

# **PERFORMANCE AUDIT REPORT**

## **Regulation of Oil and Gas Well Operations In Kansas Part II: Enforcement of Injection Well Procedures**

**A Report to the Legislative Post Audit Committee  
By the Legislative Division of Post Audit  
State of Kansas  
August 1986**

# ***Legislative Post Audit Committee***

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## ***Legislative Division of Post Audit***

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#### **OBTAINING AUDIT INFORMATION**

This audit was conducted by Leo Hafner, Senior Auditor, and Jim Davis and Rick Riggs, Auditors, of the Division's staff. If you need any additional information about the audit's findings, please contact Mr. Hafner at the Division's offices.

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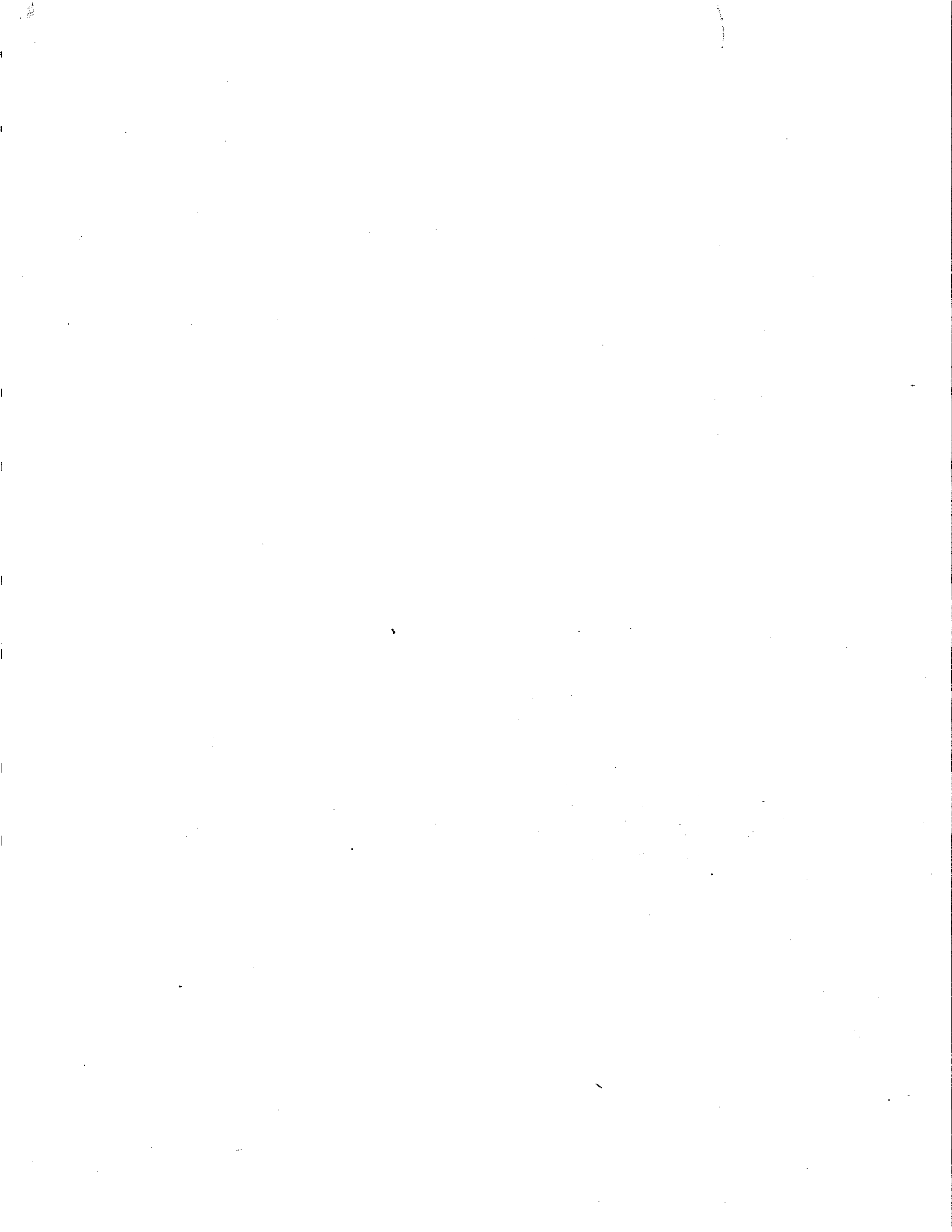
## REGULATION OF OIL AND GAS WELL OPERATIONS IN KANSAS PART II: ENFORCEMENT OF INJECTION WELL PROCEDURES

### Summary of Legislative Post Audit's Findings

**What are the State's responsibilities for enforcing proper operation and testing of injection wells?** Injection wells are regulated under the federal Safe Drinking Water Act of 1974. Under the law, the Corporation Commission is responsible for approving the location of wells, the depths at which fluids are to be injected, and the pressures under which fluids can be injected. Other major responsibilities include monitoring the wells to ensure that approved injection pressures and volumes of fluid are not exceeded, and periodically testing wells to ensure that they are not leaking into potential sources of drinking water. The Commission appears to be doing a good job of enforcing approval and testing requirements; however, monitoring could be improved. The report makes recommendations for improving the State's monitoring of injection wells.

**Are the applicable requirements for pressure testing injection wells being enforced in a consistent manner?** The Commission has developed guidelines for testing injection wells, but those guidelines were not strictly followed for some wells the auditors reviewed. In other cases, tests appeared to be inconsistent because the guidelines were not specific enough. Similarly constructed wells were tested under widely varying pressures. Other wells were allowed to lose a high proportion of their test pressure, and were still considered by Commission staff to have passed the tests. Commission personnel did not always provide all the information needed to determine if a test was carried out correctly. The audit's recommendations address improvements needed in each area.

Finally, the auditors noted that injection well testing requirements have created controversy in eastern Kansas. Oil and gas industry representatives maintain that testing wells is a waste of resources in eastern Kansas because there is no deep groundwater to protect. State water officials disagree with industry contentions. Water officials indicate that groundwater maps would need to be updated to pinpoint where the water is before decisions could be made to exempt any wells from testing requirements. The oil industry has asked for a one-year moratorium on testing injection wells. Federal officials indicate that if the State were to impose a moratorium on well testing, the Environmental Protection Agency would likely take over the program and reimpose well-testing requirements.



## **REGULATION OF OIL AND GAS WELL OPERATIONS IN KANSAS PART II: ENFORCEMENT OF INJECTION WELL PROCEDURES**

The operation of injection wells is an integral part of oil and gas production operations. Injection wells are generally used for two purposes--to dispose of saltwater wastes brought to the surface during the production of oil and gas, and to increase the rate of recovery of oil by injecting fluids into oil-bearing formations. The first type are called disposal wells, and the second type are called enhanced recovery wells. Fluids injected into the ground from these wells are a potential source of pollution of the State's fresh and useable water. Therefore, these wells must be carefully constructed, operated, and tested to ensure that pollution does not occur.

