DISPOSAL OF OIL FIELD BRINES
EFFECT ON WATER SUPPLY

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Ordinarily a discussion concerning salt water is started by reviewing the value of fresh water and explaining the need to preserve our water resources. Obviously your awareness of the problem explains your presence at this meeting.

A salt water engineer tries to convince the people with whom he comes in contact, that properly handling oil field waters is not only right, it is an essential conservation measure. But like a preacher, he often has trouble cornering the non-believer and the believers don't need to be told.

The oil industry is rapidly recognizing that they have a stake in conservation. Alert management realizes that prevention of pollution is a good investment rather than an expense. The final source of revenue in the oil business is the sale of products to the consuming public. They realize that the farmer whose land has been ruined cannot buy tractor fuel to raise and harvest crops, and the fisherman won't buy gasoline to fish in streams where the fish have been killed by highly mineralized water.

To many of you the term "salt water" may not have a specific meaning. Generally water containing more than 1000 ppm dissolved solids is regarded as saline. Very saline water may contain as much as 35,000 ppm total solids. Brine is water containing more than 35,000 ppm dissolved solids. Saline water containing as much as 3000 ppm dissolved solids have been used for irrigation but the continuous use of moderately saline water on the surface results in a buildup of salts in the soil, creating the same condition as high-salinity brines except that it takes more time. Since plants obtain their mositure by osmotic pressure, and the addition of salt increases the specific gravity of the water, the plants actually starve for lack of water. One of the first signs of oil field pollution is when the upper most branches of a tree in the area are observed to be turning brown during a good growing season.

The loss of vegetation due to surface disposal of salt water is a serious problem in some states, and a very obvious one. However,

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it isn't as difficult to deal with, as the invisible situation. This is the case in a large part of New Mexico. Much of eastern New Mexico is a smooth, grassy, treeless plain. Lea County, for example, is 30 miles wide and 100 miles long but doesn't have a bridge in it. There is practically no surface drainage and the rainfall is disposed of chiefly by seepage and evaporation. The climate is considered to be semi-arid with a mean annual rainfall of 12 to 15 inches. Yet it is most likely that more water reaches the ground water zone than it does in states where rainfall is twice or three inches that amount. The reason is that the surface sediments in New Mexico are too porous to retain water and cannot support much plant life. In other areas the soil is more impermeable, retains moisture for plants, but for the same reasons, results in a much larger runoff. So, as far as having a water supply is concerned, nature may have provided New Mexico with a better, purer reservoir than man can devise on the surface. Also less water may be lost by evaporation in New Mexico than in some other areas.

The principal problem then, is to prevent mineralized waters from percolating down from surface pits into the fresh water zone rendering otherwise potable water unfit for drinking, industrial or agricultural uses. People have a tendency to put out of mind anything that goes out of sight. This is a dangerous practice as far as oil field waters are concerned, because water in liquid form on the surface occurs either as a lake or stream. That is, it is either confined in an impervious depression and the surface of the water is level as in a lake, or one way or another is down hill and the water is flowing. If salt water seeps down and forms a lake, not visible to the eye, but confined to a given area, no harm will come expect to that area. However, if it enters flowing fresh water, very little diffusion or dilution will occur and unpleasant results may go on for years.

It is evident that rain water is not impounded on the surface in eastern New Mexico, so the water must be percolating downward. If there are areas where there is no fresh water to be found, it seems reasonable to assume that the rain soaked in until it reached an impervious layer and continued to flow down grade. It is also reasonable to think that salt water impounded in earthen pits would follow the same course, only it would soak in every day of the year. Since rains are fairly infrequent the end result is a slug of salt water and occasionally a slug of rain water flowing along an impervious layer to an undisclosed destination. Whether or not that destination is another fresh water basin may never be determined.

The oil field waters with which we have been concerned in eastern New Mexico vary in total solids content from 14,000 ppm to 136,000 ppm. The low total solid content water is much more abundant than the brine, but one bbl of the 136,000 ppm water can do as much damage as nearly 10 bbl of 14,000 ppm water. Ordinarily a person can detect by

taste, 200 ppm slat. So one bbl of 14,000 ppm water can practically ruin 70 bbl of fresh water and one bbl of the brine can ruin 700 bbl of fresh water. Therefore the quantity of water produced is not a favorable criteria for determining the need for sub-surface disposal.

By the same token the quantity of fresh water in an area is not a good criteria for determining the need for sub-surface disposal. Any amount of potable water that is sufficient to supply the needs of the user is important. A city requires large quantities of water, a small town less and a farmer or rancher may require only a few gallons a day. If a few gallons a day is all there is available, it then becomes more valuable. Scarcity, not abundance determines the value of any natural resource.

Recognizing that improperly handled oil field waters can do much damage our first reaction is that the water is waste and has no value. This is largely true when the water reaches the surface. However, in a water drive field, it is the energy that drives the oil to the well bore. Without a water drive it is frequently necessary to inject water into the reservoir to obtain a larger portion of the oil in place. Where salt water is available, secondary recovery operations may be considered successful. However, it is extremely unwise to use potable water for water flooding because the water used can never be reclaimed. Five to ten bbl of water are required to recover one bbl of oil currently worth about $3.00. Whether or not this is a good business practice and a conservation measure is certainly open to question.

The problems of salt water disposal are many and varied. Few progressive oil companies fail to recognize the problem but they also have the same problems a family has, namely money. First they have to find the oil, then develop and produce the properties and finally market the products. It is practically impossible to formulate an economical plan for salt water disposal early in the development stages of a field because no one knows how much oil or water will be produced. Thus a temporary means of handling salt water must be employed until the magnitude of the problem can be determined and a payout assured. While many people may feel that progress is slow we must remember that our first obligation is to meet the grocery bill and no one can afford to abandon their every day tasks to take on a special project. As a result the fields have been developed and disposal work has progressed as time and money permit.

The most satisfactory solution for handling produced oil field water is to either return it to the reservoir below the oil zone and thus help to maintain the bottom hole pressure, or inject it along the edge of the field. In eastern New Mexico the water in certain fields will be injected into fairly deep salt water bearing formations.

Gathering lines will bring the water from many producing wells to each disposal well so a large area will be protected.

While many of the oil companies have shown excellent cooperation in providing subsurface disposal, the question of oil field pollution will continue to exist until a clearly defined program is established.