Trihalomethanes (THMs) and Haloacetic Acids (HAA’s) are formed when chlorine reacts with the organic precursors in raw water. These precursors include humic and fulvic acids. Moving the point of chlorination from the raw water to later in the treatment and practicing effective coagulation of the precursors can result in a 40% to 70% reduction in trihalomethane levels. Current regulations limit THM concentrations in finished water to 80 µg/L and HAA concentrations in finished water to 60 µg/L.

Permanganate is used in these systems as an alternate oxidant to pre-chlorination. Further reduction (5%-20%) in THM and HAA concentrations may result from permanganate addition. The primary purpose of permanganate treatment in these cases is as a substitute pre-oxidant for chlorine to oxidize organics causing tastes and odors, and to oxidize inorganic iron and manganese. Permanganate is not a substitute disinfectant for chlorine.

Laboratory tests simulating plant conditions of time, addition of other treatment chemicals, etc., are conducted to determine the Permanganate Value (PV_t), where t is time. The procedure is described in Carus Form #3353. This is the raw water permanganate demand in a given period of time.

Permanganate is usually fed at the intake to allow the oxidant to react with the raw water before the addition of other treatment chemicals. A residual of 0.1 to 0.2 mg/L MnO_4^-1 should be maintained in the water entering the treatment plant. Control can be visual or monitored using residual permanganate analytical methods given in Standard Method 4500 - KMnO_4.

Raw Water Organic Compounds + MnO_4^-1 -> MnO_2 + No Trihalomethanes Formed No Haloacetic Acids Formed

Normal dosages will range between 0.5 and 2.5 mg/L MnO_4^-1 depending on the degree of raw water contamination. The average dosage is ~1.0 mg/L MnO_4^-1.

Proper feed equipment specially designed to handle permanganate is recommended. The product, an aqueous solution, is introduced into the system. Operators should be trained to monitor permanganate residuals and to exercise proper safety precautions when handling the oxidant.

A cost-effective disinfectant by-product control program includes the application of permanganate in place of raw water chlorination. Permanganate does not form trihalomethanes or haloacetic acids, oxidizes taste and odor producing compounds, and aids in the coagulation process.

REFERENCES
4. Ficek, K.J., Boll, J.E. Potassium Permanganate: An Alternative to Prechlorination, Aqua, No. 7 (1980). Carus Form #240

For further information on CAIROX® potassium permanganate or CARUSOL® liquid permanganate product characteristics and availability, contact Carus Corporation at 1-800-435-6856.
OTHER APPLICATIONS

• Taste & Odor Control
• Iron & Manganese Removal
• Biosolids Odor Control
• Arsenic & Radium Control

LABORATORY SUPPORT
Carus Corporation has technical assistance available to answer questions, evaluate treatment alternatives, and perform laboratory testing. Our laboratory capabilities include: Treatability Studies, Feasibility Studies, and Analytical Services.

FIELD SERVICES
As an integral part of our technical support, Carus provides extensive on-site treatment assistance. We offer full application services, including technical expertise, supervision, testing, and feed equipment design and installation in order to accomplish a successful evaluation and/or application.

CARUS CORPORATION
During its more than 100-year history, Carus’ ongoing reliance on research and development, as well as its emphasis on technical support and customer service, have enabled the company to become the world leader in permanganate, manganese, oxidation, and base-metal catalyst technologies.

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