

availability of suitable land burial facilities do not appear to be potential problems for future power reactor operations, even with the most optimistic growth projections.

Radioactive gases are normally produced in water-cooled and moderated reactors. Some of the radioactive effluents may be associated with particulate matter. All radioactive particulates discharged to the atmosphere pass through high efficiency absolute filters which remove 99.9 percent of the particles 0.3 microns or larger. Some plants have holdup capacities for radioactive gases to permit decay of some of the species to innocuous levels. Radioactive gaseous effluents from nuclear power plants are continuously monitored at the plant and further off-site monitoring is also provided by both State and Federal agencies. Nuclear power plant records indicate gaseous discharges that are only one-tenth of 1 percent (0.1 percent) of permissible limits. In one recent case, involving a pressurized water reactor, it was determined that a tall stack for release of gaseous effluents was not necessary because of the small amounts of effluents produced.

Data for power reactor waste management systems show that capital costs for water-type reactors to date have ranged from approximately \$0.5 to \$4.0 million for the collection, processing, disposal, and monitoring systems required. Such costs presently constitute 3 to 5 percent of the total reactor facility cost; operating and maintenance costs have ranged between 5 and 10 percent of the overall plant operation and maintenance costs.

From an overall water pollution standpoint, a significant problem in the future may involve thermal effects from both nuclear and fossil fueled electric power plants. The magnitude and severity of thermal effects are highly dependent on local environmental conditions. That is, the availability of adequate surface water supplies for condenser cooling is becoming a major consideration in the siting of both nuclear and conventional thermal-electric generating stations. Nuclear plants of current design discharge more waste heat to the environment than a conventionally fired plant of the same size because of a lower thermal efficiency. As more efficient nuclear plants are produced, this difference in thermal effect between nuclear and fossil plants will be diminished. Auxiliary cooling systems, involving the use of reservoirs, ponds, or cooling towers, can be a solution, but installation costs of about \$5 per kilowatt of plant capacity may be required over a conventional river water cooling system. However, these costs may be offset by increased flexibility in site selection, which could result in lower fuel, power transmission, and land costs.

FUEL REPROCESSING PLANTS

During the chemical reprocessing of irradiated reactor fuel to recover unburned uranium and plutonium, highly radioactive wastes are produced which must be contained and isolated from man and his natural resources for hundreds of years. The magnitude of the high activity waste management problem with an expanding nuclear power industry has been under continuing assessment as an integral part of the Commission's radioactive effluent control research and development program. For example, during hearings before the Joint Committee on Atomic Energy on the subject of industrial radioactive waste disposal held in 1959, it was estimated that using the then cur-