Group Discussion on Agricultural and Urban Pollution

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Water pollution that results from agricultural activities and from the activities of human populations concentrated in urban areas differ only in that the former is introduced into the system with the fresh water run-off from each tributary stream whereas the latter is primarily from point source introductions. An exception to the former would of course be intensive livestock and poultry operations which concentrate large numbers of cattle, swine, chickens, or turkeys into small areas for the more economical production of meat or eggs. The environmental effects resulting from improper handling or treatment of the byproducts of agricultural and urban activities are essentially the same, however. Modification of the natural vegetation and terrain features can increase the rate of soil erosion by as much as 1000 times; organic material capable of depressing dissolved oxygen levels are produced; large numbers of pathogenic, nonpathogenic bacteria, and viruses develop and survive; pesticides and other toxic chemicals are utilized; nutrient elements such as nitrogen and phosphorus are constituents of the organic waste products. Estuaries and tidal waters are all too frequently the recipients of these materials in quantities which exceed the assimilation capacity, and environmental degradation as aquatic nuisance conditions result.

Data acquisition by remote sensing techniques can be of some value in water quality surveillance programs. At the present state-of-the-art, however, the applications are limited by the inability to detect and measure elemental constituents such as oxygen, phosphorus, nitrogen, heavy metals, etc.; organic compounds such as pesticides and PCB's and microscopic organisms such as bacteria and viruses. Value limitations are, however, imposed by the opacity of the water to the electromagnetic radiation now utilized in detection. In other words, only surface parameters can be detected and recorded. In view of the importance of subsurface characteristics, efforts should be strengthened in areas of instrument development and sophistication to permit scans of the entire water column.

The work group is of the opinion that remote sensing techniques can be utilized to locate and quantify levels of surface-suspended solids. These may be located in the upper tidal reaches of the tributary streams, just downstream from the transition zone between fresh and salt water (the turbidity maximum), in the vicinity of engineering projects or construction, and in the vicinity of extensive shoal areas during rough sea conditions. Remote sensing techniques could provide synoptic data on the Bay and its tributaries, provide information when sea surface conditions make in situ measurements difficult, and, if the sensing interval was properly scheduled, provide information on the movement and distribution of settleable solids.

Atypical phytoplankton populations resulting from hyperenrichment are also amenable to detection and measurement by remote sensing techniques. These populations may be characterized either by high biomass levels or by a change in species composition. Both parameters are important in evaluating water quality.

Instrumentation now available can detect patches of phytoplankton on and just below the water surface. Additional capabilities must be developed to quantify and characterize the populations.

Quantification may be possible by relating the chlorophyll-a concentration in the water to the standing crop. The work group is of the opinion that a precision of $\pm 10\ \mu g/l$ chlorophyll is necessary for the data to be of maximum value. Values of less than 25 $\mu g/l$ are considered to be within the normal range, 25 to 50 $\mu g/l$ indicative of atypical conditions, and values exceeding 50 $\mu g/l$ indicating degradation.

We recommend that instrumentation be developed to permit the identification of the groups of phytoplankton by remote sensing methods. Environmental quality is, in part, based upon the species composition of the plants present in

the population. As a start, discrimination between blue-green, green, diatom, and flagellate forms would be of value to scientists and engineers involved with water quality and management studies.

Data on the location and density of rooted aquatic plants in shallow water areas can also be determined. Additional information on the species composition of these populations would be of value.

In summary, at the present state-of-the-art there are limited applications for remote sensing techniques in water quality evaluations. If these techniques are utilized certain rules must be observed if the data are to have more than superficial value. These include:

(1) The laboratory development and calibration of instrumentation must be directed to the environmental data needs.

(2) The ground-truth data acquisition program must be closely coordinated and financed by the remote sensing program.

(3) The frequency of remote sensing data acquisition must be governed by the environmental characteristics of the test site. For example, in the initial fixed-wing platform programs, daily flights for a short period may be necessary to determine the variation within the system. In any flexible schedule, the timing should be determined by an advisory committee knowledgeable in the estuarine sciences.