

Salt Water Disposal Problems From the Operator's Viewpoint

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INTRODUCTION

The operator's viewpoint toward salt water disposal problems is basically the same as any good citizen's viewpoint toward any problem: he wants to solve the problem at a minimum cost and without infringing upon the rights of others. The principal outside interests which he must protect against harmful salt water contamination are the fresh water and land resources of the area. In these days of ever increasing fresh water demands, both surface and underground water supplies must be preserved. Lands capable of supporting vegetation also require protection from salt contamination. Both types of protection must be accomplished within the economic boundaries established by the value of the hydrocarbons jointly produced with the salt water and the value of the resources to be protected.

The petroleum industry has been conserving natural resources for 60 yr. and has been a leader in conservation practices for 30 yr. In large areas of this State, there was little of value to conserve but oil and gas at the time operators moved into such areas. Values have changed with time, and now in nearly all portions of the State both water and land resources have increased in worth sufficiently to justify additional expense to insure their protection.

The industry has been aware of these changes and has made responsible and timely improvements in protection procedures. Unlike the widespread publicity given localized contamination problems, too little acknowledgement of such progress has been publicized within or without the industry. For example, by 1961, the industry was injecting 68% of the 6,600,000 bbl. of salt water produced daily and another 10% was being disposed of into saline surface waters.¹ During 1962 and the first 7 months of 1963, the Texas Railroad Commission granted approval to applications requesting authority to inject an additional 1,100,000 BPD.²

Another industry contribution has been to provide financial and technical support for fresh water developments such as Lake J. B. Thomas. Contracts for the sale of water for water-flood purposes made the project a financially feasible undertaking. Recently, an additional contract for the sale of water to Sun Oil Co. financed a 2 million dollar pipeline essentially connecting Lake Thomas with the proposed Coke County reservoir. An additional benefit from this contract was the agreement to intercept and inject salt water that would otherwise lower the quality of portions of the Colorado River. This project -- which involved a 4 million dollar investment by the company -- has made the Coke County reservoir a possibility. In addition, the industry has been given little credit for discovering fresh water sands and providing the bulk of the information necessary for mapping and evaluating the major underground fresh water aquifers. The industry has also been the principal cost-free source of the Texas Water Commission's electrical logs and

oil-field brine inventory data. Yet without consulting the industry the Water Commission presented a 115-page report³ before the Texas Water Pollution Control Board which concluded that "as a consequence of this established relationship between the surface disposal of oil-field brine and the resulting continuous contamination of ground-water resources," all unlined pits in the 48-county Ogallala area should be discontinued.

Although the provocation to retaliate and to attack the report item by item was great, the industry through the Texas Mid-Continent Oil and Gas Association decided to present an affirmative case concerning fresh water protection. This paper will follow the same policy; however, our theme for continued progress toward elimination of situations that can reasonably be termed serious pollution hazards should not be interpreted as stemming from either weakness or guilt. Such interpretations could destroy the cooperative attitude the oil industry has adopted with respect to the desires of surface owners.

Current Law

The operator must carry out salt water disposal operations within the framework of the law; the problem is to determine the limits of that framework. Currently 3 statutes and 2 opinions by the Attorney General constitute the principal Texas law controlling salt water disposal. The first of these statutes was adopted in 1955 and is now designated Art. 6029a of Vernon's Civil Statutes. The pertinent portion of this article provides that:

"The Railroad Commission shall also make and enforce rules, regulations and orders in connection with the drilling of wells, . . . for oil or gas or any purpose in connection therewith; the production of oil or gas; and the operation, . . . of such wells to prevent the pollution, . . . which would or might result from the escape or release of crude petroleum oil, salt water or other mineralized waters from any such well, or from operations in connection therewith."

No definition of pollution is provided by Art. 6029a.

During the regular session ending in May, 1961, Art. 7621b was adopted which designated the Board of Water Engineers (now the Texas Water Commission) as the permit agency for injection wells disposing of other than oil field wastes and the Railroad Commission as the permit agency for injection of oil field wastes. The act also states that an applicant before the Water Commission must have a letter from the Railroad Commission stating that such injection "will not endanger or injure any oil or gas formation." Similarly, the act says that an applicant to the Railroad Commission "shall submit with such application a letter from the

Board stating that the injection. . . will not endanger the fresh water strata in that area and that the formation or strata to be used for such. . . disposal are not fresh water sands." Permits are to be granted only if "both ground and surface fresh waters can be protected adequately from pollution." Pollution is defined to mean "such contamination or other alteration of the physical, chemical or biological properties of water as to render such water harmful, detrimental or injurious to public health, safety or welfare, or to legitimate beneficial use."

