SECTION 114

A PROGRAM TO ASSESS A THERMAL DISCHARGE ON TRINITY BAY, TEXAS

by

James B. Zaitzeff
U. S. Naval Research Laboratory
Washington, D. C.

Victor S. Whitehead
NASA-Manned Spacecraft Center
Houston, Texas

Estuarine processes are an area of great potential application in remote sensing. With increasing population growth and expansion of industrialization in coastal regions, estuaries are rapidly undergoing modifications of ecological and physical parameters, these being induced by man and by natural causes. In order for an efficient utilizations of estuary water resources (food, recreation, navigation, and as a disposal system) there is a need for a rapid accurate assessment of the effects of these modifications. This requirement complemented by the dynamic nature of the estuarine environment necessitates the spatial and temporal advantages of remote sensor instruments.

This requirement also has initiated a coordinated activity between several agencies, Figure 1, of which the overall objective is to establish a methodology whereby through the use of existing remote sensors, we can study the hydrodynamics, thermal, biological, and chemical characteristics of an estuary.

The construction of a large gas-fueled power generation plant, from which thermal waste water is discharged into a shallow estuary (Trinity Bay) has provided an opportunity to address a specific problem that is, to determine the impact of the thermal discharge on the bay. The bay and generation plant are well suited to the study, as both physical and mathematical hydraulic/thermal computer models of the bay are available. Also base-line data has been collected prior to and during the operation of the generation facility.

Specific objectives to data, to study the power plant effluent are:

a. To evaluate the application of a two dimensional mathematical model to the analysis of the thermal discharge, specifically, to verify the capability of the math model to predict the temperature distribution of Trinity Bay in the vicinity of the water outfall.

b. To compare the outputs of the Army Corps of Engineers physical model of Galveston--Trinity Bay and the mathematical models to the analysis of the thermal discharge plume characteristics.

c. To determine the heating affects by the discharge on key aquatic species specifically, the effects, if any, on "Ruppia maritima", a bottom grass that covers approximately 190 acres adjacent to the water outfall. The grass provides an important natural nursery for small shrimp, crabs, and young fish.

d. To evaluate the most effective balance between remote, in situ measurements and modeling in the determination of the discharge plume characteristics.

Objective number one will be discussed here. Basic date reported consists of aerial thermal infrared, and in situ measurements, as relating to the math model studies. In view of this objective, the key information to be determined is the extent and quantitative temperature determinations, of the outfall plume or mixing zone within the temperatures significantly above ambient are observed. The plume responds rapidly to winds and tides, and thus considerable quantities of synoptic temporal coverage via remote sensing provides an accurate assessment of temperatures and their release patterns. The assessment of ambient bay temperatures are also of much importance to this study, in particular, for a definition of real ambient bay values, and for a comparison to plume temperatures.

Trinity Bay is part of the Galveston Bay System, Figure 2, a typical gulf coastal plain estuary. The bay comprised approximately 90,000 acres or about 27% of the water area of the Galveston Bay System. It receives discharges from industrial and domestic sources, natural runoff, the Trinity River and other various smaller tributaries. The bay is relatively shallow, its central area is seven to eight feet deep, it has a complex circulation, and is biologically important to man.

The large gas fueled power generation plant now under construction by the Houston Lighting and Power Company, is located on Cedar Bayou, Figure 3. The plant is being built in six units, each unit planned to produce a capacity of about 750-800 megawatts and to circulate 750 c.f.s. of water through its condensers for cooling purposes. The ultimate capacity of the facility is 5000 megawatts and circulating 5000 c.f.s. of water by 1978.

In the planned configuration, water is drawn from upper Galveston Bay up Cedar Bayou and through the condensers where it will be heated approximately 20 degrees F. and discharged into a large cooling pond, (not yet completed) and Upper Trinity Bay, by a six mile canal. Houston Lighting and Power Company, estimate (based on model studies) that at the ultimate capacity, 2130 acres of Trinity Bay will be raised