Manual of Water Supply Practices

M14

# Backflow Prevention and Cross-Connection Control

## Recommended Practices

Fourth Edition

American Water Works Association

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Manual of Water Supply Practices—M14, Fourth Edition

# Backflow Prevention and Cross-Connection Control: Recommended Practices



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Project Manager/Senior Technical Editor: Melissa Valentine
Senior Manuals Specialist: Molly Beach
Senior Production Editor: Cheryl Armstrong

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American Water Works Association

American Water Works Association
6666 West Quincy Avenue
Denver, CO 80235-3098
**awwa.org**

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# Preface

This is the fourth edition of the AWWA Manual M14, *Backflow Prevention and Cross-Connection Control: Recommended Practices*. It provides both technical and general information to aid in the development, implementation, and management of a cross-connection control and backflow prevention program, and an understanding of backflow prevention and cross-connection control concepts. This manual is a review of recommended practice. It is not an AWWA standard calling for compliance with certain requirements. It is intended for use by water suppliers and municipalities of all sizes, whether as a reference book or a textbook for those not familiar with backflow prevention and cross-connection control.

This manual reviews regulatory provisions established to protect the potable water supply. To achieve this goal, products and measures are discussed to assist in the determination of controlling hazardous cross-connections. For fundamental knowledge and a thorough understanding, this entire manual should be carefully studied. Readers will also find the manual a useful source of information when assistance is needed with specific or unusual connections to the potable water supply.

This fourth edition of M14 includes updates to regulatory concerns and products that protect the water supply, and new material on establishing programs to control cross-connections, including surveying of piping systems to identify and monitor such connections.

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# Acknowledgments

The AWWA Technical and Educational Council, the Distribution Plant Operations Division, and the Cross-Connection Control committee gratefully acknowledge the contributions made by those volunteers who drafted, edited, and provided the significant and critical commentary essential to updating M14. The Technical Review Board members dedicated numerous hours in the final stages of preparation of this edition to ensure the overall technical quality, consistency, and accuracy of the manual.

**Technical Review Board Members**

*Stuart F. Asay,* Backflow Prevention Institute IAPMO, Westminster, Colo.
*Joseph A. Cotruvo,* Joseph Cotruvo & Associates LLC, Washington, D.C.
*Dawn M. Flancher,* American Water Works Association, Denver, Colo.
*Aneta King,* Halton Regional Muncipality, Oakville, ON, Canada
*Randolph J. Pankiewicz,* Illinois American Water, Belleville, Ill.

**Contributors to the 4th edition**

*Rand H. Ackroyd,* Deceased, Rand Technical Consulting LLC, Newburyport, Mass.
*Stuart F. Asay,* Backflow Prevention Institute IAPMO, Westminster, Colo.
*Roland Asp,* National Fire Sprinkler Association Inc., Patterson, N.Y.
*Nick Azmo,* Azmo Mechanical Inc., Piscataway, N.J.
*Lou Allyn Byus,* Retired, Jacksonville, Ill.
*Dave Bries,* City of Montrose, Montrose, Colo.
*Nicole Charlton,* Philadelphia Water Department, Philadelphia, Pa.
*Sean Cleary,* Backflow Prevention Institute IAPMO, Scranton, Pa.
*Richard A. Coates,* Retired, Miami, Fla.
*Alicia A. Connelly,* City of Norfolk, Norfolk, Va.
*Daniel Eisenhauer,* Backflow Solutions Inc., Alsip, Ill.
*Dylan Gerlack,* EPCOR Water Services, Edmonton, AB, Canada
*Steve Gould,* Peterborough Utilities Commission, Peterborough, ON, Canada
*John F. Graham,* California Water Service Company, Chico, Calif.
*James W. Green,* City of Calgary, Calgary, AB, Canada
*Byron Hardin,* Hardin and Associates Consulting LLC, Coppell, Texas
*John F. Higdon,* Conbraco Industries, Matthews, N.C.
*James Holeva,* retired, Fall River, Mass.
*Robert Hunter,* City of Norfolk, Norfolk, Va.
*Alissa Kantola,* Val-Matic Valves & Manufacturing Corp., Elmhurst, Ill.
*Aneta King,* Halton Regional Municipality, Oakville, ON, Canada
*Mark S. Kneibel,* Hydro Designs Inc., Jenison, Mich.
*Diane Meyer,* Val-Matic Valves & Manufacturing Corp., Elmhurst, Ill.
*Vince Monks,* Louisville Water Company, Louisville, Ky.
*Dan O'Lone,* USEPA, Atlanta, Ga.
*John E. Ralston,* Louisville Water Company, Louisville, Ky.
*Paul H. Schwartz,* University of Southern California FCCCHR, Los Angeles, Calif.
*Pauli Undesser,* Water Quality Association, Lisle, Ill.
*Barry Walter,* Deceased, Hydro Designs Inc., Chester, Md.

*Karl Wiegand,* Globe Fire Sprinkler Corp., Standish, Mich.
*Michelle J. Williams,* City of Norfolk, Norfolk, Va.