In August, 1961, the 1st Called Session of the Legislature enacted Art. 7621d. A statement of policy was included which emphasizes that the importance of fresh water protection requires "the use of all reasonable methods to prevent and control the pollution of the waters of this State." Definitions are broad enough to include oil field wastes as a pollution agent but no direct reference to oil or gas field operations is made. The act makes pollution without a permit unlawful but also states that, "Notwithstanding any provision of this Act, the Railroad Commission of Texas shall. . . continue to exercise the authority granted it in. . . Arts. 6029a and 7621b".

Art. 7621d also created the Water Pollution Control Board with jurisdiction over pollution permits. The Board was required to issue permits to continue discharging wastes that were being discharged on November 7, 1961, the effective date of the act. The Board was also given authority to issue or deny permits for new waste discharges within 90 days after receipt of the application. All permittees "may be required, for good cause, after public hearing initiated by the Board, to conform to new or additional conditions and terms." A permit "may be revoked for good cause shown, after public hearing initiated by the Board, in the event of the permittee's failure to comply with the conditions of such permit."

In view of the apparent conflict between authority granted the Railroad Commission and the Pollution Control Board, the latter requested an Attorney General's opinion to determine if a Board permit were necessary to dispose of oil field brines. On October 31, 1962, over Attorney General Will Wilson's name, Opinion WW-1465 was issued stating that injection well disposal of oil and gas wastes is under exclusive Railroad Commission permit jurisdiction, but that discharge of all wastes "by any means other than injection wells must be pursuant to and in accord with a permit issued by the Water Pollution Control Board." The opinion conceded that the enforcement power of the Commission to abate pollution existed but perceived no reason why dual enforcement power conflicted or infringed upon the responsibility or authority of either agency."

On November 13, 1963, an Attorney General's opinion over the name of Waggoner Carr was issued in reply to an inquiry from the Texas Water Commission. This opinion held that the Railroad Commission has sole jurisdiction over injection wells whose purpose is to increase oil and gas production. On wells for the disposal of wastes arising from oil and gas operations, the opinion held that the Water Commission letter which must accompany the application "is not binding on the Railroad Commission but merely advisory." Further, it was stated that "it is obvious that the basic scheme of the statute is to give the Railroad Commission control of oil field waste. . . ."

In January, 1964, the Pollution Control Board adopted the following resolution: "The Board, through its Chairman, requests a review of Opinion No. WW-1465

as requested by Sun Oil Company and Superior Oil Company and that the Railroad Commission be invited to join in the request." In February, the Railroad Commission, noting the Board's motion, requested such a review of Opinion WW-1465.

RAILROAD COMMISSION REGULATIONS

The Railroad Commission has an active program of fresh water protection in operation. Since 1919, the Commission has had numerous rules concerning the protection of sub-surface fresh waters. Statewide Rule 8 states the general requirements for protecting fresh water; Rule 13 details the casing and cementing regulations for such protection; Rule 14(c) covers the plugging requirements; Rule 15 provides for protection after abandonment by requiring surface casing to be left in place; Rule 9 contains the regulations relative to protecting fresh water during disposal operations; and Rule 46 presents similar requirements for such protection for injection into hydrocarbon reservoirs.

In conjunction with the last 2 rules, elaborate application forms are specified. Fig. 1 shows a copy of the disposal application. In addition to the well identification data at the top of the form, other required information includes the depth interval of the injection zone, the type and amount of surface casing and long string, the cement used on each, tubing and packer data, a description of any squeeze operations, the depths of the shallowest hydrocarbon zone and the deepest fresh water zones, the volume of salt water to be injected, the type of system, the necessity for chemical treatment and the anticipated pressure requirements. Listed on the back of the forms are the attachments which must accompany the application. These include a complete, full-scale electrical log of the wells; a letter from the Texas Water Commission stating that the injection zone is not productive of fresh water if that zone has not previously been used for disposal purposes in the subject field; names and addresses of all offset operators, their waivers or statement that notice has been given to them; and either waivers from surface owners or a copy of a letter to them from the applicant explaining the application and requesting a waiver. The application must be verified by a sworn affidavit. If all necessary waivers are not included, the application is held for 10 days after receipt in the Commission's Austin Office. During this period, any interested party may either protest or request a hearing on the matter; if neither is made, the application is processed by the Commission after the 10-day period. If all waivers are attached, the application is processed upon receipt.