Injection wells are regulated under the federal Safe Drinking Water Act of 1974. The purpose of the Act is to protect potential sources of drinking water from pollutants. Recently, legislative concerns have been raised about inconsistent enforcement of federal requirements for operating and testing injection wells, and about the effect those regulatory requirements have on the depressed oil economy. In response to oil industry concerns that the expense of testing injection wells was making production unfeasible in eastern parts of the State where there was essentially no groundwater to pollute, the 1986 Legislature passed a concurrent resolution calling for a one-year moratorium on injection well testing.

To help address these concerns, the Legislative Post Audit Committee authorized a two-part audit of oil and gas operations in Kansas. Part one, issued in June 1986, reviewed oil and gas well plugging. This second part looks at some of the Legislature's concerns about injection wells. This audit addresses the following specific questions:

- 1. What are the State's responsibilities for enforcing proper operation and testing of injection wells?**
- 2. Are the applicable requirements for pressure testing injection wells being enforced in a consistent manner?**
- 3. Can the State's enforcement efforts be improved to safeguard against improperly operated injection wells?**

To answer these questions, the auditors reviewed applicable State and federal laws and regulations. They interviewed officials from the Corporation Commission, the Department of Health and Environment, the Kansas Geological Survey, the Kansas Water Office, and the federal Environmental Protection Agency, as well as representatives from the oil and gas industry. They contacted other states to learn about their enforcement of injection well requirements. They also reviewed files for a sample of injection wells to determine whether the Commission was following appropriate procedures and whether well operators were fulfilling certain requirements. Finally, they reviewed the issues surrounding the request to discontinue injection well testing.

In general, the auditors found that Kansas' regulations governing injection wells paralleled federal requirements. For the most part, the Corporation Commission appeared to be doing a good job of enforcing the regulations. However, the Commission could improve its procedures for monitoring wells. The auditors also found that the requirements for pressure testing injection wells were not always consistently enforced. Similar types of wells were tested at very different pressures, and a few wells were not tested at the minimum required pressures. Finally, the auditors found that the Commission has not set specific guidelines for its staff to follow in determining whether wells that lose a significant amount of pressure during a test pass or fail that test. The Environmental Protection Agency has cited the Commission for deficiencies in this area in the past.

Regarding the issue of discontinuing injection well testing, the auditors noted that State officials disagree over the existence and depth of any groundwater in southeastern Kansas, and current information on the State's groundwater resources is not adequate to make those determinations without conducting individual checks at each well site. Federal officials say that without proof to the contrary, all injection wells constitute a pollution hazard to groundwater. Further, they say that the industry's economic problems are not sufficient cause to suspend well testing. Finally, they indicated that the imposition of a moratorium could result in Kansas losing its enforcement authority for the program.

These and other findings are discussed in more detail in the sections that follow. For reporting purposes, questions two and three have been combined. Recommendations for improvements are contained under specific topics addressed by the audit.

### **What Are the State's Responsibilities For Enforcing the Proper Operation and Testing Of Injection Wells?**

To determine Kansas' responsibilities for operating and testing injection wells, the auditors reviewed federal and State laws and regulations and spoke with officials from the Environmental Protection Agency, the State Corporation Commission, and the Kansas Department of Health and Environment. They also reviewed a sample of injection well files and a draft of the Environmental Protection Agency's mid-year evaluation of the Kansas program to determine whether the State appeared to be meeting its responsibilities.

The auditors found that in 1984 the Environmental Protection Agency granted Kansas the authority to enforce the federally mandated program controlling injection wells. The Corporation Commission is currently responsible for enforcing that program. Federal laws and regulations require the State to ensure that injection wells are properly approved, monitored, and tested. The auditors' review showed that the Commission is generally meeting minimum federal requirements for approving new well applications, and that it is making progress toward testing all existing wells. For monitoring purposes, the Commission's Conservation Division is requiring all operators to record and annually submit data on injection wells. However, no one at the Division currently reviews those reports, which weakens the Commission's monitoring efforts. These findings are discussed in the sections that follow.

### **Since 1984, Kansas Has Had Primary Authority For Enforcing the Federally Mandated Underground Injection Control Program**

The Safe Drinking Water Act of 1974 requires, among other things, that the injection of fluids into the ground to enhance the recovery of oil and to dispose of oil field wastes be done in a manner that protects underground sources of drinking water. The Act makes the Environmental Protection Agency responsible for enforcing these requirements. The Environmental Protection Agency may allow individual states to enforce their own regulatory programs, provided those programs meet the minimum requirements of federal law and regulations. In February 1984, the Environmental Protection Agency approved Kansas' proposed Underground Injection Control program. This approval gave the State primary enforcement authority for the federally mandated program.

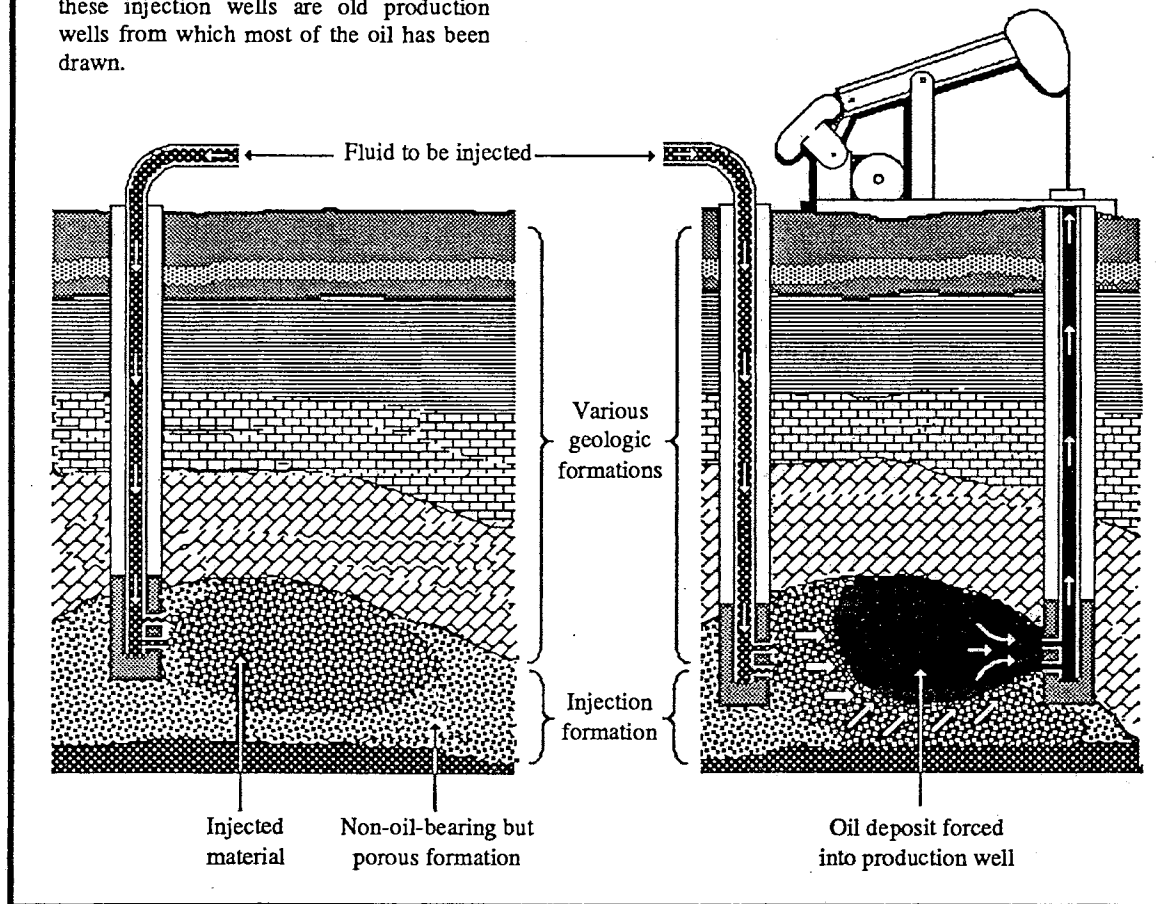
The federal law governs five classes of injection wells, including those for radioactive or hazardous waste and those associated with mining operations. This audit is concerned only with class II injection wells--disposal and enhanced recovery wells related to oil and gas production.



