Water Fluoridation
Principles and Practices

AWWA MANUAL M4
Fifth Edition

American Water Works Association

Science and Technology
AWWA unites the drinking water community by developing and distributing authoritative scientific and technological knowledge. Through its members, AWWA develops industry standards for products and processes that advance public health and safety. AWWA also provides quality improvement programs for water and wastewater utilities.
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Foreword

This manual assists decision makers planning fluoridation installations, engineers designing them, and water utility personnel operating them. The manual presents guidelines and is not intended to take the place of expert advice. Anyone planning or using fluoridation should carefully consider fluoride research, regulations, and methods.

The first edition of AWWA Manual M4 was prepared from material supplied and previously published by the US Environmental Protection Agency. This fifth edition updates the following major areas:

- Health effects
- State and federal regulations
- Defluoridation treatment
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Chapter 1

History, Theory, and Chemicals

Fluoridation treatment in this manual refers to the addition or removal of fluoride from drinking water to maintain an optimum level to reduce tooth decay. Fluoridation has been practiced for more than 50 years. This chapter discusses the history of fluoridation and the theory of how it reduces tooth decay. The chapter summarizes the results of health effects studies and addresses legal issues. The common chemicals used in fluoridation are also discussed.

HISTORY AND THEORY

Fluoridation History

In 1908, Dr. Frederick McKay, a dentist in Colorado Springs, Colo., became concerned because the teeth of many children in the community were mottled or discolored. Investigations showed that excessive amounts of fluoride in the local water supply caused the mottling. In other towns using naturally fluoridated water, mottled teeth appeared only when, as in Colorado Springs, the fluoride content of the water was abnormally high. This mottling was later termed dental fluorosis. Fluorosis occurs only when fluoride is consumed during childhood tooth formation, generally between the ages of 6 months and 3 years.

In the 1920s, the teeth of thousands of children and the water supplies of the communities in which they lived were evaluated. By 1931, the results showed significant relationships between the fluoride concentration in the drinking water and the incidence of tooth decay, technically called dental caries. Three distinct relationships were discovered (Figure 1-1).

1. When the fluoride level exceeds approximately 1.5 mg/L, any further increase does not significantly decrease the incidence of decayed, missing, or filled teeth, but higher levels do increase the occurrence and severity of mottling.