

*contribution to the nation's water pollution problems and, further, does E.P.A. [Environmental Protection Agency] have a mechanism by which they can acquire such information and apply it?*

Answer. The Office of Saline Water (OSW) has not been authorized and does not have any ongoing large programs on the application of desalting technology for pollution control problems. However, both distillation and membranes technology can be applied to waste water reuse. As part of the research and development program, OSW has tested some electrodialysis membranes to determine their suitability for treatment of brackish water supplies contaminated with municipal sewage. Additionally, pilot plant tests were conducted on polluted brackish surface waters at Las Vegas Wash, Nevada.

EPA has been conducting membrane field tests on secondary sewage effluent at Pomona, California, to determine the process suitability as a tertiary treatment for municipal sewage. EPA receives data from OSW on process design and operations for possible solution to pollution problems.

*Question 2. What work is going on in the treatment of irrigation return flows? It seems to me that single-purpose water supply systems are no longer economically feasible and one must learn to reuse waters in a multipurpose manner. By providing the technology to permit the reuse of water we are, in fact, increasing the available supply while, at the same time, improving its quality, and the environment.*

Answer. EPA and OSW jointly conducted membrane pilot plant field tests on irrigation return flows at Firebaugh, California, in 1968 and 1969.

In 1969 a second membrane pilot plant field test was conducted on irrigation return flows at Grand Junction, Colorado. In both field tests, the technical feasibility of using the reverse osmosis process for agricultural reuse of irrigation return flows was demonstrated. No OSW field tests are underway at the present time on irrigation return flow.

*Question 3. Would you please submit for the record—by processes—the elements of cost involved in design, construction and operation of the several ways of treatment of waters by desalting technology, such as distillation, reverse osmosis, etc. As an example, what is the hardware, current cost of money, and operating expenses—broken down into energy costs, chemical treatment, personnel costs and general operation expenses? The figures should be broken down into capital investment and the operating expenses.*

Answer. Attachments 1, 2, and 3 reflect the requested data relative to cost elements for various desalting processes. The costs shown for brackish water desalting may be lowered due to recent improvements in membrane technology, various feed water conditions, power costs, and other site-related factors. They show the relationship of costs elements as requested.

*Question 4. How is process and hardware development by the Office of Saline Water made available for industrial applications and what has been the utilization to date?*

Answer. Data relative to process and hardware development by the Office of Saline Water is made available to industry by—

(a) Publication of OSW Research and Development Reports. Over 600 of these have been issued.

(b) Technical symposiums and information meetings.

(c) Meetings and conferences with manufacturers.

(d) Issuance of periodic technical data through such publications as the "Distillation Digest."

(e) Visits to OSW facilities by technical personnel to review operations.

Examples of developments that have been utilized to date include—

(a) pH control to prevent scale formation so as to operate distillation plants at 250° F. (Previous operating temperatures were less than 200° F.)

(b) Use of hard wall, thinner tubing in multi-stage flash distillation (MSF) plants, thus resulting in savings of capital cost.

(c) Decreased margins of plant overdesign through development of knowledge of approach to equilibrium (improved thermal efficiency) in flash stages.

(d) Refinements in MSF condenser tube bundle design to obtain higher performance.

(e) Development of the vertical tube evaporation (VTE) distillation technology and the combined VTE/MSF process. Associated with this has been the development of high heat transfer enhanced tubes.

(f) Utilization of the OSW Universal Design in a 5 mgd distillation plant in Saudi Arabia with the evaporators constructed by a U.S. firm. Furthermore, the Universal Design will be utilized by the Saudi Arabian Government for two