## What Injection Wells Do

**Disposal Wells** inject waste salt-water from oil production back into the ground. The water is pumped under pressure, or simply drained, into a porous rock formation that can absorb it. Frequently, these injection wells are old production wells from which most of the oil has been drawn.

**Enhanced recovery wells** are used to increase the pressure on oil deposits, assisting in recovery. Fluids are injected into the formation, helping to force the oil up through the production well.



The Corporation Commission is currently responsible for administering the program in Kansas. When the Environmental Protection Agency approved the State program, the Corporation Commission and the Department of Health and Environment jointly regulated the State Underground Injection Control program. In 1986, the Legislature passed House Bill 3078 giving the Commission sole responsibility for administering this program as it relates to oil and gas wells. This law became effective July 1, 1986. The Commission estimates that there are about 10,000 injection wells in Kansas. There were about 850 applications for new wells in 1985. Tests on just over 1800 wells were completed during that year.

### Federal Laws and Regulations Require the State To Ensure That Injection Wells Are Approved, Monitored, and Tested

Under federal requirements, the Commission must approve all new injection wells to ensure that they will not pollute current or potential underground sources of drinking water.

The Commission must also oversee well monitoring by operators to ensure that fluids are not injected under such pressure that they fracture geological formations, leak into underground water resources, and pollute drinkable water. Finally, the Commission must ensure that existing injection wells are tested at least once every five years to determine whether they are leaking fluids that can pollute drinking water sources. The box below summarizes the major federal requirements for approving, monitoring, and testing wells.

**Approval Requirements:**

The Commission must

- require injection well operators to obtain a permit
- ensure that applications have identifying information about the applicant and the proposed injection facility. This must include a map showing the proposed injection well, all existing injection wells, water wells, springs, and bodies of surface water listed in public records or otherwise known to the applicant within a quarter mile of the facility's property boundary
- only approve wells which inject into geological formations with no known open fractures and which are separated from underground sources of drinking water
- set maximum injection pressures low enough that injected fluids do not cause new fractures or widen existing fractures in geological formations adjacent to underground sources of drinking water

**Monitoring Requirements:**

The Commission must

- require operators to monitor and record their actual injection pressures, rates of injection, total volume of fluids injected, and the nature of what they are injecting
- receive annual reports from operators of their monthly injection pressures, rates of injection, total volume of fluids injected, and the nature of their injected fluids

**Testing Requirements:**

The Commission must

- ensure that new wells are tested to identify significant leaks when issuing a permit
- ensure that existing wells are tested at least once every five years

**The Corporation Commission Appears To Be Fulfilling Approval and Testing Requirements, But Its Monitoring Efforts Could Be Improved**

In 1985, the Commission staff tested about 1,800 injection wells. The auditors reviewed documents for a sample of 97 injection wells to determine whether the Commission was adequately enforcing approval, monitoring, and testing requirements. They also reviewed a draft report of an Environmental Protection Agency evaluation of the program. These reviews showed that the Commission was generally meeting the requirements for approving new well applications. It was also making progress toward ensuring that all existing injection wells are tested by 1989, as required. On the other hand, the Commission's monitoring of injection wells appears to have several weaknesses. These findings are discussed in the sections that follow.

The Commission appears to be properly approving applications for new injection wells. Operators send applications for new injection wells to the Commission's Conservation Division office in Wichita for initial approval. The Division reviews each application for proper construction to protect oil and gas resources and useable water from waste and pollution. The Conservation Division also sets a maximum injection pressure. The operator must then test the new well for leaks. If the well passes the test and meets the construction requirements, the Commission grants the operator a

permit. Each of the 97 injection well files reviewed by the auditors contained a properly approved injection well application and all the necessary evidence of testing and other supporting documentation.

The Environmental Protection Agency reported that the number of injection well tests in Kansas was running slightly behind the number agreed upon, but was increasing. The Commission is required to ensure that all injection wells are tested at the time of their original permit application and at least once every five years thereafter. When the State was granted primary enforcement authority for its Underground Injection Control program in 1984, it agreed to require all operators of existing wells to test their wells by 1989. Commission officials estimate there are about 10,000 injection wells in Kansas.

In May and June 1986, officials from the Environmental Protection Agency visited Kansas to evaluate the effectiveness of the State's Underground Injection Control program and to assess its compliance with federal requirements. One area reviewed by the officials was the number of injection well tests completed. In a draft report reviewed by the auditors, the Agency stated that the number of well tests completed to date was fewer than the number the State and the Agency had agreed to, but that the number of tests was increasing. The actual figures shown in the report state that 1,095 tests were conducted during the first two quarters of fiscal year 1986. This figure is 30 fewer tests than the targeted number, which was 1,125.

The Agency report also noted that the Commission's percentage of well tests witnessed was substantially higher than required. The Environmental Protection Agency suggests, but federal regulations do not require, that states witness a minimum number of well tests. Kansas regulations require 25 percent of all well tests to be witnessed. Commission officials said their policy is to witness as many tests as possible. The auditors' sample showed that the Commission staff witnessed about 90 percent of all injection well tests.

