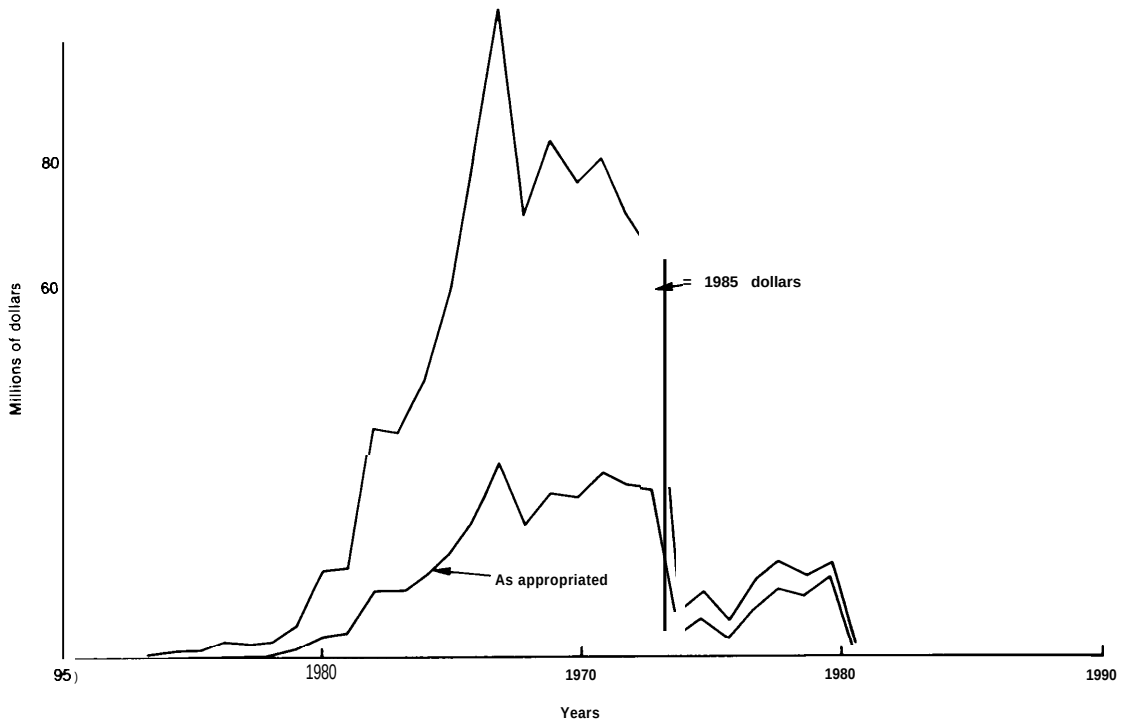
# Chapter 7
# Government Involvement in Desalination

Between 1952 and 1982 Federal funding for desalivation research, development, and demonstration averaged about $30 million per year (in 1985 dollars). Annual funding levels are provided in figure 11, and appendix B. This research program was primarily responsible for the development of reverse osmosis (RO), and for many advances and improvements in distillation technologies. Any future Federal funding for R&D could lead to further improvements in membrane technology and desalination plant operations. Innovative applications of these technologies to complex treatment problems could also be advanced by demonstrations.

**Figure 11.—Yearly Federal Funding for Desalination R&D**




SOURCE: U.S. General Accounting Office, "Deealting Water Probably Will Not Solve the Nation's Water Probleme, But Can Help," GAO/CED-79-80, May 1979.

## PAST FEDERAL INVOLVEMENT

In accordance with the Saline Water Conversion Act (Public Law 82-448), research was initiated in the Department of Interior in 1952 to promote the development of economical processes for desalinating brackish water and seawater for municipal, industrial, agricultural, and other uses. Much of the interest in desalination came from arid and semi-arid Western States who were becoming increasingly aware of their vulnerability to periodic droughts. Funding was set for multi-year periods with the intention of reducing Federal support when desalination technology became commercially available.

During the early 1950s Federal officials were optimistic that economic desalination technologies

could be developed over a relatively short period of time to provide ample supplies of freshwater for the arid and semi-arid areas in the United States and for the rest of the world. In 1955 research funding was increased and a new Office of Saline Water (OSW) formed within the Department of Interior (DOI). During this same time period the proponents of nuclear power were advocating the use of nuclear power for desalination. In the 1960s and 1970s OSW built pilot-scale desalination plants and other test facilities at five sites: Freeport (TX), San Diego (CA), Roswell (NM), Webster (SD), and Wrightsville Beach (NC). In fact, the MSF plant built in San Diego was later moved to our navy base at Guantanamo Bay, Cuba, in the mid- 1960s where it operated for about 20 years (9).

Added impetus for desalination R&D was provided by the Water Resources Research Act of 1964, which provided funding not only for OSW, but also for more general water resources research through Interior's Office of Water Resources Research (OWRR). During the mid to late 1960s the OSW sponsored a great deal of basic and applied research into all desalination processes, with special emphasis on developing membranes and improving the efficiency of distillation processes. Federal support for the desalination program peaked in 1967 with a funding level of over $100 million (in 1985 dollars). The technology developed under this program was made freely available throughout the world through workshops and the wide distribution of published reports. Thus, by the late 1960s and early 1970s this R&D program had established the United States in a technological leadership role for desalination throughout the world.

