THE DISPOSAL OF DESALINATION BRINE WASTES

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With ever increasing demands being placed on the water resources of this and other nations, men have begun thinking seriously about developing the saline waters of the oceans and underground aquifers.

Fresh water derived in this manner can contribute materially to the spectrum of useable water supplies. In some regions it appears that this means of fresh water production is almost the only alternative. Research continues on conversion methods with emphasis on cost reduction. Practical conversion may be approaching reality. 'Many people are beginning to believe that major water supply problems will soon be solved in this manner. These considerations stimulate interest in saline water conversion and provide the impetus for advanced research.

Cost Consideration

A major goal of current experimentation with process design is the production of water at rates which compare favorably with average prices by other methods of production. Prices are related to the need and availability of water supplies and range from 1 to 5 cents per 1,000 gallons for irrigation; 2 to 15 cents per 1,000 gallons for industrial use; and 5 cents to 7 dollars per 1,000 gallons for domestic use. Chemical and Engineering News (June 1963) reports that the investment costs per 1,000 gallons for the three currently operating saline water conversion plants are approximately $1.40 at Webster, $1.46 at Freeport, and $1.30 at San Diego. These costs while well below the stated maximum domestic cost, are still considerably higher than most current prices.

There is an addition, and of signal importance, the consideration of the cost associated with the disposal of wastes from the various water conversion operations. The production of fresh water by desalination is essentially unique in this respect. Except for sludges produced in major water softening plants, most current operations produce only small quantities of readily disposable wastes.

Cost estimates for saline water disposal operations are at present still greatly subject to question. In 1958 Koenig made the following statement in a report to the Office of Saline Water:

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"Thus the various cost estimates for converted water lacked an essential element of total cost which might indeed prove even greater than, in fact much greater than, the cost of conversion itself. Obviously, economic judgements cannot be made except on the basis of total costs."

The Magnitude of the Disposal Problem

Disposal of waste brine is not a new problem although most previous considerations have been relative to the production of oil field brines. Lewis (1956) stated that:

"Some idea of the magnitude of salt production may be gained when one realizes that a "good" well producing only ten barrels of brine per day, with a 15% sodium chloride content, is producing 525 pounds of pure salt every 24 hours, or nearly 100 tons of salt per year. The maximum well, producing 190 barrels of brine per day yields nearly five tons of salt per day and 1,823 tons of salt per year."

Contrasting this with a consideration of the Roswell, New Mexico plant gives some indication of the expanded problem derived from saline water conversion operations. The Roswell plant will deliver 1 million gallons of pure water daily and about 1/3 million gallons of waste effluent per day. This waste flow will contain about 130 tons of solids per day, about 1.3 times that produced in an entire year by the oil well in the first example.

A consideration of the enormous volumes of waste which might be produced by future saline water conversion plants is cause for concern. It should also be emphasized that the volumes of fresh water produced by plants of the size currently in operation at Roswell, Freeport, Webster, and San Diego are not large, in fact, for a community of about 40,000 people. One million gallons per day might represent only 15 percent or less of the average domestic consumption.

An additional example of the relative size of the waste operation can be had by comparing the wastes produced by a complete sewage treatment facility with those derived from a saline water conversion plant. Consider a community of 40,000 people with a portion of the domestic water supplied by desalination. Assume this portion to be 1 million gallons per day and to represent 15 percent of the average daily consumption. The daily volume of sludge developed in the community sewage treatment plant (consider the plant to utilize sludge digesters and dewatering operations) would be about 160 cubic feet. The solid waste derived from treatment of only 15 percent of the community water supply might be as high as 2,500 cubic feet per day, nearly 16 times the volume produced by the entire sewage treatment operation. This prototype problem clearly illustrates the comparative magnitudes of waste production with which we must be concerned.

The preceding remarks should serve to indicate the magnitude of the waste problem and thus illustrate that the costs of handling brine wastes can be highly significant. Consideration of these costs is vitally important even in process research as some methods produce less waste per unit product produced than others. In fact, given a specific location, the waste operation should be considered an integral part of the process design so that the most economical overall operation can be produced.

Disposal Operations

In 1958, Koenig set forth twelve processes for handling saline water conversion brine wastes. These are summarized as follows:

1. Transport to the sea.
2. Evaporate to saturation and convey to the sea.
3. Evaporate to dryness and transport the solid residue to the sea.
4. Convey to a remote land dump.
5. Evaporate to saturation and transport to a land dump.
6. Evaporate to dryness and transport the residue to a land dump.
7. Evaporate to dryness and abandon residue at location.
8. Inject into underground strata.
9. Inject waste after bringing to saturation.
10. Use abandoned oil wells for injection.
11. Evaporate to reduce costs of conveyance and injection.
12. Discharge wastes into flood flows.

There is obviously some overlap in these operations but in general they indicate current possibilities for disposal. A careful study indicates that some of these operations (abandonment, land dumping, injection for example), if used indiscriminately, could result in serious pollution problems. It is also apparent that the disposal method selected as most appropriate for one particular plant might not be feasible for another. Individual studies of the economics and pollutional aspects of waste disposal must therefore be given primary consideration in evaluating the potentialities of any region for saline water conversion development.

Conclusions

It has been the intent of this paper to discuss the brine waste disposal problem, the other side of the desalination story. Considerable literature has been produced in the last few years regarding the importance of saline water conversion and discussing the various processes which are under development. Relatively little has been said about the very significant waste disposal problem that is associated with all of these processes. Saline water conversion holds the promise of providing fresh water for many areas where existing supplies of adequate quality water are limited. It is an important part of the development of technology for increasing our useable water supplies. The associated waste problem is also of considerable importance from both an economic and pollutional point of view. It should not be overlooked or de-emphasized in the early stages of planning, research, or development. If it is neglected now, it will strikingly present itself in compounded form once large scale operations commence.

List of References

1. Koenig, L., "Disposal of Saline Water Conversion Brines--An Orientation Study," O.S.W., Research and Development Report 20, 1958.

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3. "More Stress Put on Basics in Saline Water Technology," Chemical and Engineering News, June 10, 1963.