The Commission could improve its enforcement of operator monitoring requirements. When the Commission issues a permit for a new injection well, it sets a maximum injection pressure and rate of injection so that injected fluids do not cause new fractures or widen existing fractures in geological formations and cause pollution of underground sources of drinking water. Federal and State regulations require operators to record their actual injection pressures, rates of injection, total volume of fluids injected, and the nature of their injection fluids on a monthly basis. Operators must report these monthly readings annually to the Commission. The Commission can compare the self-reported readings with well permits to help determine whether operators are exceeding maximum levels for pressure and volume of fluid injected.

The auditors' review of a sample of wells showed that not all operators are submitting the required reports. For this review, the auditors used 1984 reports

**A Review of Complaint and Violation Files Indicated Few Testing-Related Problems**

The auditors reviewed a sample of Department of Health and Environment compliance files to determine the number of injection well-related complaints or violations. A significant number of such complaints or violations would indicate that faulty injection wells could be a major problem in the State. Of a sample of 48 compliance entries, 47 either were routine well test notifications to operators, or were not related to a pollution problem. Only one entry related to an injection well that had failed a pressure test. In that case, the well failed the test in February 1986, was repaired, and passed the following April. The file contained no evidence that pollution had in fact occurred.

because Conservation Division staff had not yet filed the reports for 1985. Of 25 wells sampled, 19 were operating in 1984. Reports were on file for only 15 of those wells, or 79 percent of the sampled wells. During their review, the auditors also found no indication that anyone from the Commission's staff had reviewed or approved the reports. From discussions with Conservation Division officials, the auditors learned that no employee is currently assigned the task of reviewing the operators' annual reports to ensure that pressures are not exceeded.

The auditors examined the information reported by injection well operators in their sample to determine whether any operators had exceeded the maximum injection pressure or volume limits imposed on their wells. None had. Although the sample did not indicate a problem in this area, the lack of a review weakens the Commission's monitoring efforts over injection wells. Reviewing the injection data submitted by well operators is particularly important because there is no practical way for the Commission staff to gather the information directly.

### **Recommendations**

To ensure that injection wells operators are not injecting fluids under pressures or in volumes that will create a drinking water pollution hazard, the Corporation Commission should do the following:

1. Ensure that all injection well operators file annual reports as required by K.A.R. 82-3-407 and federal regulations.
2. Review or spot check the reports submitted to ensure that operators have not exceeded maximum allowable pressures and volumes.

### **Are the Applicable Requirements For Pressure Testing Injection Wells Being Consistently Enforced, And Can the State's Enforcement Efforts Be Improved?**

To answer this question, the auditors reviewed federal and State well-testing requirements. They interviewed staff of the Corporation Commission and representatives of the the oil and gas industry, and examined a sample of injection well tests. They also attended public hearings on well-testing regulations held by the Commission. Finally, they reviewed the draft copy of the most recent mid-year review of Kansas' Underground Injection Control program conducted by the Environmental Protection Agency.

In general, the auditors found that the Commission has developed procedures stating how injection well tests should be performed. However, some tests the auditors reviewed did not appear to comply with those testing guidelines. The auditors also found that the guidelines did not clearly address initial pressures to be applied in testing an injection well and did not account for large drops in pressure during a test. This lack of clarity appears to have resulted in inconsistent pressures being applied to wells. Some wells were pressured to two or three times the required minimum pressure, while others were not. Lack of clarity in the guidelines may also have resulted in well tests in which large pressure drops occurred being counted as satisfactory tests. One well in the auditors' sample lost 62 percent of its original pressure and still passed the test. The Environmental Protection Agency has indicated that Kansas has been too lenient in the past in the amount of pressure loss it allows during injection well tests. Some other states have adopted testing guidelines that seem more clear. Finally, the auditors found that over the short run, little can be done

to suspend testing of wells in Kansas without losing authority over the program. Over the longer run, it appears that State water maps will need to be updated if a case is to be made for exempting certain injection wells from the federally mandated testing requirements. These and other findings are discussed in more detail in the sections that follow.

### **The Commission Has Written Guidelines Describing How Each Type Of Injection Well Test Should Be Performed**

The Corporation Commission has approved guidelines for several different types of tests that show if an injection well is leaking and may be polluting groundwater. The tests include a casing pressure test, injection well monitoring, dual completion monitoring, a fluid depression test, a radioactive tracer survey, and a differential temperature survey. The standard injection well test used in Kansas is the casing pressure test. The Commission's guidelines state that, before any of the other tests can be used, the well operator must obtain agreement from both the appropriate Corporation Commission district office and the Underground Injection Control section of the Conservation Division in Wichita. As a practical matter, the alternative tests are rarely used in Kansas.

**The casing pressure test is the primary test used in Kansas.** The casing pressure test involves applying pressure to the well with a pump and monitoring that pressure for a specified period of time to determine whether the pressure remains constant. Constant pressure indicates no leaks in the casing or tubing (depending on the specific type of well construction). Loss of pressure indicates that the well is leaking. The figure on the next page illustrates how a pressure test works.

