Cleanup Program designed to encourage developers, landowners, or other innocent parties to identify and clean up oilfield pollution. Details about these programs are available on the RRC web site at <http://www.rrc.state.tx.us/>. The programs are funded through a variety of mechanisms, including operator filing fees, regulatory fees on oil and gas production, penalties, and collections on financial security instruments.<sup>viii</sup> In addition, the RRC has leveraged these funds with millions of dollars of other state and federal grant funds.

### **Funding**

In 1965, the Texas Legislature created a Well Plugging Fund to assist in the plugging of a polluting well for which no operator could be found; however, biennial appropriations were required, and appropriated funds were less than what was needed to fully address the problem.<sup>ix</sup> In 1983, the Legislature provided the RRC with administrative penalty authority and application fees to fund the Well Plugging Fund as well as an increased budget for additional legal, administrative, and field staffing.<sup>x</sup> The RRC also imposed plugging deadlines and financial security requirements on oil and gas operators.

In 1991, the Legislature replaced the Well Plugging Fund with an expanded Oil Field Cleanup Fund to plug abandoned wells as well as to clean up pits and other sites associated with oil and gas operations. This fund, the legislation for which was supported by the Texas oil and gas industry, is supported by fees, penalties, and other payments collected from the oil and gas industry.<sup>xi</sup> The RRC leverages this fund with various state and federal grants. Since the RRC implemented the Well Plugging Program in 1984, the RRC has plugged over 24,000 abandoned wells. Since the initiation of the Oil Field Cleanup Program in 1992, the RRC has completed over 3,000 clean up activities at abandoned sites with state-managed funds. The abandoned wells to be plugged and sites to be cleaned up are prioritized based on the risk to public safety or the environment.

### **Pollution Cleanup**

RRC regulations require that responsible operators clean up pollution caused by oil and gas activities. The RRC considers groundwater pollution cleanup requirements on a site specific, case-by-case basis. The RRC allows the responsible operator to select the remediation technique as long as clean up is effective and timely. Currently-accepted federal or state remediation protocols are applicable, and acceptable cleanup standards are consistent with federal and state drinking water standards unless aquifer characteristics and land use controls allow for alternate cleanup levels.

## Pollution Sources

A variety of oilfield materials can impact groundwater. These include produced saltwater, drilling fluids, and associated wastes such as well treatment chemicals, crude oil, and hydrocarbon condensate. Produced water constitutes about 98 percent of all oil and gas waste; however, in Texas over 99 percent of all produced water is injected in wells regulated under the RRC's Underground Injection Control program. Drilling fluids and associated oil and gas wastes make up about 1.6 percent and 0.4 percent by volume of oil and gas waste, respectively.<sup>xii</sup>

Groundwater quality has been impacted by past practices (now prohibited), accidental spills, pipeline leaks, blowouts, and situations that are noncompliant with current RRC regulations. Contaminants released as a result of these situations can include dissolved salts from produced water; barium from drilling fluids; hydrocarbons from crude oil and natural gas condensate, as well as other heavy metals; and refined hydrocarbons and chemicals from well treatment fluids.

## Interagency Cooperation

The RRC is one of ten members of the Texas Groundwater Protection Committee (TGPC), which was established in 1989 by the Texas Water Code, Chapter 26, Subchapter J, relating to Groundwater Protection.<sup>xiii</sup> The purpose of the TGPC is to coordinate groundwater protection activities across Texas. TGPC duties include publishing an annual groundwater monitoring and contamination report, updating the state groundwater protection strategy, and reporting to the Texas Legislature on groundwater protection activities and recommendations for groundwater legislation. The TGPC's annual report for 2004, entitled "Joint Groundwater Monitoring and Contamination Report for 2004," lists a total of 6,746 active documented groundwater contamination cases from all sources. Of those 6,746 cases, 241, or approximately 3.6 percent of all active, documented cases, were related to oilfield activities. Over 230 cases in which the probable source of contamination was related to oilfield activities have been closed since the RRC began reporting such cases in 1989.

