

Internal Corrosion Control in Water Distribution Systems

AWWA MANUAL M58

First Edition



**American Water Works
Association**

MANUAL OF WATER SUPPLY PRACTICES — M58, First Edition

Internal Corrosion Control in Water Distribution Systems

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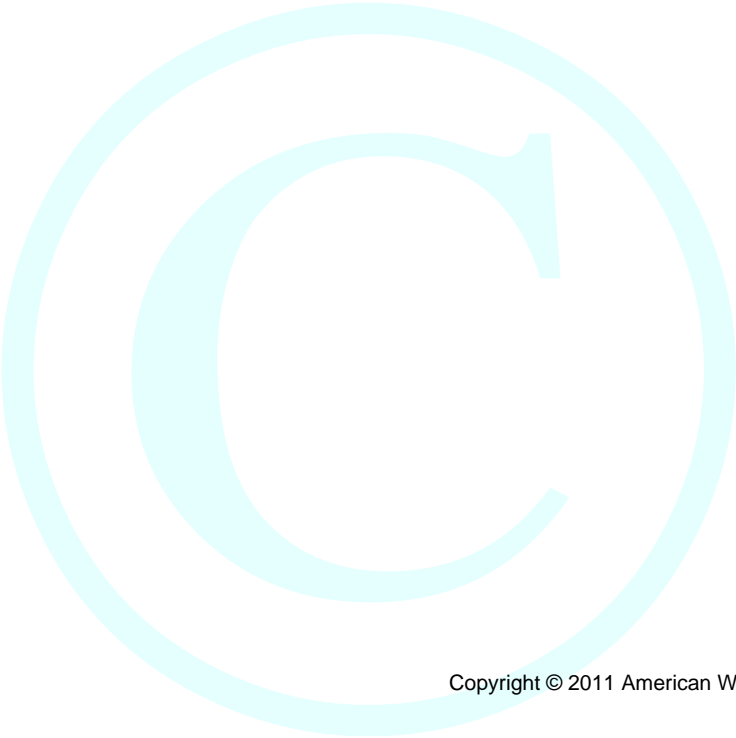
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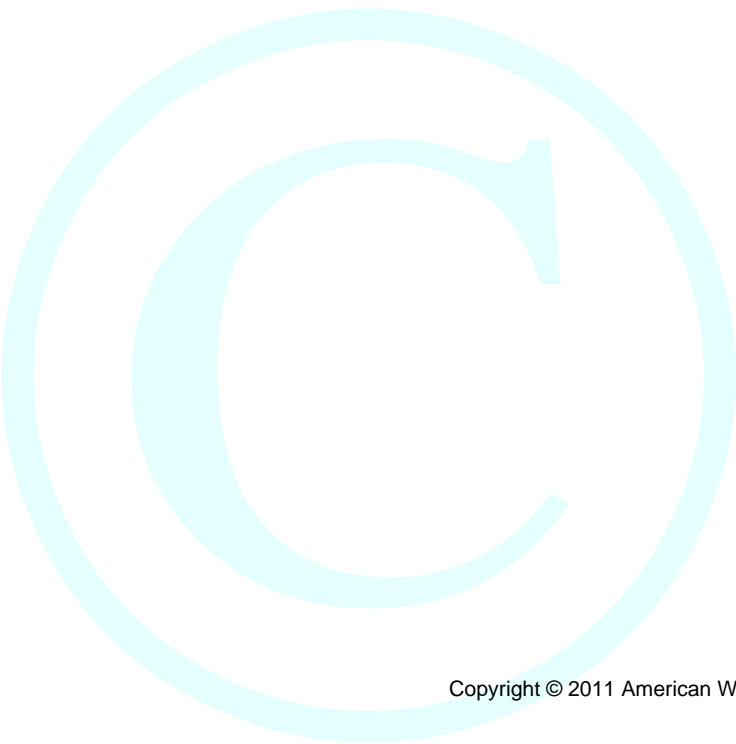
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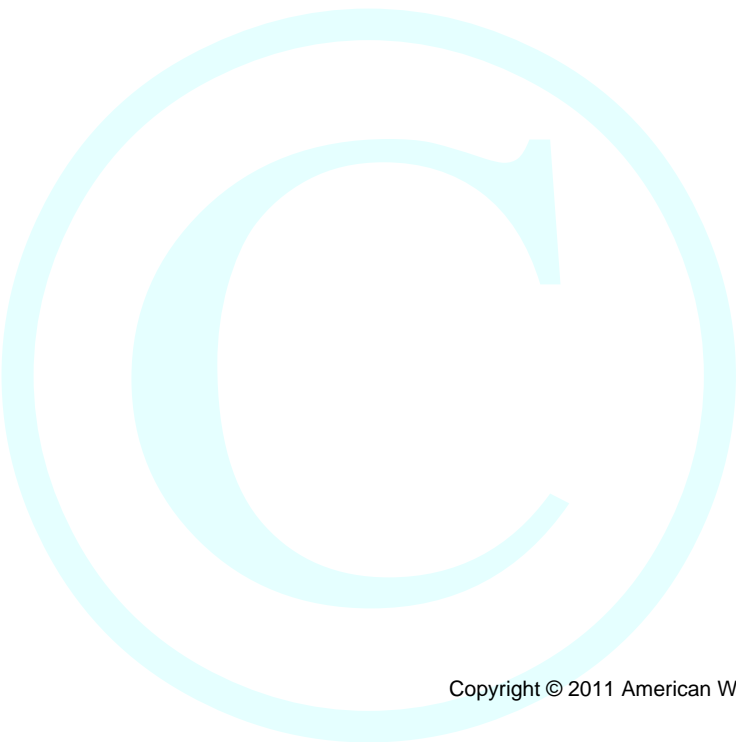
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Preface