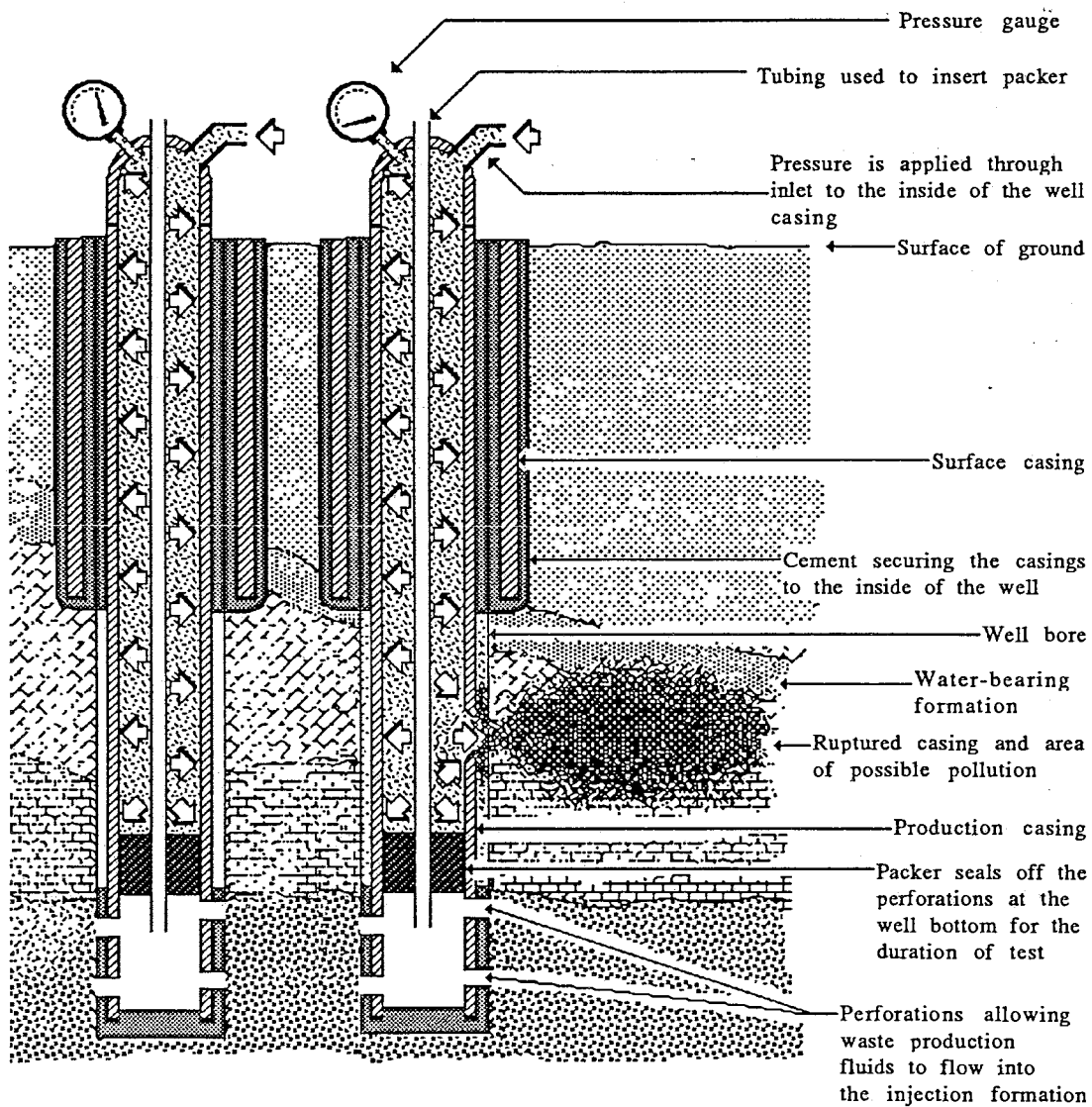
The Corporation Commission notifies well operators when a test must be conducted. The operators are responsible for hiring someone to conduct the tests on their wells. The Commission's district office staff evaluates pressure loss or fluid leakage during an injection well test to determine if it is significant enough to cause the well to fail the test. If a well fails the test, the operator generally must close it down until it can be repaired to pass a subsequent test.

### **Some Injection Well Tests Did Not Conform to The Commission's Minimum Testing Guidelines**

The auditors reviewed a sample of 25 injection well tests to determine whether they met the testing guidelines and whether the wells were tested consistently. They found that two of the 25 wells sampled were tested at pressures below the minimums required by the Commission's testing guidelines. If the minimum required pressure is not applied when a well is tested, there is a danger that the test will not expose leaks that might occur when full pressure is applied during injection operations.

In one case, a well was tested at 250 pounds of pressure when it should have been tested at 600 pounds of pressure. In this particular case, the original permit for the well had been amended in 1964 to allow it to operate under 600 pounds of pressure, instead of its original permitted pressure of 250 pounds. It appears that the test was conducted in February 1986 under the original permitted pressure even though the pressure had been amended. The second well should have been tested at its authorized injection pressure of 500 pounds, but was tested at only 490 pounds. By the end of the test, this well held 450 pounds of pressure.

## What A Casing Pressure Test Does



The most common kind of injection well test is the casing pressure test. In a typical pressure test, the well is sealed, just above the level where the injected fluids enter the rock, with a device called a "packer." The space above the packer is then filled with fluid or gas under pressure. If the well holds pressure, the well is considered to be sound.

If, during the pressure test, the well does not hold most or all of the pressure, it may have a leak. If the production casing is cracked, broken, or corroded, waste salt water can leak out into the surrounding formations, possibly polluting groundwater supplies.

**Commission Guidelines Are Not Specific Regarding Pressures Used to Test and Evaluate Wells**

Although there are variations based on how a well is constructed and whether the well is old or new, Commission guidelines generally require injection wells to be tested at 100 pounds of pressure per square inch, or the well's maximum allowable operating pressure, whichever is greater. The well must then hold that minimum required amount of pressure to successfully pass the test.

During their review to determine whether tested wells met these guidelines, the auditors noted two areas of concern and confusion. First, the guidelines do not specify the initial pressure that should be applied to a well at the beginning of the test. Second, the guidelines do not address significant pressure drops during a test. Because the guidelines do not address these two areas, some wells are tested at pressures much higher than necessary. Also, some wells that are tested at high pressures still are allowed to pass the pressure test even though they lose a significant amount of that initial pressure. The Environmental Protection Agency has criticized the State's program for being too lenient in this area. It has stated that a maximum allowable pressure loss policy should be set at about 10 percent.

Commission guidelines do not specify the initial amount of pressure that should be applied to a well. The guidelines state the minimum pressure at which each type of injection well is required to be tested. They also state that an unspecified amount of additional pressure over the minimum is generally needed at the start of a test to allow for normal "bleed off" (loss of pressure) during the first few minutes of a test. Although guidelines do not specify starting pressures for tests, Conservation Division officials indicated that, during field staff training sessions, staff were advised to use 150 pounds to 200 pounds as a desirable starting pressure for a minimum 100-pound well test.

In their sample of 25 injection well tests, the auditors found that some wells were tested at the minimum required pressure. Others were tested at pressures higher than the minimum, and also higher than the 150 to 200 pound starting pressures that field staff were told was desirable. The following table demonstrates some of the inconsistencies in the initial pressures applied to wells during pressure tests. The wells shown below were not the only wells in the auditors' sample for which test pressures appeared inconsistent. However, the ones shown below were all wells of the same type of construction and therefore it would appear that the test pressures applied should have been more consistent.

**Injection Well Test Pressures (a)**

<u>Sampled Well</u>	<u>Maximum Pressure Under Which Fluids Are Permitted To Be Injected into the Well</u>	<u>Pressure Needed To Pass The Test Per Commission's Guidelines</u>	<u>Actual Beginning Test Pressure</u>	<u>Deviation From Minimum Pressure Needed To Pass The Test Per Guidelines</u>
1	0	100	1,200	+1,100
2	0	100	315	+215
3	0	100	160	+60
4	0	100	100	-0-

(a) All pressures are given in pounds per square inch

As the table shows, the initial pressures applied during the tests ranged from the required minimum of 100 pounds to 1,200 pounds, or 12 times the required minimum.

The lack of specific written guidelines has apparently created a great deal of inconsistency in the pressures applied to wells at the beginning of a test. Conservation Division officials indicated that one field office in the western part of the State has adopted 300 pounds as the minimum starting pressure. Officials also indicated that well operators have traditionally used 300 to 500 pounds of pressure to test their wells, even though the Commission does not require them to do so. Oil industry officials told the auditors that the greater the pressure applied to a well, the greater the likelihood that the well casing will be ruptured. Therefore, to clear up the inconsistency in the pressures applied to wells during a well test, and to avert possible damage to wells through the application of unnecessary pressure, it appears that the Commission should establish standard beginning test pressures in its written well testing guidelines. Any tests conducted at pressures higher than established standards would be at the discretion of the well operator. The reasons for any deviations from the standards should be documented by district office staff who witness the tests.