It is interesting to note that of the closed documented groundwater contamination cases related to oilfield activities under the RRC's jurisdiction, the contaminant was salt and/or hydrocarbons in 222, or approximately 97 percent, of the cases. The remaining eight cases included other contaminants, such as metals (barium, mercury, and chromium), hydrochloric acid (HCl), glycol, polychlorinated biphenyls (PCBs), and sulfates.

## Conclusion

There has been oil and gas activity in Texas since 1866, when Lynis T. Barrett drilled the first producing Texas well in Nacogdoches County.<sup>xiv</sup> From the beginning, the RRC has exercised its statutory authority to enact regulations to protect surface and subsurface water and has vigorously enforced those regulations to ensure compliance. In the last few years, the RRC has broadened and enhanced its ability to prevent pollution through strengthening its regulations and enforcement and to abate pollution of groundwater with numerous complementary programs that are funded by the oil and gas industry. As oil and gas exploration and development

methodologies become more sophisticated, so too does the concomitant need for environmental protection, assuring that, as new plays and higher prices drive additional oilfield development, groundwater and other resources of Texas are preserved and protected.

## References

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- <sup>i</sup> Texas House, 1899, House Bill 542, 26<sup>th</sup> Texas Legislature, regular session. Ch. 49, *Tex Gen Laws* 68.
- <sup>ii</sup> Special Order Pertaining to Disposal of Salt and Sulphur Water Produced Incident to the Production of Oil and Gas In the Rodman-Noel (Grayburg) Field, Upton County, Texas, Oil and Gas Docket No. 7-32,629, December 19, 1955.
- <sup>iii</sup> Special Order Amending Rule 8 of the General Conservation Rules of Statewide Application, Oil and Gas Docket No. 20-56,841, April 3, 1967 (effective January 1, 1969).
- <sup>iv</sup> Rule 20, Oil and Gas Circular No. 7, June 18, 1919, (available) at the Railroad Commission Library and the University of Texas Center for American History.
- <sup>v</sup> Memorandum to District Supervisors, May 30, 1957 (available) at the Railroad Commission Library, (codified as Rule 15, effective June 1, 1964).
- <sup>vi</sup> Railroad Commission of Texas, Statewide Rules, 16 Tex. Admin. Code, Chapter 3, Oil and Gas Division.
- <sup>vii</sup> 16 Texas Administrative Code §3.8, relating to Water Protection, amended effective March 1, 1984.
- <sup>viii</sup> Texas Natural Resources Code, §91.111, relating to the Oil Field Cleanup Fund, 1991.
- <sup>ix</sup> Texas Natural Resources Code Annotated, 89.001, 89.003, 89.011-89.013, 89.081-89.084, 89.041-89.045, 89.121, 89.122 (Vernon 1978) [original version at 1965 Tex. Gen. Laws, Ch. 355, Tex. Rev. Civ, Stat. Art. 6005, 6005 note, 6032c-2 note (Vernon Supp. 1979-1980)].
- <sup>x</sup> Texas Natural Resources Code, §85.2021 (Vernon Supp. 1985)(Original version at 1983 Tex. Gen Laws, ch. 967).
- <sup>xi</sup> Texas Senate, 1991, Senate Bill 1103, 72nd Texas Legislature, regular session, Ch. 603, effective September 1, 1991.
- <sup>xii</sup> U.S. Environmental Protection Agency, Report to Congress: Management of Wastes from the Exploration, Development, and Production of Crude Oil, Natural Gas, and Geothermal Energy II-28 and -29 (1987).

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<sup>xiii</sup> Texas House, 1989, House Bill 1458, 71st Texas Legislature, regular session, Ch. 768, § 1, effective September 1, 1989.

<sup>xiv</sup> Handbook of Texas Online, s.v. "OIL AND GAS INDUSTRY," (<http://www.tsha.utexas.edu/handbook/online/articles/OO/doogz.html>).