The Federal Government's desalination efforts were reinforced in 1971 with reauthorization of the Saline Water Conversion Act (Public Law 92-60). Funding for research grants and contracts during the early 1970s was about $70 million per year. However, in 1974 the desalination research and testing program was cut to about $7 million resulting in significant reductions in ongoing research, development, and testing. This program cutback came in the wake of the 1973 oil embargo which significantly increased distillation costs and increased the need for energy research (9). In addition, the visions of cheap nuclear power were quickly fading and recent commercialization of RO seemed to reduce the need for Federal support. In 1974 the OSW and the OWRR were administratively integrated into the OffIce of Water Research and Technology (OWRT) (81).

The western drought of 1976-77 stimulated a renewed Federal interest in the application of science and technology to the water resources problems facing the nation and individual States. This increased interest led in turn to the passage of the the Water Research and Conversion Act of 1977 (Public Law 95-84) and the Water Research and Development Act of 1978 (Public Law 95-467). Desalination research in OWRT was expanded somewhat with a focus primarily on membrane improvement for RO and ED, and secondarily on further development of other basic desalination processes, such as freezing. In addition to providing renewed funding for basic desalination research, Public Law 95-467 authorized the construction of five small desalination plants in the United States to demonstrate desalination technology where there was a need to supplement existing drinking water supplies.

By 1980 Alamagordo (NM), Virginia Beach (VA), and Grand Isle (LA) had been selected out of a field of 37 as sites for federally supported demonstration plants. Under this program the Federal Government was to pay for the design and construction of the plants, as well as the first 3 years of their operation; State and/or local government agencies were responsible for providing on a cost-sharing basis (of 15 percent to 35 percent) the land, utilities, feed water for desalination, and waste concentrate disposal. After 3 years the plants were to be deeded to the local agencies as part of their water supply systems. Plant design studies were initiated, but funding for this part of the program was withdrawn in 1981.

The OWRT was restructured in 1981 and then abolished (along with most of its funding) by the Secretary of Interior in 1982. The remaining Saline Water Conversion Research and Development Program was transferred to the Bureau of Reclamation in the Department of the Interior, and management of the remaining test facilities at Wrightsville Beach, NC, and Roswell, NM, was turned over to the local governments in 1983. Since Federal funding for the three demonstration plants was

also abolished at this time, there was not enough financial backing at State and local levels to continue plant construction. Consequently, none of the plants were ever completed. In 1985 all water resources research, including desalination research and development, was shifted to the U.S. Geological Survey (USGS) in DOI.

The Federal Government now supports some desalination research under Section 105 of the Water Resources Research Act of 1984 (Public Law 98-242) administered by the USGS. Federal funding for these projects amounts to a few hundred thousand dollars per year; an equivalent level of support is provided for each project by non-Federal organizations. Federal funding for all water research under Section 105 grants will decrease from $4.4 million in fiscal year 1987 to $1.8 million in fiscal year 1988 (88). Section 106 of the Act provides for projects to develop and demonstrate desalination technologies; however, no funds have been appropriated by the Federal Government for such activities in the last 3 years. The military also spends a few million dollars per year for basic R&D on particular field uses of desalination.

The Department of Energy (DOE) and the Commerce Department's National Bureau of Standards (NBS), have a joint program, called the NBS/DOE Energy Related Inventions Program, that supports the development of energy-saving inventions, which could include desalination technologies. NBS provides a detailed evaluation of proposals for possible funding by DOE's Inventions and Innovative Programs. About $2.5 million is available each year for grants supporting about 20 new inventions per year. Since 1975 about 400 inventions have been recommended for funding; 250 have received fimding. One desalination concept was recommended, but never funded.

Section 5 of the 1980 appropriations bill (Public Law 96-336) that provided funding for construction of the Yuma Desalting Plant (described in ch. 8) also provided authority to expend 5 percent of the authorized funding for evaluating and improving desalination technology. The test facility at the Yuma plant is partially used for further developing desalination technology, primarily RO, but not for basic research.

Title III of the Water Resources Development Act of 1986 (Public Law 99-662) provides funding for research into problems related to the drawdown of the Ogallala Aquifer beneath the High Plains States east of the Rocky Mountains. Section 304 of Title III could be used to fund some desalination-related research. Up to $13 million has been authorized for all Title III research, including $2.2 million for Section 304, but no funds have yet been appropriated. Such research would be directed by the USGS.

## FEDERAL LAWS INDIRECTLY RELATED TO DESALINATION

During the 1960s there was growing evidence that many aquatic environments were becoming polluted as a result of population increases, and industrial growth and development. In light of this situation Congress passed numerous bills in the 1970s regulating the disposal of certain types of waste and protecting different disposal environments. The Safe Drinking Water and Clean Water Acts are most directly related to desalination.