**Commission guidelines also do not address significant pressure drops during a test.** A large drop in pressure during a pressure test means that there is a leak somewhere in the system. The leak may occur in the pressure lines or the pump used to test the well or it may occur in the well itself. In either event, logic would dictate that a test in which a significant amount of pressure is lost should not be a satisfactory test. The Commission's written testing guidelines do not state a percentage of the original pressure applied to the well that must be retained. Thus, a well that loses 50 percent of its initial pressure and a well that loses only five percent of its initial pressure could both pass the test, provided they have both maintained at least the required minimum pressure by the end of the test.

The auditors reviewed the 25 wells in their sample to determine the amount of pressure lost by each well during the pressure test. They could not determine how much pressure was lost during the course of the pressure test for nine injection wells because district office staff did not record the beginning pressures on the test forms. Most of the remaining 16 well tests showed that the well held at constant pressure during the entire test, indicating the well had no leaks. A few wells, however, lost considerable amounts of pressure, raising questions as to whether those wells should have passed the test. In fact, two of these wells did not even maintain the minimum required pressure, but still passed the test. These wells are shown in the following table.

**Wells That Lost Pressure During Tests**

<u>Well</u>	<u>Pressure Needed To Pass The Test Per Commission Guidelines</u>	<u>Beginning Test Pressure</u>	<u>Ending Pressure</u>	<u>Percent Drop</u>
a	100 psi	120 psi	105 psi	12.5%
b	600 psi	950 psi	775 psi	18.4
c	500 psi	490 psi	450 psi	8.2
d	500 psi	250 psi	95 psi	62.0

As the table shows, during testing, the four wells lost from 15 to 175 pounds of pressure, or eight percent to 62 percent of their initial pressures. All four of these wells passed the tests. It appears that the last two wells shown on the chart should not have passed the test regardless of the percent of their original pressure they lost, because their ending test pressures were lower than the minimum test pressure the Commission's guidelines specify for passing the test.



The Environmental Protection Agency's review of Kansas' program addressed this same subject. In a draft of the Agency's mid-year evaluation of the Kansas Underground Injection Control Program, the Agency criticized the Corporation Commission for allowing as much as a 50 percent loss of pressure on an injection well pressure test to count as a passing test. The Agency stated that a maximum allowable pressure-loss policy should be set at about 10 percent.

Some other states have established pass/fail guidelines that specify an unacceptable drop in pressure. The auditors contacted officials in Arkansas, Louisiana, Oklahoma, Pennsylvania, and Texas to learn about their procedures for injection well testing. They found that two of those states have established written criteria specifying the maximum pressure drop acceptable for passing a pressure test. In Arkansas, wells with a depth of 3,000 feet or less are pressured to at least 300 pounds and must maintain that limit for 30 minutes with no more than a 10 percent loss of pressure. For each additional 1,000 feet of depth, the minimum pressure applied to the well increases 50 pounds, with the same 10 percent tolerance level for pressure lost. In Pennsylvania, where the federal Environmental Protection Agency administers the program, the wells are pressured to 10 percent above normal operating pressure, and must maintain that level of pressure for 30 minutes with less than a five percent loss of pressure.

Officials from Oklahoma and Louisiana also indicated they have maximum allowable pressure drops, although their guidelines are not written. In Oklahoma, the maximum allowable pressure loss is 10 percent. Louisiana guidelines allow no more than a five pound pressure drop.

Conservation Division officials indicate that variables unrelated to a well's soundness can affect test results, making it difficult to develop specific pass/fail guidelines. Officials state that applying standard loss-of-pressure criteria for evaluating a casing pressure test is difficult because leaks can occur that will cause the pressure to drop even though the well is sound. These leaks may occur at the wellhead where the pressure pump is connected to the well. If the well casing is badly corroded, the packer (plug placed in the well to allow the well to be pressurized) may not completely seal. Also, there can be a certain amount of leakage in the threads of the joints of the well casing. Officials indicated that district office staff need to give consideration to all of these factors when deciding if the results of a pressure test are satisfactory.

If such leaks are occurring, it appears that it would be extremely difficult to determine how much of the pressure loss may be due to bad seals on the testing equipment and how much is attributable to the well itself. Such results would render the test inconclusive at best. Hence, it appears that the Commission could eliminate some subjective interpretation of well results, and avoid future criticism by the Environmental Protection Agency by doing as some other states have done, and adopt standards for acceptable amounts of pressure loss in their written guidelines for pressure tests.

### Conclusion

Although the Corporation Commission has adopted guidelines for minimum pressures to be used in conducting injection well pressure tests, its guidelines do not specify the initial pressures at which different types of wells can or should be tested. The guidelines also do not specify an acceptable percentage drop in pressure for passing a test. Many of the well tests the

auditors reviewed were conducted at pressures significantly higher than the minimums specified in the guidelines. By adopting guidelines stating how much pressure in excess of the minimum should be applied to a well when starting a pressure test, and requiring district office staff to document reasons for the significantly higher pressures used during tests, the Commission could eliminate some potential for inconsistent treatment of well operators. The auditors' review also showed that most wells tested maintained constant pressure during the pressure test, but some wells showed a sizable drop in pressure and still received a passing rating. For many wells in the auditors' sample the amount of pressure loss could not be determined because district office staff did not record the starting pressure for the test. The Environmental Protection Agency has recently questioned the Commission's actions in passing wells that experience large drops in pressure. By adopting written guidelines that specify what amount of pressure or fluid loss is acceptable for passing a pressure test, the Commission could remove some subjectivity in evaluating tests and avoid criticism from the Environmental Protection Agency, while ensuring that all operators are treated consistently.

### **Recommendations**

To help ensure that requirements for pressure testing injection wells are enforced as consistently as possible, the Corporation Commission should take the following steps:

1. Expand guidelines for conducting a casing pressure test to specify a method for determining how much pressure should be applied to a well at the beginning of a test. If more pressure needs to be applied to a particular well, the Commission should require district office staff to document the reasons why the higher pressure was used.
2. Adopt written criteria defining what constitutes an acceptable level of pressure or fluid loss for passing a casing pressure test.
3. Direct district office staff to supply all the requested information of the forms filled out for an injection well test.

### **Injection Well Testing Requirements Have Created Controversy in Eastern Kansas**

During the audit, the auditors heard oil and gas industry concerns that current testing procedures made production on many eastern Kansas wells uneconomical given the depressed state of oil prices. Industry representatives cited cost figures ranging from \$400 to \$18,000 to test individual wells. The operators also contend that mechanical integrity testing may be unnecessary in certain areas of eastern Kansas because there is no groundwater to protect. Western Kansas is mostly underlaid with a large underground aquifer, while most water in eastern Kansas is either on the surface or in scattered groundwater deposits.

