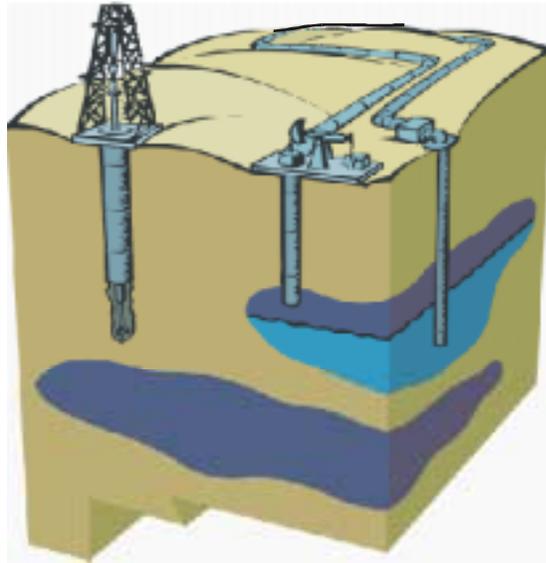


NEW MEXICO'S

Underground Injection Control (UIC) Program

CLASS II WELL FACTS



Injection Wells Related To Oil and Gas Activity

Oil Conservation Division
Energy, Minerals and Natural Resources Department
Santa Fe, New Mexico

INTRODUCTION

Regulated by the Oil Conservation Division for several decades, underground injection has been an essential production practice utilized by the petroleum industry in New Mexico to dispose of produced liquid and to enhance the recovery of oil in producing fields (Please see Figure 1). In the past, the realization that subsurface injection could contaminate ground water prompted New Mexico and other states to develop State programs or methods to protect subsurface sources of usable water. Additionally, to increase ground water protection, a Federal Underground Injection Control (UIC) program was established under the provisions of the Safe Water Drinking Act of 1974 for the purpose of establishing minimum requirements for effective state UIC programs. Since ground water is a major source of drinking water in New Mexico, the UIC program requirements were designed to prevent contamination of underground sources of drinking water (USDW) by the operation on injection wells.

Since the passage of the Safe Drinking Water Act, New Mexico has modified existing and developed new strategies to protect ground water by establishing more effective regulation and rules to control the permitting, construction, operation, monitoring, and abandonment of injection wells.

The United States Environmental Protection Agency (USEPA) has delegated primary regulatory authority (primacy) to those states, including New Mexico, that have implemented UIC programs that meet USEPA requirements. Many states like New Mexico have had oil and gas programs in place for decades. We have been able to demonstrate that our existing programs for Class II wells represent an effective measure to prevent endangerment of drinking water sources by underground injection well practices.

A well, as defined in Title 40 of the Code of Federal Regulations, is either a dug hole or a bored, drilled or driven shaft the depth of which is greater than its largest surface dimension. Injection is defined as the subsurface emplacement of fluids in a well, where a fluid is any material that flows or moves whether it is semi-solid, liquid, sludge or gas.

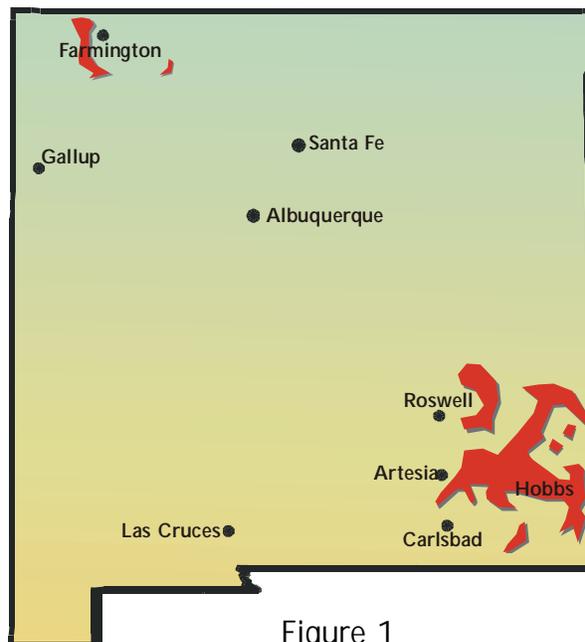


Figure 1

Major Waterflood Injection Areas of the State

Waterflooding and disposal are most often associated with oil production. The southeast portion of New Mexico accounts for approximately 95% of the injection activity as well as oil production. The northwest portion produces the majority of New Mexico's natural gas; consequently there is substantially less underground injection going on.

