Spartan Environmental Technologies
Air and Water Treatment

Technical Bulletin

Iron and Manganese Removal Using Ozone Water Treatment

While iron and manganese don't pose health problems, water contaminated by these species can stain water fixtures and clothing that is washed with this water. Oxidation of Fe by aeration is possible unless the Fe is complexed or the reaction has to take place under acidic conditions. In these cases a stronger oxidant such as ozone is required. Manganese, complexed or not, can not be oxidized by aeration. Spartan supplies ozone generators and associated equipment that can be used for iron and manganese removal.

Chlorine can also be used for oxidation of iron and manganese, but significantly more chlorine is required versus ozone. This is due to the fact that ozone has an oxidation proposal 150% greater than chlorine. The use of chlorine can also result in the formation of THM if organic material is present in the water. Application of ozone for iron and manganese removal depends on a variety of factors. The following discussion provides some base line information on the conditions and amounts of ozone required. Pilot testing will define the exact amount of ozone required and the type of ozone generator equipment required.

Ozone oxidizes iron from Fe (II) to Fe (III). Fe (III) hydrolyzes to Fe $(OH)_3$ which precipitates to a solid form which can be filtered. The oxidation reaction requires 0.43 mg of ozone per mg of Fe (II). Excess ozone can be used without negative effect. Fe oxidizes in the pH range of 6-9.Ozone oxidizes Mn (II) to MnO_2 (Mn IV) which is insoluble and can be filtered out of the water. The oxidation reaction requires 0.88 mg of ozone per mg of Mn (II). Excess ozone beyond this ratio will form soluble Mn (VII), permanganate. If oxidizable organic material is present in the water and there is sufficient contact time, permanganate will be reduced back to MnO_2 (Mn (IV)). Manganese oxidation is most effective around a pH of 8. In general, when organic materials are present in water, more ozone will be required than the amount shown above since ozone will also oxidize these materials.

The nature of the precipitate will depend on temperature, water chemistry and method of ozone injections. It is important to note that at start-up ozone might strip deposits of iron and manganese in the treatment plant. During the break in period, therefore, iron and manganese may remain high until these deposits are removed. Beyond removing iron and manganese ozone offers other benefits including micro flocculation which can result in improved filtration. Ozone use is not indicated in all situations. If more than 100 micrograms of Br ion are present the formation of bromate might be possible. With water temperature above 105 degree F ozone will decompose prematurely. Pilot testing should be conducted before ozone is selected.

Spartan Environmental Technologies, LLC supplies complete ozone generation systems for drinking water treatment applications. You can learn more about these products at www.spartanwatertreatment.com, Phone: 800-492-1252, Fax : 440-368-3569, e-mail : info@SpartanWaterTreatment.com