To assess these concerns, the auditors interviewed officials of the Corporation Commission, the Department of Health and Environment, the Kansas Geological Survey,

the Kansas Water Office, the Environmental Protection Agency, and representatives of the Eastern Kansas Oil and Gas Association. In meetings with these officials, the auditors attempted to determine the validity of these concerns and any options the State might have in this area that would still fulfill federal testing requirements. The auditors found that testing costs cited by oil industry representatives include the cost of repairing wells so they can pass the test. Some Commission staff agree with oil industry representatives' view about the absence of groundwater in eastern Kansas that might be polluted, but State water officials generally do not. Although the 1986 Legislature passed a concurrent resolution calling for a one-year moratorium on well testing, the Commission has taken no final action, and the Environmental Protection Agency is likely to block any State attempt to stop injection well testing. These findings are discussed in the sections that follow.

Testing costs cited by oil industry representatives apparently include the cost of repairing wells so they can pass the test. Representatives from the oil and gas industry gave the auditors cost figures for testing individual wells that range from \$400 to about \$18,000. These industry figures include not only the cost of the tests but also the costs associated with cleaning corrosion and deposits out of the wells so that they can be tested, and for repairing the wells so that they will pass the test. Information supplied by the Corporation Commission shows that charges for testing an injection well range from about \$50 to \$500 in southeast Kansas, and \$100 to \$1,000 elsewhere in the State. Hence, some of the higher costs reported by the industry would appear to be for well repair and cleaning.

Some Commission staff agree with oil industry representatives that there is no deep groundwater in much of eastern Kansas, and therefore, testing wells results in a waste of resources. Because of the geological differences between eastern and western Kansas, well operators and Conservation Division officials told the auditors they thought the procedures and regulations that were appropriate for western Kansas were not right for eastern Kansas. These officials said that proper casing and cementing of the well when it is constructed is generally sufficient to protect the groundwater that exists in eastern Kansas. Most groundwater deposits in eastern Kansas are at depths of less than 50 feet. The Commission requires that all wells in eastern Kansas have at least 50 feet of surface pipe cemented in place, and that the smaller production pipe within the surface casing also be cemented in place. Thus, industry and Commission officials say, groundwater formations penetrated by the well are protected by two layers of pipe and two layers of cement (see the illustration on page eight).

State water officials disagree with the view that some southeast Kansas wells should not be required to be tested. Officials of the Kansas Geological Survey and the Kansas Water Office indicated that some unprotected groundwater may occur below the 50-foot zone protected by a well's surface casing, sometimes to a depth of 300 feet. These officials also told the auditors that it is difficult to know precisely which areas could safely be exempted from well testing, and that some shallower groundwater in the southeast part of Kansas may already be polluted. These officials also said that the State water maps have not been systematically updated for many years, and therefore did not represent the latest data available on the location of underground water. These officials concluded that it may be difficult or impossible to adequately protect underground water sources without testing wells.

The 1986 Legislature requested that the Commission consider a one-year moratorium on enforcement of injection well testing requirements. In April 1986, the oil and gas industry asked the Legislature to suspend all but emergency testing of wells in the hope that oil prices would rise in the meantime and provide enough cash flow to make continued testing affordable. House Concurrent Resolution 5051 calls

for the Commission and the Department of Health and Environment to hold public hearings on the issue and to consider suspending well testing. To date, the Commission has held public hearings, but no decision has been made on the moratorium. Commission staff indicated that until a formal Commission decision is made, they will maintain the current well-testing schedule and requirements.

Environmental Protection Agency officials have said that no part of the State can be exempted from federal well-testing requirements, and that those requirements would be enforced even if the State enacts a moratorium. The well-testing requirements enforced by the Commission are actually imposed by the Environmental Protection Agency. Federal regulations require that any well drilled above or through any potential or current source of useable drinking water must be tested to ensure that the well fluids do not pollute the water. Under the regulations, neither the expense of the tests, the condition of the well, nor the extent or depth of the groundwater deposits justifies a failure to test the soundness of the well. The auditors learned of one reported well-testing exemption granted to an area in Louisiana. The groundwater in that part of Louisiana was determined to be too salty to drink, and therefore was not "useable" water under the federal definition.

The auditors contacted officials of Region VII of the Environmental Protection Agency to determine whether any options existed for exempting portions of Kansas where there may be little danger of pollution. These officials responded that, given the available information, there was no justification for failure to test all injection wells in Kansas. Federal officials did note that the State has the power to delay testing southeast Kansas wells until nearer the end of the five-year deadline, possibly until 1989. But Corporation Commission officials indicated that southeast Kansas already had the highest proportion of untested wells, and that delaying testing further would present unsurmountable scheduling problems. Federal officials agreed that the idea may not be workable, but said that no other option existed under current federal requirements.

Environmental Protection Agency officials also told the auditors that if Kansas imposes a moratorium on injection well testing, the Agency would likely take over the State's program and immediately reimpose testing requirements. Agency officials said that no State or industry representative has attempted to show that there is no possibility of contaminating any useable groundwater in any part of eastern Kansas.

### Conclusion

State officials disagree over the existence and depth of any groundwater in southeastern Kansas, and current information on the State's groundwater resources is not adequate to make those determinations without testing individual wells. Federal officials say that without proof to the contrary, all injection wells constitute a pollution hazard to groundwater. Further, they say that the industry's economic problems are not sufficient cause to suspend well testing.

Over the longer term, if the Corporation Commission or the Legislature think it is desirable to further explore the possibility of exempting some eastern Kansas wells from testing requirements, the State's groundwater resource information will have to be updated to provide specific information about the existence and depth of groundwater throughout the eastern part of the State.

## APPENDIX A

Copies of the draft audit report were sent to the Kansas Corporation Commission and the Department of Health and Environment on August 29, 1986. Both agencies submitted responses to the draft report, and those responses are included in this Appendix.



State of Kansas . . . John Carlin, Governor

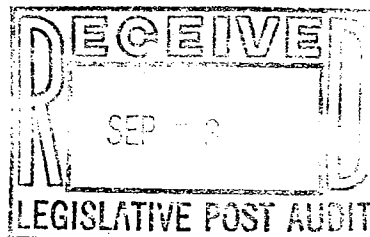
# DEPARTMENT OF HEALTH AND ENVIRONMENT

Barbara J. Sabol, Secretary

Forbes Field  
Topeka, Kansas 66620  
913-862-9360



September 2, 1986



Mr. Meredith Williams  
Legislative Post Auditor  
Legislative Division of Post Audit  
109 West Ninth Street, Suite 301  
Mills Building  
Topeka, Kansas 66612

Dear Mr. Williams:

Thank you for the opportunity to comment on the legislative post audit report, Regulation of Oil and Gas Operations in Kansas. Part II: Enforcement of Injection Well Procedures.