Through the Safe Drinking Water Act (SDWA) of 1974 the Environmental Protection Agency (EPA) and/or States have the authority to regulate the quality of public drinking water supplies, including those that rely on desalinating brackish groundwater. Private systems, most of which get their water from underground sources, are not regulated under the SDWA. Although the States retain the primary control over the use of groundwater, EPA grants are now available for partially funding State programs that protect sole source aquifers and wellhead areas supplying public water systems. EPA's enforcement powers to regulate underground injection wells have also been strengthened and streamlined.

In 1986 the SDWA was amended to increase the level to which EPA and States will be regulating public drinking water supplies. Current EPA guidelines recommend that drinking water supplies have less than: 500 ppm of total dissolved solids, 250 ppm for both chloride and sulfate ions, and 100 ppm cal-

cium carbonate for hardness. Since these guidelines are not enforceable, these levels can legally be exceeded. However, over the next 3 years EPA will be developing standards for over 80 other contaminants. For those water quality parameters that can not be easily measured by utilities, EPA can specify treatment techniques, rather than a numerical standard. Considering these increasingly stringent water quality standards, it is quite likely that the use of various desalination technologies for centralized water treatment and for point-of-use/point-of-entry treatment will probably increase in the coming years.

Desalination demonstration projects could be considered for funding under the SDWA. Under Section 1444 EPA can make grants for State-approved projects that will: 1) demonstrate a new or improved method, approach, or technology, for providing a dependable safe supply of drinking water to the public; or 2) investigate the health implications associated with the treatment and reuse of wastewater for potable purposes. Grants are limited to two-thirds of the cost of construction and three-fourths of any other costs. Priority is given to projects where there is a known or potential health hazard. This section also makes Federal loan guarantees available to private lenders for upgrading small public water systems.

Under the Clean Water Act (1972) desalination plants that discharge wastewater into the Nation's surface waters are required to have a National Pollutant Discharge Elimination System, or so called NPDES, permit. Under NPDES, industrial and municipal dischargers are required to use the best available technology for cleaning up wastewater prior to its discharge into adjacent waterways. The regulation of industrial discharges may indirectly encourage the use of desalination technologies for removing dissolved solids in wastewater prior to its discharge or direct reuse. Also, desalination plants would probably need a NPDES permit to discharge their waste concentrate into waterways or marine environments.

## STATE AND MUNICIPAL INVOLVEMENT

Whereas the Federal Government has traditionally been most active in developing large water resource projects and regulating water quality, States have traditionally retained control over the use of existing surface water and ground water supplies through State water laws and regulations. All States have agencies that typically evaluate the quality and quantity of their water resources and have developed plans for meeting the fhture needs of the State. Forty-eight States (and territories) have developed federally approved programs for regulating drinking water. Thirty-six States have developed federally approved programs for regulating industrial and municipal discharges into waterways under the NPDES program (52). States also have primary responsibility for protecting groundwater under the SDWA. Some States regulate underground injection wells that might be used for waste concentrate disposal.

In cases where water use involves several States, multi-State organizations are often formed. For example, the Salinity Control Forum was organized by the seven States in the Colorado River Basin (i.e., Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming) to reduce the input of salt and other minerals to the Colorado River. [1] In addition to adopting numerical standards for total dissolved solids at three dam sites along the

[1]The Colorado River, which has an average flow of about 14 million acre-ft per year, provides about 12.7 million acre-ft of water to about 2.5 million people living within its basin and to another 16 million people that live outside the basin in adjacent areas and States. The total amount of water used approximately equals its supply; however, the 55 million acre-ft of water in the river system's storage reservoirs delays by a few years any supply shortages from droughts (31).

From its point of origin in the Rocky Mountains, the Colorado River picks up about 10 million tons of salt as it moves through the 7 basin States toward the Gulf of California (30). Salt concentrations of about 50 ppm near the river's headwaters increase to about 800 to 900 ppm in the lower reaches of the river. About 38 percent of the salinity in the Colorado (at the Hoover Dam) is contributed by diffuse natural sources of salt, and another 37 percent comes from irrigation drainage water. The remaining salt is contributed by evaporation and riparian plant transpiration (13 percent), natural point sources of salt (10 percent), exports of freshwater out of the basin (3 percent), and discharges from municipal and industrial discharges (1 percent).

Agriculture in the United States and Mexico is the major user of the Colorado's water. Irrigation development in the Colorado Basin began gradually in the late 1800s, but increased significantly during the early 1900s as major federally financed reservoirs were completed. There are now about 4 million acres of agricultural land that are irrigated by Colorado River water.

river, [2] the basin States have placed effluent limitations on industrial and municipal effluents (under NPDES), encouraged salinity control measures for area-wide planning, and developed plans for reducing salt and mineral inputs to the Colorado River.

Agencies operated by muncipal governments are beginning to take a more active role in desalination as the importance of reverse osmosis and electrodialysis for treating drinking water increases. Municipal development of new sources of drinking water, especially for smaller communities, is often supported directly or indirectly by State agencies.

[2] **In response to an EPA regulatory requirement, water quality standards for total dissolved solids were established by the Forum and later adopted by the basin States for three major diversion points in the lower Colorado River: 723 ppm below Hoover Dam, 747 ppm below Parker Dam, and 879 ppm at Imperial Dam.**