**Agency Contributors to the 4th edition**

New England Water Works Association, a Section of AWWA
AWWA Pacific Northwest Section
The American Society of Sanitary Engineering (ASSE)
University of Florida, Center for Training, Research, and Education for Environmental Occupations (UF TREEO)

# Dedication

The 4th edition of AWWA's Manual M14, *Backflow Prevention and Cross-Connection Control: Recommended Practices*, is dedicated to Rand Ackroyd and Barry Walter. During the revision of this manual edition, the industry lost two valuable professionals that were vital resources and contributors who eagerly shared their collective wisdom.

## Rand Ackroyd

*Rand Ackroyd* became an active member of the M14 committee in the early 1980s. His experience as vice president of engineering for Watts Regulator Co. brought a wealth of technical information regarding backflow preventers, their capabilities, and proper applications. After leaving Watts, he continued his active involvement as a go-to resource for nearly every aspect of backflow prevention.

## Barry Walter

*Barry Walter* will be remembered as a professional who was passionate about his work in the backflow prevention industry. He derived great satisfaction from teaching a group about the subject and from participants gaining an understanding of the important health and safety aspects of the subject. While working on this edition of the manual, he was instrumental in coordinating several chapter teams, working toward consensus, and striving to achieve the best reference manual on the subject.

These valuable committee members will be missed but never forgotten.

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# Metric Conversions

| | | | | |
|---|---|---|---|---|
| **Linear Measurement** | | | | |
| inch (in.) | × | 25.4 | = | millimeters (mm) |
| inch (in.) | × | 2.54 | = | centimeters (cm) |
| foot (ft) | × | 304.8 | = | millimeters (mm) |
| foot (ft) | × | 30.48 | = | centimeters (cm) |
| foot (ft) | × | 0.3048 | = | meters (m) |
| yard (yd) | × | 0.9144 | = | meters (m) |
| mile (mi) | × | 1,609.3 | = | meters (m) |
| mile (mi) | × | 1.6093 | = | kilometers (km) |
| millimeter (mm) | × | 0.03937 | = | inches (in.) |
| centimeter (cm) | × | 0.3937 | = | inches (in.) |
| meter (m) | × | 39.3701 | = | inches (in.) |
| meter (m) | × | 3.2808 | = | ft (ft) |
| meter (m) | × | 1.0936 | = | yards (yd) |
| kilometer (km) | × | 0.6214 | = | miles (mi) |
| **Area Measurement** | | | | |
| square meter ($m^2$) | × | 10,000 | = | square centimeters ($cm^2$) |
| hectare (ha) | × | 10,000 | = | square meters ($m^2$) |
| square inch ($in.^2$) | × | 6.4516 | = | square centimeters ($cm^2$) |
| square foot ($ft^2$) | × | 0.092903 | = | square meters ($m^2$) |
| square yard ($yd^2$) | × | 0.8361 | = | square meters ($m^2$) |
| acre | × | 0.004047 | = | square kilometers ($km^2$) |
| acre | × | 0.4047 | = | hectares (ha) |
| square mile ($mi^2$) | × | 2.59 | = | square kilometers ($km^2$) |
| square centimeter ($cm^2$) | × | 0.16 | = | square inches ($in.^2$) |
| square meters ($m^2$) | × | 10.7639 | = | square ft ($ft^2$) |
| square meters ($m^2$) | × | 1.1960 | = | square yards ($yd^2$) |
| hectare (ha) | × | 2.471 | = | acres |
| square kilometer ($km^2$) | × | 247.1054 | = | acres |
| square kilometer ($km^2$) | × | 0.3861 | = | square miles ($mi^2$) |
| **Volume Measurement** | | | | |
| cubic inch ($in.^3$) | × | 16.3871 | = | cubic centimeters ($cm^3$) |
| cubic foot ($ft^3$) | × | 28,317 | = | cubic centimeters ($cm^3$) |
| cubic foot ($ft^3$) | × | 0.028317 | = | cubic meters ($m^3$) |
| cubic foot ($ft^3$) | × | 28.317 | = | liters (L) |
| cubic yard ($yd^3$) | × | 0.7646 | = | cubic meters ($m^3$) |

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Chapter 1

# Introduction

For millennia, people have been concerned with obtaining and maintaining pure and safe water supplies. Archeological studies reveal that as early as 3000 BC, the ancient Egyptian State had a government official who was required to inspect the country's water supply every 10 days. With the widespread use of water closets in the 1800s came direct cross-connections with water mains. This brought into focus the problem that, as one nineteenth century authority stated, "foul matters may get into the pipes."* Currently, many government and industry professionals are aware of the need to prevent contamination of potable water supplies through cross-connections. However, the water supplier goals and levels of involvement may vary.

## PURPOSE OF MANUAL

This manual provides guidance to all professionals working with the potable water supply on the recommended procedures and practices for developing, operating, and maintaining an efficient and effective cross-connection control program. The manual also provides insight into the basic areas that should be addressed to ensure that public water system connections are made safely; that those connections will be operated and maintained to ensure water quality; and that public water suppliers have the basic knowledge needed to assist in this effort. The purpose of any such program is to reduce the risk of contamination or pollution of the public water system.

A cross-connection is an actual or potential connection between any part of a potable water system and an environment that would allow substances to enter the potable water system. Those substances could include gases, liquids, or solids, such as chemicals, water products, steam, water from other sources (potable or nonpotable), and any matter that may change the color or taste of water or add odor to water.

* A.J. Keenan, C.S.I., B.C. Section AWWA Cross-Connection Control, September 1977.