Volunteers from the Distribution System Water Quality Committee of the American Water Works Association (AWWA) have prepared this manual of practice. The need for a manual on corrosion assessment, monitoring, and control results from the increased focus on corrosion-related water quality and infrastructure impacts in drinking water distribution systems. Considerable literature is available regarding the factors that influence corrosion in the distribution system. However, little practical guidance is available to public water systems regarding the design, implementation, and maintenance of an effective corrosion control program. This manual seeks to provide that practical guidance.

This manual helps readers understand the factors that influence corrosion, assess corrosion-related impacts, and develop a strategy to implement and maintain effective corrosion control in the water distribution system.

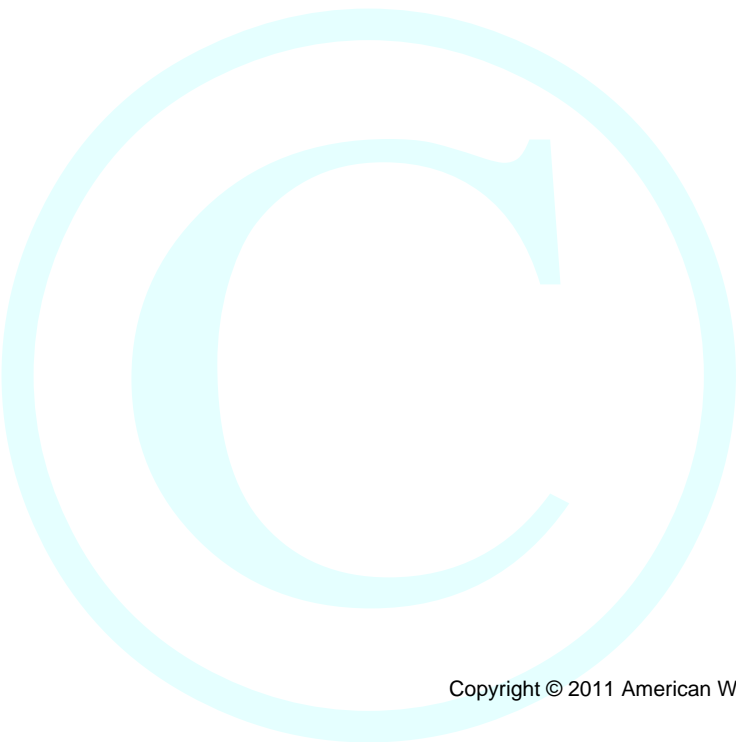
The manual is organized in three main parts. Chapters 1 through 3 help the reader develop an understanding of the factors that influence corrosion and determine potential causes of corrosion in the distribution system. Chapters 4 and 5 present corrosion control alternatives and outline development of an effective corrosion control strategy. Chapter 6 discusses monitoring and optimization to maintain effective corrosion control treatment. Appendix A provides an example of how to achieve and maintain stable pH in the distribution system for the purposes of maintaining effective corrosion control. Appendix B provides a very thorough case study of one utility's approach to identifying the causes of and successfully dealing with corrosion-related water quality problems. Each chapter may be read stand-alone. Therefore, there is some limited repetition among the chapters to furnish necessary background of important concepts; references to other chapters are provided. Appendix C is a summary of the 2008 AWWA-DSWQC Corrosion Survey sponsored by the American Water Works Association (AWWA) Water Quality & Technology Division's Distribution System Water Quality Committee (DSWQC) and funded by the AWWA Technical and Education Council, conducted in the fall of 2008. This web-based survey summarized corrosion control objectives, practices, effectiveness of practices (US utilities), and corrosion control needs (primarily for Canadian utilities) for over 150 utilities in North America.

As previously mentioned, this manual is intended to be a practical guide to implementation of an effective corrosion control program. As a result, it provides only an overview of available research and literature in many areas. To assist the reader in identifying additional research or literature that may be of interest, many chapters include additional suggested readings that might be of interest and that will provide more detail regarding a number of the main topics contained in that chapter.