The implementation of the recommendations as set forth in the report will aid in the effective administration of the state's water protection program.

Sincerely,

*Barbara J. Sabol*  
Barbara J. Sabol  
Secretary

cah



JOHN CARLIN  
MICHAEL LENNEN  
MARGALEE WRIGHT  
KEITH R. HENLEY  
JUDITH A. McCONNELL  
BRIAN J. MOLINE

Governor  
Chairman  
Commissioner  
Commissioner  
Executive Secretary  
General Counsel

State Corporation Commission

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September 10, 1986

Mr. Meredith Williams  
Legislative Post Auditor  
Legislative Division of Post Audit  
301 Mills Building  
Topeka, Kansas 66612

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DIVISION OF POST AUDIT

Dear Mr. Williams:

The State Corporation Commission offers the following information and comments in response to the audit report submitted by the Legislative Post Audit concerning the recent audit of the Oil and Gas Conservation Division. This response shall follow the sequence of the audit report and concentrate on the recommendations presented in the report.

APPROVAL, TESTING, and MONITORING of INJECTION WELLS

Finding - The Environmental Protection Agency reported that the number of injection well tests in Kansas was running slightly behind the number agreed upon, but was increasing.

Response - Kansas is committed to requiring all operators of existing injection wells (permitted prior to February 4, 1984) to have a test conducted and passed by February 4, 1989. The mechanical integrity testing of injection wells is being carried out as a priority program and will continue to receive primary emphasis. The witnessing of as many tests as possible by field staff generates a good field presence and additionally allows understanding of some of the factors which can affect the validity of a particular type of test. The report suggests the state is not required under EPA regulations to witness more than 25% of all tests. While not contained in regulations, EPA has required the witnessing of mechanical integrity tests (MIT's) in the form of policy guidance published in the Federal Register, and this policy has been enforced since the inception of the program in 1984.

Finding - The Commission could improve its enforcement of operator monitoring requirements.

Response - The necessary steps will be taken to provide sufficient personnel to review and approve reports required of operators and to ensure timely filing of annual reports by injection well operators.

Recommendations #1 - Page 6 - Ensure that all injection well operators file annual reports as required by K.A.R. 82-3-407 and federal regulations, and personnel comments are being initiated.

Response - Review procedures will be improved by the Conservation Division to achieve compliance with K.A.R. 82-3-407.

Recommendation #2 - Review or spot check the reports submitted to ensure that operators have not exceeded maximum allowable pressures and volumes.

Response - Review procedures and personnel commitments within the Conservation Division will be initiated to achieve an enhanced level of review and enforcement procedures will be developed for those operators not in compliance with requirements. The monitoring of maximum injection pressures has been a long standing activity at the district office level on a majority of non-compliance events and have been resolved at the field level as a routine program activity.

Finding - Commission guidelines do not specify the initial amount of pressure that should be applied to a well.

Response - The Industry Underground Injection Control Committee has just completed a draft revision of K.A.R. 82-3-405 (Mechanical Integrity Testing Requirements) which will provide a clearer direction and a higher degree of standardization of minimum testing procedures and the initial amount of pressure to be used by operators in conducting MIT tests under certain geologic conditions and with certain types of well construction. Some operators of injection wells prefer to test their wells at a higher than required pressure and this should be allowed. The Oil and Gas Advisory Committee has reviewed and generally concurs with the revisions to K.A.R. 82-3-405. Such standardization does not preclude those specific instances where higher testing pressures may be required due to unusual ground water protection requirements.



Finding - Commission guidelines also do not address significant pressure drops during a test.

Response - The Conservation Division has assigned staff to develop a new, stricter set of written guidelines to address pressure loss during a MIT. While there is no universal acceptance of any particular figure, the Commission concurs that 50% pressure loss may be more lenient than is the case in most other oil producing states where the state has primacy.

Recommendation #1 Page 12 - The Commission should expand guidelines for conducting a casing pressure test to specify a method for determining how much pressure should be applied to a well at the beginning of a test. If more pressure needs to be applied to a particular well, the Commission should require district office staff to document the reasons why the higher pressure was used.

Response - The guidance for conducting a casing pressure test will be outlined by amended regulation K.A.R. 82-3-405 as described previously in this report. The documentation of exceptions where more stringent pressure testing was required by the district office will be covered in future staff training sessions. Additionally, the form letter notifying operators of the need for an MIT now includes test pressure requirements.

Recommendations #2 Page 12 - The Commission should adopt written criteria defining what constitutes an acceptable level of pressure on fluid loss for passing a casing pressure test.

Response - The Conservation Division's staff is currently developing written criteria defining an acceptable level of pressure on fluid loss as described above.

Recommendation #3 Page 12 - The Commission should direct district office staff to supply all the requested information of the forms filled out for an injection well test.

Response - The necessary education and review procedure will be initiated within the Conservation Division.

#### TESTING IN EASTERN KANSAS

Finding - State officials disagree over the existence and depth of any ground water in Southeastern Kansas and current information on the State's ground water resources is not adequate to make those determinations without

testing individual wells. Federal officials say that without proof to the contrary, all injection wells constitute a pollution hazard to ground water. Further, they say that the industry's economic problems are not sufficient cause to suspend well testing.

Over the longer term, if the Corporation Commission or the Legislature think it is desirable to further explore the possibility of exempting some Eastern Kansas wells from testing requirements, the State's ground water resource information will have to be updated to provide specific information about the existence and depth of ground water throughout the eastern part of the State.

Response - The Commission will be working through members of the Oil and Gas Advisory Committee and specifically the Kansas Geological Survey to better define the occurrence and absence of ground water in Eastern Kansas and delineate quality variations. Current studies being conducted on the Douglas Group and Kansas City - Lansing sections will be expanded to other aquifers in Southeastern Kansas. These are necessarily long term efforts and not conclusive to short term judgments sought by HCR 5051. A meeting between Conservation Division staff and the Kansas Geological Survey is being held this month to determine where information is needed. Kansas has been committed to the protection of ground water from brine injection practices since the 1930's and has operated under a set of geologic standards since the early 1960's. On page 7 of the audit report, a statement is made that approval of alternative tests is difficult to obtain and are, therefore rarely used in Kansas. Alternative tests are approved routinely by the District Offices through guidelines established by the Commission and are conducted by the operator on that authority. Some of the alternative tests are less expensive than the standard pressure MIT which is the basic concern of Eastern Kansas operators.

Thank you for the opportunity to respond to this audit.

Sincerely,

  
Michael Lennen, Chm.

cc: Commissioner Margalee Wright  
Commissioner Keith Henley  
Jack McCord  
Bill Bryson