



**American Water Works
Association**

The Authoritative Resource on Safe Water®

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AWWA Standard

Ferrous Sulfate

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Foreword

This foreword is for information only and is not a part of ANSI/AWWA B402.

I. Introduction.

I.A. *Background.* In 1903, the use of ferrous sulfate (FeSO_4) as a coagulant was introduced in the United States in Quincy, Ill., by William B. Bull. Lime was used in conjunction with ferrous sulfate because it aided in the oxidation and precipitation of the iron as ferric hydroxide. The first large city to use this combination was St. Louis, Mo., in 1904. "This was done in great haste in order that the visitors to the St. Louis Exposition might not be repelled by the turbid water which St. Louisans put up with since Kirkwood's recommendation for sedimentation and slow sand filtration was ruthlessly thrust aside in 1866. A permanent plant was soon built. Next among the large cities to use sulfate of iron and lime were Cincinnati, 1907, and New Orleans, 1909."*

The combination of ferrous sulfate and lime is an effective coagulant for the clarification of turbid raw waters. Ferrous sulfate is also used as a base material for the preparation of chlorinated copperas, another effective coagulant used for the treatment of some waters. Chlorinated copperas is formed by reacting ferrous sulfate ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$) with chlorine in the ratio of 7:1. Chlorine solution is added to a solution of ferrous sulfate, usually in an enlarged pipe section that serves as a retention tank and permits complete oxidation of the ferrous sulfate to the ferric form.

Ferrous sulfate is produced as a co-product in the manufacture of certain metals and compounds, such as titanium dioxide. The principal sources providing the greatest quantity of ferrous sulfate are the sulfate process for the manufacture of titanium dioxide and the spent sulfuric acid solutions from the pickling of steel, known as pickle liquor. For shipping, solutions made from these two sources are reduced to moist and dried crystalline forms. For applications, they are dissolved and applied to water through chlorine oxidizers or with lime. Moist ferrous sulfate crystals are produced in a heptahydrate form ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$) containing up to 10 percent free moisture and 17 to 19 percent iron. This form of ferrous sulfate is not free flowing and is generally used in large quantities for water

*Baker, M.N., 1948. *The Quest for Pure Water*, ANSI/AWWA, Denver, Colo.

treatment. Dried ferrous sulfate, which is produced by dehydrating moist ferrous sulfate crystals, can be obtained in two hydrate forms—heptahydrate ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$) containing 19.5 to 20.5 percent iron and monohydrate ($\text{FeSO}_4 \cdot \text{H}_2\text{O}$) containing 29 to 31 percent iron. The practice of shipping “pickle liquor” in liquid form began in about 1965 and is still largely confined to areas within reasonable hauling distance of heavy-steel producers. Today, liquid ferrous sulfate, produced by dissolving moist or dried crystals, contains less free sulfuric acid than “pickle liquor.” Because of transportation costs, it is generally sold within a 250-mi (402-km) radius of suppliers. Liquid ferrous sulfate normally contains a minimum of 5.5 percent ferrous iron or 0.5 lb of ferrous iron per gal of liquid ferrous sulfate solution (60 kg/m^3).

I.B. History. The first edition of this standard was prepared by the AWWA Committee on Ferrous Sulfate and was approved by the AWWA Board of Directors on June 2, 1968. Subsequent revisions to ANSI/AWWA B402 were prepared by the AWWA Standards Committee on Iron Salts, Aluminum Salts, and Related Coagulant Aids and approved on Jan. 27, 1985, Jan. 28, 1990, Jan. 22, 1995, and June 11, 2000. This sixth edition was approved by the AWWA Board of Directors on June 11, 2006.

I.C. Acceptance. In May 1985, the US Environmental Protection Agency (USEPA) entered into a cooperative agreement with a consortium led by NSF International (NSF) to develop voluntary third-party consensus standards and a certification program for all direct and indirect drinking water additives. Other members of the original consortium included the American Water Works Association Research Foundation (AwwaRF) and the Conference of State Health and Environmental Managers (COSHEM). The American Water Works Association (AWWA) and the Association of State Drinking Water Administrators (ASDWA) joined later.

In the United States, authority to regulate products for use in, or in contact with, drinking water rests with individual states.* Local agencies may choose to impose requirements more stringent than those required by the state. To evaluate the health effects of products and drinking water additives from such products, state and local agencies may use various references, including two standards developed under the

*Persons outside the United States should contact the appropriate authority having jurisdiction.