Each form is individually processed by a technically trained member of the Commission's Staff. If the disposal well is to be approved, the application must show that the well and the injection system satisfy stringent, although unwritten, standards. These standards include requirements that the disposal zone be separated from the nearest fresh water and hydrocarbon zones by a distance adequate to insure the probability of fluid separation. This distance, although always at least 150 feet, is of course subject to the types of intervening formations, the amount and method of placement of cement, the injection volumes and the maximum anticipated injection pressures. Annulus injection is frowned upon, principally because there is usually no assurance that the surface casing cementing job was effective. Wellhead injection pressures in excess of 1/2 psi per foot of depth are suspect and

injection through tubing with packer is favored.

Prior to the Attorney General's Opinion of November, 1963, the Texas Water Commission had adopted the procedure of requiring a copy of the disposal application form prior to providing the required letter. The letter the Water Commission then wrote would often contain a number of provisions concerning well completion methods which they would set out as conditions to their approval of the use of the disposal zone. The Railroad Commission's Staff was reluctant to approve disposal applications unless the Water Commission's conditions were met by the operator.

The Water Commission then petitioned for an Attorney General's opinion by asking if Art. 7621b included all injection wells -- whether for disposal or for pressure maintenance or waterflood; if their determination as to whether such wells endangered fresh water strata was binding on all State Agencies; if the first 2 replies were yes, were all permits granted without their determination void; and if they were void or voidable, how could the Water Commission get such permits reviewed? As mentioned above, Attorney General Carr's reply was that not only did the Water Commission jurisdiction not extend beyond disposal wells but that their determination concerning such disposal wells "is not binding on the Railroad Commission but merely advisory." The chaos that would have resulted from a contrary opinion is, thankfully, not necessary to describe here. Since the opinion, the Railroad Commission grants disposal applications which its technical staff determines to protect both fresh water and hydrocarbon strata and views the Water Commission conditions as advisory.

Fig. 2 shows the Railroad Commission form used to apply for authority to inject fluid into a hydrocarbon reservoir. The front of this form deals principally with descriptive data and reservoir information. Section IV does require injection data including type and source of the fluid, maximum injections pressure and anticipated maximum injection rates. On the back, the form requires well data similar to that required by the disposal form although in tabular rather than question form. The table also permits including a number of injection wells on the same application. This application must also be verified by sworn affidavit.

Like the disposal form, this application requires attachments of an electrical log of one of the proposed injection wells; names and addresses of offset operators -- if the 10-day waiting period is to be avoided; and waivers from offsets if other fluid injection has previously been authorized for the subject reservoir, or waivers from all operators in the reservoir if it is the initial application. Two additional requirements are made for injection into hydrocarbon reservoirs. A plat must be shown of the project area and a copy of the form, plat and log must also be filed in the appropriate District Office.

These applications are also individually processed by a technical member of the Commission's Staff. No written standards are set out but criteria similar to those used in evaluating disposal applications are used. In view of the countless situations involved, these standards defy specific enumeration because they are mutually interdependent as well as dependent upon the specific factual aspects applicable to the individual injection well.

In spite of the difficulties inherent in setting out written standards for injection wells, such an undertaking is advisable for 2 reasons. First, written stand-

ards would provide the operator with a clear concept of what the Commission considered necessary in order to insure fresh water protection. This would permit applicants to plan ahead for proper completion of injection wells and would also provide all concerned an opportunity to call a hearing to show why such standards should be modified. A second reason for written standards is that the written word would reassure those outside the industry that the Railroad Commission is truly evaluating injection applications and not -- as sometimes rumored -- merely applying unfettered discretion in approving injection requests.

Shortly after the Legislature passed Art. 6029a charging the Railroad Commission with the duty of preventing pollution arising out of operation or drilling of oil and gas wells, the Commission adopted a series of "No-Pit" Orders having a compliance date of September 1, 1955. To date, 44 fields, 15 counties and 2 watersheds have been subjected to "no-pit" orders. In every case where a reasonable case has been presented that unlined pits might cause pollution, the Commission has acted to bar them as a means of salt water disposal. In few, if any, of these cases has the industry made an active effort to retain pit disposal.

