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Book Review

WATER-QUALITY ENGINEERING IN NATURAL SYSTEMS
Fate and Transport Processes in the Water Environment

David A. Chin

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Surface water and groundwaters are sources of drinking water for humans, and, along with coastal waters, are habitats for aquatic life. Also, these waters are depositories of discharges of municipal and industrial wastewaters. Water-quality engineering is a specialty area within environmental engineering that includes the subspecialties of water treatment, wastewater treatment, and water-quality control and monitoring in natural systems.

Detailing of the fundamental problems that describe the fate and transport of contaminants in the environment, *Water-Quality Engineering in Natural Systems. Fate and transport Processes in the Water Environment* covers the practical application of these equations to engineering design and environmental impact analysis relating to contaminant discharges into rivers, lakes, wetlands, ground water, and oceans.

The book begins with an introduction exploring the sources of water pollution and the control of water pollution and is followed in Chapter 2, *Water Quality* by an presentation of the various water quality standards, including the physical, chemical, and biological measures.

Chapter 3, *Fundamentals of fate and transport* covers the mathematical formulation of fate and transport processes in aquatic systems, including the advection-diffusion equation (ADE), and the fundamental mathematical solutions and properties of this equation. The ADE is applicable to all natural waters with the principal differences being the relative importance and nature of the fate and transport processes represented in the ADE.

In Chapter, 4 *Rivers and streams* the fate and transport processes in rivers and streams, is presented including the dispersion of contaminants originating from instantaneous spills and continuous discharges, the fate of volatile organic compounds in streams, the depletion of dissolved oxygen in streams resulting from the discharge and accumulation of biodegradable organics, and the determination of allowable loadings of various contaminants in impaired streams.

In the next Chapter, *Groundwater* there are described water-quality related processes in groundwater, including the natural quality of groundwater, quantification of sources of groundwater contamination, advection, dispersion, sorption onto aquifer materials, biochemical decay, and the fate and transport of nonaqueous phase liquids in groundwater. Detailed coverage is provided on the application of fate and transport principles to the remediation of contaminated groundwater.

Chapter 6, *Watersheds* covers water-quality based watershed management where the primary focus is on estimating the contaminant loading on receiving waters from activities within the watershed. Detailed attention is given to sources of pollution, fate and transport processes associated with urban and agricultural watersheds.

Chapter 7, *Lakes and Reservoirs* describes water-quality processes in lakes and reservoirs, with particular emphasis on quantitative relationships describing flow and dispersion, sedimentation, eutrophication, nutrient recycling, and thermal

stratification. Techniques to control eutrophication, dissolved oxygen levels, toxic contaminants, acidity, and aquatic plants are all covered.

Chapter 8, *Wetlands* describes the occurrence, function, and hydrology of wetlands the delineation of jurisdictional wetlands, and the design, construction, and operation of artificial (constructed) wetlands. Particular attention is given to factors controlling contaminant removal efficiencies is constructed wetlands.

Chapter 9, *Oceans and Estuaries* offers information about water-quality processes in oceans and estuaries, with particular attention to the design and operation of domestic wastewater outfalls and water-quality control in estuaries as they relate to the physical, chemical and biological conditions in an estuary.

The final two chapters are dedicated to analyzing water-quality measurements and modelling of water quality. Analysis of environmental data is covered in Chapter 10, *Analysis of Water-Quality Measurements*, which includes a concise review of the relevant basics of probability and statistics, and an exposition of statistical methods commonly used in analyzing water-quality data.

The fundamentals of numerical modelling are covered in Chapter 11, *Modeling of Water Quality*, with particular emphasis on calibration, validation, and estimation of predictive uncertainty when using numerical models.

The book *Water-Quality Engineering in Natural Systems. Fate and Transport Processes in the Water Environment* by David A. Chin presents the tools and concepts required for water-quality control in natural waters. These include an understanding of water-quality criteria, the fundamentals of fate and transport in natural waters, estimation of pollutant loading, and the design of remediation systems.

This book is obviously a very valuable tool for the specialists in the field, for researchers, and students for enlarging their horizon on water-quality engineering in natural systems.

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