

Modeling the Hydraulic Zone of Influence of Connecticut Yankee Nuclear Power Plant's Cooling Water Intake Structure

JOHN RICHARDSON*

Alden Research Laboratory, Holden, Massachusetts, USA

DOUGLAS A. DIXON

Electric Power Research Institute, Palo Alto, California, USA

Abstract.—Ecological studies performed in the late 1960s and throughout the 1970s sought to identify the impact of the Connecticut Yankee nuclear power plant (CY) located on the banks of the Connecticut River. These original studies relied on intensive biological sampling, hydrography, and inference based on observations. Numerical modeling was, at that time, in its infancy, and comprehensive dynamic simulations of river, lake, and estuarine systems required computer resources beyond the reach of most individuals and institutions. Today, detailed hydraulic analyses over large scales are practical, and unified approaches can now be used to study complex flow problems involving different near-field and far-field dynamics. For example, where scale models would have been used to study the dispersion of effluents from a heated water discharge in the past, today, this kind of analysis can be done on the computer using computational fluid dynamics (CFD) techniques. This paper demonstrates how the hydraulic zone of influence (HZI) of the CY cooling water intake structure (CWIS) can be determined from the results of CFD investigation. The analysis procedures are general and can be used for HZI or intake area of influence determination on other water body types (e.g., lakes, rivers, salt wedge estuaries, and open coastal locations).

Introduction

Ecological studies performed in the late 1960s and throughout the 1970s sought to identify the impact of the Connecticut Yankee nuclear power plant (CY) located on the banks of the Connecticut River (Merriman 1970; Merriman and Thorpe 2004 [1976], this volume). These original studies relied on intensive biological sampling, hydrography, and inference based on observations. Numerical modeling was, at that time, in its infancy, and comprehensive dynamic simulations of river, lake, and estuarine systems required computer resources beyond the reach of most individuals and institutions.

Recent developments in computer technology are providing new ways to integrate different kinds of data and to promote informed decision

making (e.g., this is the emphasis of *Hydroinformatics*—an expression coined in the 1980s by Michael Abbott, former director of the Danish Hydraulic Institute). As a result, initiatives like the EPA's Total Daily Maximum Load (TMDL) Program are being devised and a new generation of analysis tools are being implemented (e.g., Chen et al. 2004, this volume). Hydraulic modeling has developed similarly since the original Connecticut Yankee Ecological Study was performed.

Today, detailed hydraulic analyses over large scales are practical, and unified approaches can now be used to study complex flow problems involving different near-field and far-field dynamics. For example, where scale models would have been used to study the dispersion of effluents from a heated water discharge in the past, today, this kind of analysis can be done on the computer using computational fluid dynamics (CFD) techniques.

Emerging hydraulic modeling techniques,

* Corresponding author: johnbecky615@earthlink.net