OTHER REGULATORY AGENCIES

After Opinion WW-1465 was issued, the Water Pollution Control Board attempted to assume the task of permitting all disposal pits. In the fall of 1963 the Board sent out 70,000 application Forms 109 based on data submitted to the industry and requested hordes of additional information bits -- primarily regarding pits for which the statute required permits to be issued as being in use on November 1, 1961. These cards, plus the Ogallala 48-county hearing, fully awakened the industry to the gathering storm of confusion growing out of 3 agencies attempting to regulate the same subject matter. The Water Pollution Board has issued 36 pages of "Rules, Regulations & Modes of Procedures" and another 7 pages of "Addendum to Rules, Regulations & Modes of Procedures." In addition, the Board has called several county-wide hearings culminating in so-called no-pit orders although the statute provides only the authority to require the permittee "for good cause, after public hearing initiated by the Board, to conform to new or additional conditions and terms imposed by the Board." The act goes on to state that "Such permit or amended permit may be revoked for good cause shown, after public hearing initiated by the Board, in the event of the permittee's failure to comply with the conditions of such permit as issued or amended."

The Board culminated its no-pit activities with the 48-county Ogallala hearing. The sweeping charges and rash conclusions made in that hearing alerted the industry to the bad name it was receiving because of an infinitesimal percentage of exceptions to an otherwise excellent disposal record. For example, the Texas Water Commission study³ introduced in that hearing alleged only 63 cases of oil-field brine contamination in the entire 31,500 square miles underlain by the Ogallala. Insufficient evidence was contained in the report to verify any of these cases, but even if they were all actual oil-field contamination situations, they involved less than 0.2% of the fresh water wells in the area -- hardly enough to show an "established relationship between the surface disposal of oil-field brine and the resulting continuous contamination of ground-water resources."

In addition to the advisory letters concerning injection wells mentioned in the discussion on Railroad Commission regulations, the Texas Water Commission furnishes advice as to the depth fresh water must be protected when drilling wells in areas where Railroad Commission field rules have not been adopted. The casing rule of the special rules adopted for a field specify protection depths which are also based on Water Commission advice. In both cases this information is furnished by correspondence on individual wells.

It would seem more efficient if the Water Commission would publish a map of the depths at which fresh water is encountered in the State, with area or field maps provided where surface or sub-surface conditions require additional detail. Both the operators and the Railroad Commission would be apprised of the depth to which protection is required and could better plan casing programs in advance. A system should also be instituted where interested parties could obtain a hearing before one of the commissions in order to show that a depth different from the one depicted should be protected. Currently, disagreements in such matters usually devolve into an argument between the affected party and a member of the Water Commission's staff.

In addition, there are over 700 special district agencies in Texas operating in some phase of water conservation. Twenty-three federal agencies having an interest in fresh water also operate in Texas. To insist that an operator be regulated by each such agency would impose an impossible burden. Coordination of all fresh water protection from petroleum operations would best be centered in the Railroad Commission with the other agencies providing advice or actual participation in hearings involving such protection.

CURRENT TECHNOLOGY

The major problem relating to fresh water protection is the disposal of salt water produced with oil. Technically speaking, sub-surface injection into formations not productive of fresh water is normally the disposal method best assuring protection of all fresh waters. Such a solution is handicapped by the expense involved. Gathering lines, treating facilities and injection equipment are all expensive; where waste disposal only is involved, obtaining the landowners' permission to inject is often an additional burden. Yet substantial progress has been made in injecting produced water.

In 1956, a salt water inventory indicated a salt water production of 4,609,000 BWPD; a similar inventory in 1961 showed that nearly that amount, 4,466,000 BWPD, was injected. No injection figures are available on the 1956 inventory, but the 1961 injection rate represents 68% of the daily water production. From January, 1962, through July, 1963, the Commission granted applications authorizing the injection of more than 1,100,000 BWPD. These approved applications are estimated to increase sub-surface injection of salt water to approximately 80% of current production. Since 10% of the production is discharged into surface water courses -- with most of this discharge being into saline waters along the Gulf Coast -- the percentage of production disposed of in surface pits is estimated to be only 10%.

The best method for reducing the expense of salt water injection is advance planning. Where other factors permit, the produced water should be returned to the formation from which it was produced -- not merely

for disposal out in such a manner as to increase ultimate recovery also. Upon the completion of a discovery well or upon contemplating additional development in an area where water production is likely to occur, the disposal problem should be considered in setting up a drilling program.

