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Background information on iron and manganese removal in water supplies

There are three main Types of Iron found in water:

Ferrous Iron- This type of iron is often called "clear water iron" since it is not visible in poured water. It is found in water, which contains no oxygen, such as water from deep wells or groundwater. Carbon dioxide reacts with iron in the ground to form water-soluble ferrous bicarbonate, which, in the water, produces ferrous ions (Fe++). The main way of removing ferrous iron is Oxidation / filtration. Oxidation followed by filtration is a relatively simple process. The oxidant chemically oxidizes the iron (forming a particle) and kills iron bacteria and any other disease-causing bacteria that may be present. The filter then removes the iron Oxidation caused by the transfer of electrons from the iron, manganese, or other chemicals being treated to the oxidizing agent. Air is one of the most common oxidising agents and can be used to convert dissolved iron into a form that can be filtered. This approach mimics what happens when untreated dissolved iron comes into contact with the air. Within the treatment system the dissolved iron precipitates in the first tank and is carried into the second tank where it is filtered in a Pyrolox, Birm or multi-media filter. Chlorination and ozonation can also be used as an additive in the removal of iron.

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The three main types of Oxidizing Filtration Media

- *Pyrolox*- a natural ore that oxidizes and then filters the resulting insoluble iron. It does not need to regenerate therefore it doesn't need other chemicals. However, it needs, ideally, to backwash at 25 to 30 gallons per sq. ft.
- *Birm* - acts as a catalyst to promote the reaction between the oxygen and iron dissolved in the water. It requires no regeneration but needs a relatively high level of dissolved oxygen and works best at a pH above 6.8.
- *Manganese Greensand* - the most common chemical oxidant used, it has a relatively high capacity for iron removal and can operate at high flow rates with moderate backwash requirements. Greensand is a processed material consisting of nodular grains of the zeolite mineral glauconite. The material is coated with manganese oxide. The ion exchange properties of the glauconite facilitates the bonding of the coating. This treatment gives the media a catalytic effect. This coating is maintained through regeneration with potassium permanganate – about 1.5 to 2 oz. per cubic foot of greensand.

Ferric Iron **-** Ferric iron is also known as "red water iron". This type of iron is basically ferrous iron that has been exposed to oxygen (oxidized), usually from the air. As carbon dioxide leave the water, oxygen combines with the iron to form ferric ions (Fe+++). These oxidized particles are generally visible in poured water. In theory, the elimination of ferric iron is simple - use a properly sized media filter to filter it from the water. In practice, however, there may be other issues; some iron may be present in colloidal form. Unlike ferric iron,

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which will generally stick together to form large flakes, the tiny particles of colloidal iron do the opposite. Their large surface area and charge relative to their mass cause the individual particles to repel one another. As a result they will not coagulate. Their small size, then, makes them difficult to filter, and a coagulating agent is often required to obtain adequate filtration. Most water containing ferric iron also contains ferrous iron. This can add complexity to the process, since some of the methods for removing ferrous iron will not remove ferric iron.

Bacterial Iron **-** Slime depositing in toilet tanks or fouling water filters and softeners is a good indication of the presence of bacterial iron. Better described as iron biofouling, the iron bacteria problem is both complex and widespread. It attacks wells and water systems around the world in all sorts of aquifer environments, both contaminated and pristine. In some places, it causes great damage; in others, it is considered a minor nuisance. Iron bacteria can be controlled by periodic well chlorination or it can be treated in the building. The treatment involves the following: Chlorination, retention, and filtration. Activated carbon is usually used as the filter material so the excess chlorine can also be removed.