The materials included herein provide a compendium of the state-of-the-art knowledge as of the writing of this manual. The renewed focus on corrosion in the distribution system has resulted in much new research in this area. As a result, more data and a better understanding of some key corrosion concepts are now being developed, including: the limited applicability of calcium carbonate saturation indices as predictors of corrosion; an increased focus on the prevalence of microbially influenced corrosion; the role of coagulant change, chloride, and sulfate in corrosion; the importance of oxidation-reduction potential; and better tools for evaluating and managing corrosion control effectiveness. As a result, this manual will likely be updated in the future to reflect these advances and better understanding of corrosion and corrosion control treatment in drinking water distribution systems.

Editor's note: Throughout this manual, references are made to the Awwa Research Foundation (AwwaRF), the original name of the foundation. As of 2009, the foundation changed its name to the Water Research Foundation. Any publication prior to 2009 will reflect the foundation's original name.

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Chapter 1

Overview of Internal Corrosion Impacts in Drinking Water Distribution Systems

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INTRODUCTION

Prior to development of a corrosion control program, it is important to first gain an understanding of the factors that influence internal corrosion and metal release in drinking water distribution systems. Afterward, implementation of an effective corrosion control program can be accomplished in eight steps (Table 1-1).

Table 1-1 Eight steps to implementing an effective corrosion control program

| Step | Discussed in Chapter(s) |
|---|-------------------------|
| • Develop an understanding of the general concepts behind internal corrosion and metal release in drinking water distribution systems | Ch. 1, Ch. 2 |
| • Determine the extent and magnitude of corrosion | Ch. 3 |
| • Determine the possible causes of corrosion | Ch. 2, Ch. 3 |
| • Assess corrosion control alternatives | Ch. 4 |
| • Develop a corrosion control strategy | Ch. 4 |
| • Implement a corrosion control program | Ch. 5 |
| • Monitor the effectiveness of the corrosion control program | Ch. 3, Ch. 6 |
| • Optimize the corrosion control program if necessary | Ch. 5, Ch. 6 |