Handbook of Water and Wastewater Treatment Technologies

Nicholas P. Cheremisinoff

Pollution Engineering

BH

HANDBOOK OF WATER AND WASTEWATER TREATMENT TECHNOLOGIES

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Preface

This volume covers the technologies that are applied to the treatment and purification of water. Those who are generally familiar with this field will immediately embrace the subject as a treatise on solid-liquid separations. However, the subject is much broader, in that the technologies discussed are not just restricted to pollution control hardware that rely only upon physical methods of treating and purifying wastewaters. The book attempts to provide as wide a coverage as possible those technologies applicable to both water (e.g., drinking water) and wastewater (i.e., industrial and municipal) sources. The methods and technologies discussed are a combination of physical, chemical and thermal techniques.

There are twelve chapters. The first of these provides an orientation of terms and concepts, along with reasons why water treatment practices are needed. This chapter also sets the stage for the balance of the book by providing an organizational structure to the subjects discussed. The second chapter covers the A-B-Cs of filtration theory and practices, which is one of the fundamental unit operations addressed in several chapters of the book. Chapter 3 begins to discuss the chemistry of wastewater and focuses in on the use of chemical additives that assist in physical separation processes for suspended solids. Chapters 4 through 7 cover technology-specific filtration practices. There is a wide range of hardware options covered in these three chapters, with applications to both municipal and industrial sides of the equation. Chapter 8 covers the subjects of sedimentation, clarification flotation, and coalescence, and gets us back into some of the chemistry issues that are important achieving high quality water. Chapter 9 covers membrane separation technologies which are applied to the purification of drinking water. Chapter 10 covers two very important water purification technologies that have found applications not only in drinking water supply and beverage industry applications, but in groundwater remediation applications. These technologies are ion exchange and carbon adsorption. Chapter 11 covers chemical and non-chemical water sterilization technologies, which are critical to providing high quality drinking water. The last chapter focuses on the solid waste of wastewater treatment - sludge. This chapter looks not only at physico-chemical and thermal methods of sludge dewatering, but we explore what can be done with these wastes and their impact on the overall costs that are associated with a water treatment plant operation. Sludge, like water, can be conditioned and sterilized, thereby transforming it from a costly waste, requiring disposal, to a useful byproduct that can enter into secondary markets. Particular emphasis is given to pollution prevention technologies that are not only more environmentally friendly than conventional waste disposal practices, but more cost effective.

What I have attempted to bring to this volume is some of my own philosophy in dealing with water treatment projects. As such, each chapter tries to embrace the individual subject area from a first-principles standpoint, and then explore case-

specific approaches. Tackling problems in this field from a generalized approach oftentimes enables us to borrow solutions and approaches to water treatment from a larger arsenal of information. And a part of this arsenal is the worldwide Web. This is not only a platform for advertising and selling equipment, but there is a wealth of information available to help address various technical aspects of water treatment. You will find key Web sites cited throughout the book, which are useful to equipment selection and sizing, as well as for troubleshooting treatment plant operational problems.

Most chapters include a section of recommended resources that I have relied upon in my own consulting practice over the years, and believe you will also. In addition, you will find a section titled ***Questions for Thinking and Discussing*** in eleven of the twelve chapters. These chapter sections will get you thinking about the individual subject areas discussed, and challenge you into applying some of the calculation methods and methodologies reviewed. Although my intent was not to create a college textbook, there is value in using this volume with engineering students, either as a supplemental text or a primary text on water treatment technologies. If used as such, instructors will need to gauge the level of understanding of students before specifying the book for a course, as well as integrate the sequence and degree of coverage provided in this volume, for admittedly, for such a broad and complex subject, it is impossible to provide uniform coverage of all areas in a single volume. My own experience in teaching shows that the subject matter, at the level of presentation in this volume is best suited to students with at least 3 years of engineering education under their belts.

Another feature that is incorporated into each chapter is the use of sidebar discussions. These highlight boxes contain information and facts about each subject area that help to emphasize important points to remember, plus can assist plant managers in training technical staff, especially operators on the specific technologies relied upon in their operations. Finally, there is a ***Glossary*** of several hundred terms at the end of the book. This will prove useful to you not only when reading through the chapters, but as a general resource reference.

In some cases equipment suppliers and tradenames are noted, however these citations should not be considered an endorsement of products or services. They are cited strictly for illustrative purposes. Also recognize, that neither I, nor the publisher guarantee any designs emanating from the use of resources or discussions presented herein. Final designs must be based upon strict adherence to local engineering codes, and federal safety and environmental compliance standards.

A heartfelt thanks is extended to Butterworth-Heinemann Publishers for their fine production of this volume, and in sharing my vision for this series, and to various companies cited throughout the book that contributed materials and their time

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