One phase of such a program would be investigatory. A coring, testing and/or logging program should be scheduled to evaluate possible disposal strata during the drilling program. If water disposal is an immediate problem, the hole size and the cementing program should be adequate to permit a combination injection-producing well, if conditions permit. If small quantities of water are to be disposed of and annulus injection appears feasible, the surface casing program could be modified to provide for setting in a hard, impermeable formation if available and a cementing program utilizing centralizers, scratchers, turbulent flow and higher strength cement. When the inevitable dry hole is drilled, the probable disposal and recovery problems should be forecast and the well considered for possible dual-purpose injection to dispose of salt water while concurrently increasing hydrocarbon recovery. By serving 2 functions with 1 investment, the expense of injecting salt water can often be justified.

During the development phase, consideration should be given to location of surface equipment in conjunction with later salt-water gathering and treating facilities. Another matter in which foresight would be of help is in securing the right from surface owners to dispose of salt water into saline sub-surface strata. Often a proposed injection program is economically feasible only where water from several leases is to be injected through a single well from treating facilities on a single lease. In this situation, it is necessary to have the consent of the surface owners as well as the mineral and royalty owners under the injection site. By planning ahead, even to the extent of explaining to such owners the desirability or necessity of the salt water injection, excessive delay and expense in instituting the injection system can be avoided. The less than cooperative attitude of some landowners has frequently rendered the problem of eliminating surface discharge of produced water difficult and expensive. Since, normally, the industry is merely carrying out the desires of the landowner in eliminating such discharge, this added obstacle is most frustrating. Education is one key to unlocking the door to cooperation and no one is better located than field personnel to provide such education.

CONCLUSIONS

The operator's problem of salt water disposal is a continuing one. A portion of the water being disposed of on the surface, constitutes a hazard to fresh water and sub-surface disposal is only as safe as the injection system. The price of fresh water protection involves vigilance as well as money.

At this date, the regulation of the oil industry in matters of fresh water protection is in an unsatisfactory condition. It is unfair, inefficient and confusing to have 3 administrative agencies attempting to exercise jurisdiction over the same subject. Action should be taken to consolidate all authority over fresh water protection from oil field operations within the Railroad Commission. The Chairman of both the Texas Water Commission and the Salt Water Pollution Board has stated in public hearing that he personally agrees such a consolidation should be made. It appears that this consolidation would require at least a new Attorney

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SUBSCRIBED AND SWORN To before me, this the _____ day of _____

(Back)

RAILROAD COMMISSION OF TEXAS
APPLICATION TO INJECT FLUID
INTO A RESERVOIR PRODUCTIVE OF OIL OR GAS

Field _____ County _____ District _____
Operator _____ Date _____
Address _____
Lease (s) & Number (s) _____
Reservoir _____ Discovery Date _____

HAVE ANY INJECTION PERMITS BEEN GRANTED PREVIOUSLY IN THIS RESERVOIR?
IF ANSWER TO ABOVE QUESTION IS "NO", ALL OPERATORS IN THE RESERVOIR MUST BE
NOTIFIED OF THIS APPLICATION, AND COPIES OF NOTIFICATION ATTACHED HERETO.

I. Reservoir and fluid characteristics

A. Information on entire reservoir

1. Name of formation _____
2. Estimated productive area of entire reservoir _____
3. Composition (sand, limestone, dolomite, etc.) _____
4. Type of structure _____
(Include cross-section and structural maps)
5. Subsea depth of oil-water contact _____ Gas-oil contact _____
6. Type drive during primary production _____
7. Original BHP _____ Current BHP _____
8. Was gas cap present originally? _____ At present? _____
9. Ratio of gas cap volume to oil zone volume _____
10. Saturation pressure _____ Formation Volume Factor _____

B. Information on proposed project area

1. Number of productive acres in lease (s) within project area _____
2. Average depth to top of pay _____
3. Average effective pay thickness (feet) _____
4. Average porosity (%) _____
5. Average horizontal permeability (mds.) _____ Range _____
6. Connate water content (% of pore space) _____
7. Gravity of oil (API) _____ Viscosity _____

II. Primary Production history

1. Date first well completed on lease (s) _____
2. Oil, gas, water production by months since discovery. (Graphically as well as in tabular form.) _____
3. Stage of depletion of project area _____
4. Number of producing wells on each lease in project area _____
5. Average daily oil production per well at present time _____
6. Average gas-oil ratio _____ Water production (%) _____
7. Cumulative oil production to date from lease (s) _____

III. Results expected

1. Estimated original oil in place (bbls.) _____
2. Estimated oil saturation at present time (% of pore space) _____
3. Estimated residual oil saturation at abandonment _____
4. Estimated ultimate additional oil that will be recovered as a direct result of injection (bbls.) _____

IV. Injection

1. Type of Injection Fluid (water, gas, LPG) _____
2. Source of injected fluid (formation, depths) _____
3. Injection pattern and spacing _____
4. Maximum injection pressure to be used (psi) _____
5. Estimated maximum per well rate of injection (bbls.) _____
6. List complete injection well data on reverse side of this sheet.

