# TECHNICAL APPLICATION BULLETIN

# Silver

**Recognized Treatment Techniques For Meeting Drinking Water Regulations For The Reduction Of Silver From Drinking Water Supplies Using Point-of-Use/Point-of-Entry Devices And Systems**

**PREPARED AND DISTRIBUTED BY THE**

Water Quality® ASSOCIATION

# TECHNICAL APPLICATION BULLETIN

# Silver

**Recognized treatment techniques for meeting drinking water regulations for the reduction of silver using point-of-use and point-of-entry (POU/POE) devices and systems.**

## Chemistry & Health Effects

Biologically, silver is a nonessential, nonbeneficial element to humans. It has never been found to cause a problem to any one in United States due to its presence in drinking water from natural sources. However because of its bactericidal abilities, silver is used as a water bacteriostat in carbon containing water filters. The silver is deposited onto the carbon granules to potentially inhibit the growth of bacteria on the surfaces of these carbon particles. Such filters tend to leach out trace levels of silver into the effluent water. At these concentrations, the ingestion of silver has no detrimental effect on humans. When ingested and absorbed, silver is held indefinitely within tissue, particularly skin, eyes, and mucous membranes. Skin discoloration is a cosmetic effect related to silver ingestion. This effect, called argyria, does not impair body function.

A standard has been set, however, because silver is used as indicated above as an antibacterial agent in many home water treatment devices, and so USEPA believes it presents a potential problem which deserves attention. The U.S. Environmental Protection Agency has set a nonenforceable secondary standard for silver because of its ability to cause aesthetic discolorations of the skin or argyria. The Secondary Maximum Contaminant Level (SMCL) for silver is 0.10 (milligrams per liter) mg/L.

## Treatment Alternatives.

Current technology suggests that several techniques may be used for removing the silver ion from drinking water including reverse osmosis, distillation, and cation exchange.

Reverse osmosis is capable of reducing the silver cation concentration by up to 90 percent of the influent water levels.

Distillation is capable of reducing the silver concentration by greater than 98 percent.

The treatment methods listed herein are generally recognized as techniques that can effectively reduce the listed contaminants sufficiently to meet or exceed the relevant MCL. However, this list does not reflect the fact that point-of-use/point-of-entry (POU/POE) devices and systems currently on the market may differ widely in their effectiveness in treating specific contaminants, and performance may vary from application to application. Therefore, selection of a particular device or system for health contaminant reduction should be made only after careful

investigation of its' performance capabilities based on results from competent equipment validation testing for the specific contaminant to be reduced.

As part of point-of-entry treatment system installation procedures, system performance characteristics should be verified by tests conducted under established test procedures and water analysis. Thereafter, the resulting water should be monitored periodically to verify continued performance. The application of the water treatment equipment must be controlled diligently to ensure that acceptable feed water conditions and equipment capacity are not exceeded.

| **Contaminant** | **SMCL*, mg/L** | **Treatment Methods** |
|---|---|---|
| Silver Cation 0.10 | 0.10 (total silver) | Reverse Osmosis, Distillation, Strong Acid Cation Exchange ($Na^+$ form). |

*The U.S. EPA has now established only a recommended Secondary Maximum Contaminant Level (SMCL) for silver because its effects are aesthetic rather than of health significance.

*The Water Quality Association publishes this Technical Application Bulletin as a service to its members and the interested public. Information contained herein is based upon the most recent public data known as of the publication date, which is printed at the bottom of the last page, and of course, cannot take into account relevant data published thereafter. The Water Quality Association makes no recommendations for the selection of a treatment system, and expressly disclaims any responsibility for the results of the use of any treatment method or device to reduce or remove a particular contaminant.*

**ACKNOWLEDGEMENT**

WQA wishes to express sincere appreciation for the unselfish contributions of the following members of WQA who contributed their time and expertise toward the completion of this bulletin.

**Water Sciences Committee**

Frank A. Brigano, Ph.D.
Michael Gottlieb
Joseph F. Harrison, P.E., CWS-VI
Bret L. Petty, CWS-II
Robert B. Ruhstorfer II, CWS-V
Glen Trickle, P.E.
Stephen J. VerStrat
Rod Yoder

*Contributors and Reviewers*

Jeffrey G. Franks, CWS-V
Michael Gottlieb
Joseph F. Harrison, P.E., CWS-VI
Michael C. Keller
Charles F. Michaud, CWS-VI
Albert F. Preuss, Ph.D.
P. Regunathan, Ph.D
James Sabzali
John Schlafer, CWS-VI, CI



This reference document is published by:

Water Quality ASSOCIATION

**National Headquarters & Laboratory**
**4151 Naperville Road • Lisle, Illinois 60532**
**Tel: 630 505 0160 • Fax: 630 505 9637**

R43p

PRINTED IN USA
03/04