INJECTION WELL CLASSIFICATION

Injection wells covered by the UIC program are divided into the following five groups:

Class I: Subclassifications: Hazardous and Non-Hazardous. Wells used to inject liquid [non] hazardous wastes or dispose of industrial and municipal waste waters beneath the lower-most USDW.

Class II: Wells used to dispose of fluids associated with the production of oil and natural gas (hydrocarbons); to inject fluids for enhanced oil recovery; or for the storage of liquid hydrocarbons.

Class III: Wells used to inject fluids for the extraction of minerals (i.e. solution mining).

Class IV: Wells used to dispose of hazardous or radioactive wastes into or above a USDW. The USEPA has banned the use of these wells.

Class V: Wells not included in the other classes used generally to inject non-hazardous fluid into or above a USDW.

CLASS II INJECTION WELL TYPES

Class II injection wells have been used in oil field related activities since the 1930's. Today, there are approximately 6,000 active Class II wells located in New Mexico.

Class II injection wells are categorized into three main groups. They are (1) Salt Water Disposal Wells, (2) Enhanced Oil Recovery (EOR) Wells, and (3) Hydrocarbon Storage Wells.

SALT WATER DISPOSAL WELLS

The production of oil and gas is often accompanied by salt water. On average, approximately 10 barrels of salt water are produced with every barrel of crude oil. This water is reinjected into authorized geologic formations through disposal wells and EOR wells. One of the common forms of liquid waste disposal by the oil and gas industry is injection into non-hydrocarbon bearing geologic formations. These disposal wells have been used extensively to return the salt water associated with oil and gas production to the subsurface. Industry sources state that 30% of salt water produced with oil and gas onshore in the United States is disposed of via salt water disposal wells.

ENHANCED OIL RECOVERY WELLS

Enhanced Oil Recovery (EOR) injection wells are used to increase and prolong oil production from depleting oil producing fields. SECONDARY RECOVERY is an EOR process, commonly referred to as waterflooding. In this process salt water co-produced with oil and gas is reinjected into the oil producing horizon to drive oil into pumping wells, resulting in greater recovery of oil. TERTIARY RECOVERY is an EOR process which is employed after secondary recovery methods become inefficient or uneconomical. Tertiary recovery methods include the injection of gases, enhanced waters and steam in order to maintain and extend oil production. Approximately 60% of salt water produced with oil and gas onshore in the United States is injected into EOR wells. New Mexico is a leader in legislating tax incentives that encourage oil companies to institute these types of projects to boost the nation's supply of oil.

HYDROCARBON STORAGE WELLS

These wells are used for the underground storage of crude oil, liquified petroleum gas (LPG), and other liquid hydrocarbon products in naturally occurring rock formations. Often the same wells are designed for both injection and removal of the stored hydrocarbon storage wells are vital to our nation's strategic reserves.

CONSTRUCTION OF CLASS II WELLS

Construction of new Class II injection wells is subject to State and Federal regulations. Construction design must adequately confine injected fluids to the authorized zone as well as prevent the migration of fluids into USDWs. Through the permitting process for Class II injection wells, site-specific construction regulations can be imposed to meet any unusual circumstances.

Injection wells are drilled in to geologic rock formations that will accept the injected fluids. The fluid pressure, fracture pressure, and geological characteristics of the injection zone must be considered when evaluating a zone that may be suitable for injection. Confining zones generally overlie the injection zones. Confining zones are non-permeable zones that add to the environmental security of the well by restricting the upward movement of the injected fluids.

New injection wells are drilled and cased with steel pipe. The pipe is cemented in place to prevent the migration of fluids into USDWs. Figure 2 depicts an injection well construction diagram. It should be noted that the surface casing is commonly set below the base of the lowermost USDW and cemented back to the surface, preventing the movement of fluids into USDWs. Secondly, cement is placed behind the long string casing for several hundred feet above the injection zone to prevent injected fluids from migrating upward into the USDW. The long string casing and cement sheath are perforated in the injection zone to allow for fluid emplacement.

As shown in Figure 2, a typical injection well also has an interior string of pipe called tubing through which injection takes place. A packer is used to isolate the injection zone from the casing above the packer, and also helps to facilitate the detection of any leakage.

