

institutional framework for the system and, (b) the necessary monitoring network for most effective operation of the system. The study will also attempt to determine methods for determining variations in the charges to allow for upgrading in the use characteristics of the Nation's water resource over time. Attempts will be made also to determine industry attitude and response to such a system. These preparations are being made in conjunction with the Delaware River Basin Commission.

*Question 18: Recent news releases by the Department of the Interior suggest a "breakthrough" in control of algae in the waters receiving sewage plant effluent, through an inexpensive means of reducing the amount of phosphate in the effluent. Please explain the importance of the development reported, and how it relates to the testimony given the committee.*

Answer: Recent investigations at the municipal sewage treatment plant, San Antonio, Tex., by the research staff of our Robert S. Kerr Water Research Center, Ada, Okla., have indicated that by a combination of modifications to activated sludge process operating parameters, removal of phosphorus to the 80 to 90 percent level may be possible. The experimentation is still in the preliminary stage and much work remains to be done before such modifications could be applied on a broad scale throughout the Nation. The findings, however, are of potentially breakthrough significance because of the possibility opened for achieving much higher phosphate removals in conventional treatment systems then thought possible. Effort in this area is undergoing substantial acceleration.

In terms of the importance of this development, however, the discussion presented in response to questions 7 and 10 must be borne in mind. Even with increases in phosphorus removal to the order of 80 or 90 percent, the remaining 10 to 20 percent residual load will become of real significance in the near future. Further, elimination of algal blooms, the primary manifestation of accelerated eutrophication is not absolutely tied to the attainment of high efficiency phosphorus removal from municipal outfalls. The mechanisms of accelerated eutrophication and the waste components that are primarily responsible for the development of algal bloom nuisance conditions are incompletely known at this time. Nitrogen and phosphorus compounds are generally believed to be associated with the development of such conditions but the critical controlling contaminant could conceivably be some other trace contaminant presently unknown.

*Question 19: Is your agency doing any research on possibilities for stimulating growth of algae or other aquatic plants and harvesting them as a means of removing nutrients from sewage plant effluents?*

Answer: Algae, when their growth is stimulated in shallow ponds with frequent mixing, can accumulate within themselves at least 80 percent of the nitrogen and from 75 to more than 98 percent of the phosphorus in waste water depending upon the operating and environmental conditions employed. Removals of this order can theoretically be achieved if an efficient harvesting technique is used to separate the algae from the water. A variety of harvesting methods have been studied by a variety of investigators but none has yet been highly successful from both technical and economic standpoints. Moreover, the process is probably applicable only in areas of consistently high