

Exhibit D

STEVEN R. WHARTON

# Toward a Cleaner Aquatic Environment

Kenneth M. Mackenthun  
*Director, Technical Support Staff*

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stimulate a biological population to increase and become restrictive, or more detrimental, to a given water use.

Hutchinson (1957) states, "Of all elements present in living organisms, phosphorus is likely to be the most important ecologically, because the ratio of phosphorus to other elements in organisms tends to be greater than the ratio in primary sources of the biological elements. A deficiency of phosphorus, is therefore, more likely to limit productivity." Research over the succeeding years has not produced evidence that would discredit this basic observation.

Basic sources of nutrients to waterways are (1) tributary streams carrying land runoff and domestic and industrial wastes, (2) the biological and chemical interchange between bottom sediments and superimposed water, and (3) precipitation from the atmosphere. Tributary streams have been reported to carry 21 pounds of phosphorus per square mile of drainage area in sparsely settled forested areas, 225 pounds of phosphorus per square mile of drainage area in agricultural areas, and more than 6,000 pounds in densely populated urban areas (Keup, 1968).

The question is sometimes asked, how much algae can be grown from a given amount of phosphorus? Allen (1955) found that the maximum that could be grown in the laboratory on sewage, an excellent growth media for algae, was 1 to 2 g/l (dry weight) and in the field in sewage oxidation ponds the maximum was 0.5 g/l. Thus, assuming optimal growth conditions and maximum phosphate utilization, the maximum algal crop that could be grown from 1 pound of phosphorus would be 1,000 pounds of wet algae under laboratory conditions or 250 pounds wet algae under field conditions. Considering a cellular phosphorus content of 0.7 percent in algae, 1 pound of phosphorus could be distributed among 1,450 pounds of algae on a wet weight basis. A considered judgment suggests that to prevent biological nuisances, total phosphorus should not exceed 100  $\mu\text{g/l}$  P at any point within the flowing stream, nor should 50  $\mu\text{g/l}$  be exceeded where waters enter a lake, reservoir, or other standing water body. To enhance the quality of this Nation's lakes, reservoirs and estuaries, we must reduce to the ultimate phosphates, and all other nutrients where feasible, from all controllable sources.

With suitable environmental conditions, plants will develop and avail themselves of the space and available nutrients. With the applica-

lates. Some of these are metabolites that may function as stimulators to themselves self-destruct. After a group accumulates, it is thought that, in a sense, many extracellular substances (growth of certain other species depending first in a broad sense upon its inhibition) comes a reduction in the species is permitted to develop.

Natural waters contain created by fresh-water algae and bacteria and to fish in the aquatic environment not just one substance but The amount secreted and determined by the prevalence Thus sequences of algal conditions of a nutrient supply