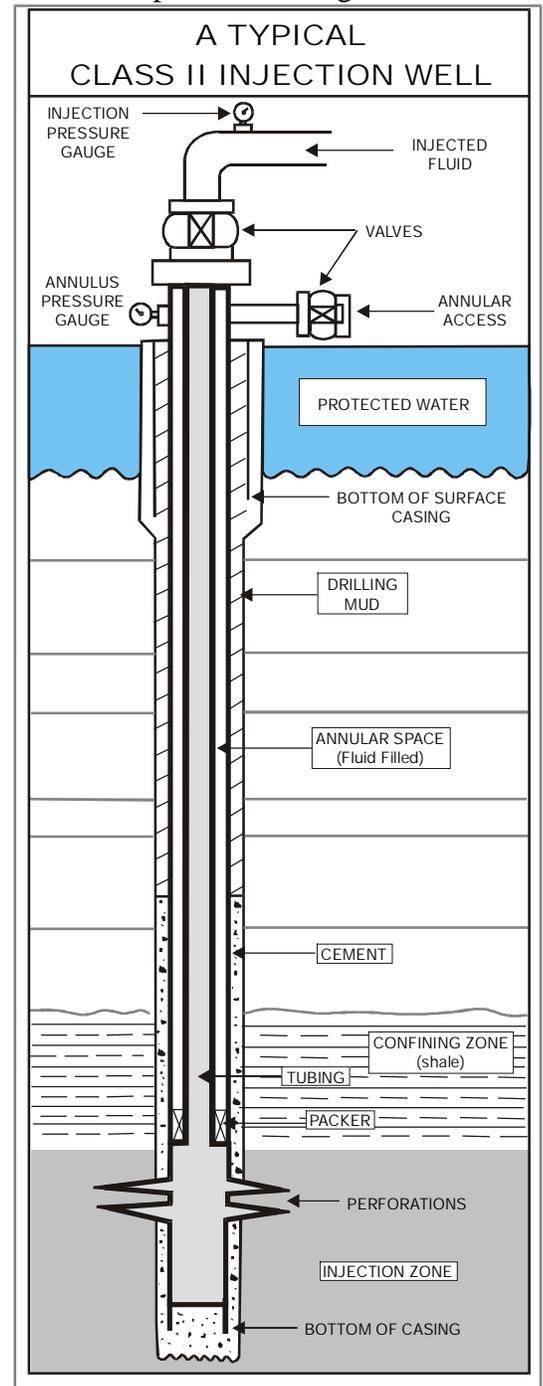


Figure 2

OPERATIONS

Injection well operations must be directed in such a manner as to prevent the contamination of USDWs and to ensure fluid emplacement and confinement within the authorized injection zone.

Typically, the oil, gas and salt water are separated at the oil and gas production facility. The salt water is then either piped or trucked to the injection site for disposal or EOR operations. There, the salt water is transferred to holding tanks and pumped down the injection well. For EOR, the salt water may be treated or augmented by other fluids prior to injection to maximize oil recovery in some EOR operations.

New Mexico, as well as other primacy states, has adopted its own regulations, which meet or exceed federal standards, concerning injection well operations in terms of maximum allowable injection pressures, mechanical integrity testing, pressure monitoring and reporting.

TESTING AND MONITORING

Continuous ground water protection is accomplished by testing and monitoring the injection wells after placing them in service. Injection pressures and volumes are monitored as a valuable indicator of well performance.

Downhole problems normally can be recognized through the monitoring of injection well pressures. Effective monitoring is important so that corrective action can be taken quickly to prevent endangerment of USDWs. Monitoring reports must be submitted to the appropriate State or Federal Agency for review.

Mechanical Integrity Tests (MITs) are required prior to initial injection and at a minimum of once every five years thereafter. Variations of acceptable tests and frequencies of the tests are determined on a state-by-state basis. For example, New Mexico utilizes a bradenhead test on an annual basis in addition to the pressure test every five years. These tests are utilized to evaluate the operational integrity of the well so that USDWs will not be endangered.

New Mexico's newest tool for monitoring operations and conditions of injection wells, in addition to scheduling all MITs, is known as the Risk Based Data Management System (RBDMS). The core system was developed by the Ground Water Protection Council, a national organization made up of State and Federal regulatory agencies, industry representatives and municipal officials. RBDMS New Mexico has been highly customized to meet the needs of New Mexico's program. It is used on notebook computers by inspectors in the field to record and track all relevant data in the constant business of protecting New Mexico's underground sources of drinking water.

For More Information:

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