(APPLICANTS MUST COMPLY WITH THE INSTRUCTIONS ON REVERSE SIDE HEREOF.)

(Front)

INJECTION WELL DATA

LEASE NAME & NO. WELL NUMBER							
SURFACE CASING	SIZE						
	LENGTH						
	SACKS & TYPE CEMENT						
PRODUCTION CASING	SIZE						
	LENGTH						
	SACKS & TYPE CEMENT						
TUBING	LENGTH						
	PACKER DEPTH						
INJECTION	DEPTH						
	THRU CASING OR TUBING?						

THE STATE OF TEXAS

COUNTY OF _____

BEFORE ME, The undersigned authority, on this day personally appeared _____ known to me to be the person whose name is subscribed to the above instrument, who being by me duly sworn on oath states that he is duly authorized to make the above report and that he has knowledge of the facts stated therein and that said report is true and correct.

Signature and Title _____

SUBSCRIBED AND SWORN To before me, this the _____ day of _____, 19 _____

Notary Public in and for _____

County, Texas

INSTRUCTIONS

1. ATTACH waivers from each operator offsetting the subject lease (s), or attach copies of letters of "Request for Waivers" sent to each operator offsetting the subject lease (s), provided, that if this is the initial application for fluid injection authority for this reservoir, waivers from all operators, or copies of "Request for Waivers", for all operators in the reservoir shall be attached.
2. ATTACH a list of names and addresses of all offset operators.
3. ATTACH plat of lease (s) in project area, showing producing wells, injection wells, offset wells, and also identify ownership of all surrounding leases.
4. ATTACH a complete electrical log of one of the proposed injection wells.
5. No application will be considered unless items 1, 2, 3, and 4 are attached to this application. If all necessary waivers are not attached, the Commission will hold this application for a period of ten (10) days from date of receipt in the Austin office. If no protest has been received in the Austin office within ten (10) days, the application will be processed.
6. Mail the complete application (including waivers) directly to the Austin office of the Railroad Commission; and the same day mail a copy of the application form, copy of plat and log to the appropriate District office.

Fluid Injection Application
Order No. 20-52,413
August 1, 1963

Fig. 2

(Back)

General's opinion restoring exclusive control of oil field pits to the Railroad Commission; at most, legislation clearly placing the responsibility and authority for such protection within the Commission. The opinion has been requested by the Railroad Commission and it is hoped that multi-agency regulation will soon be eliminated.

Since the letter from the Water Commission on disposal wells is merely advisory, it should be eliminated as an application requirement. The Railroad Commission could request such advice as it deemed necessary directly from the Water Commission. In order to reduce the inter-agency correspondence and also to enlighten all concerned, the Water Commission could prepare a map of the entire State showing, by contours, the depth to which fresh water should be protected. Area and field maps could be provided where additional detail is necessary. The maps could be revised periodically to reflect additional data and should be subject to a showing in a hearing that a different depth is proper in a particular area.

Another enlightening, although admittedly difficult, innovation would be to reduce to written rules the standards currently employed by the Railroad Commission's staff in evaluating injection applications. In view of the unlimited number of well situations involved, such criteria would necessarily have to be general; nevertheless, the assurance of the written

word would help all concerned understand the care with which injection requests are screened.

Fresh water protection will be the industry's top priority public relations job in the next few years. Generally, Texas operators are doing an excellent job in disposing of 7 million bbl. of salt water daily. Nevertheless, the increasing importance of fresh water and the distorted publicity given the relatively infinitesimal instances of oil-field contamination have created a situation which requires extra effort on the part of each individual in the industry to correct. Those directly and daily concerned with producing operations and lease problems can do the most toward enhancing the industry's reputation as a good citizen.

REFERENCES

1. 1961 Salt Water Disposal Inventory.
2. Railroad Commission Answer to Interstate Oil Compact Commission Engineering Questionnaire, September, 1963.
3. Effects of Surface Disposal of Oil-Field Brine on the Quality and Development of Ground Water in the Ogallala Formation, High Plains of Texas. Prepared by Texas Water Commission for presentation at a Public Hearing held by the Texas Water Pollution Control Board on September 25, 1963.

