Iron and Manganese

Iron and manganese are naturally occurring metallic elements that closely resemble each other in the way they react in water. Small amounts of iron and manganese will seriously affect the usefulness of the water for household purposes. The recommended limits in drinking water are 0.3 milligrams per liter (mg/1) iron, 0.05 mg/l manganese, or a total of no more than 0.3 mg/l for both.

CAUSES:

The presence of iron and manganese is common in well water. The metals are dissolved from soils and rocks as the water passes through the earth. It is not unusual to find iron concentrations as high as 5 mg/l in some areas. Manganese occurs naturally in lesser amounts than iron. Therefore, it will be found in well water less frequently and in smaller concentrations than iron.

The corrosion of galvanized or steel plumbing materials will dissolve iron into the water. With galvanized metal, zinc will also be dissolved.

EFFECTS:

Iron and manganese are essential and beneficial elements. There is no evidence to indicate that the amount of iron and manganese normally found in well water is harmful. In fact, a normal diet provides an average of 16 milligrams (mg) iron and 10 mg manganese per day.

When dissolved in water, iron and manganese are colorless. However, if allowed to stand, the iron will combine with the oxygen in the air, first turning the water cloudy, then orange, and then forming a reddish deposit on the bottom of the container. This process is called oxidation. Iron may also form an oily film on top of the water.

Manganese reacts similarly, but produces a gray or black deposit. Manganese will cause a coating to form inside the plumbing. This coating will periodically break free, causing black particles to appear in the water.

Iron and manganese will give water a bitter, metallic taste. Coffee and tea prepared with the water may turn black. Deposits from these metals will cause stains on plumbing fixtures, appliances, and in laundry. Bleaches or scouring powders will not remove the stains and may make them worse. Special products designed to remove rust stains are available in most grocery stores.

Deposits of iron and manganese can accumulate in pressure tanks and water heaters. If appreciable amounts of these metals are present, pressure tanks and water heaters should be drained regularly to remove the deposits.

For most iron removal processes, any acidity in the water must first be neutralized. As a general rule, the pH should be at least 6.5, with a minimum alkalinity of 100 mg/l.

1. **Automatic Chlorination and Filtration:** Using a metering pump, small amounts of a chlorine solution are continuously added to the water. The chlorine chemically oxidizes the iron, producing an insoluble rust particle which can then be filtered out with a sand or activated carbon filter. The filter must be periodically backwashed to remove the accumulated iron.

   Activated carbon filters will also remove any excess chlorine not used in the iron removal. However, the carbon must be periodically replaced.

2. **Manganese, Zeolite (Greensand)Filters:** This method uses a material which contains manganese dioxide. This compound releases an atom of oxygen to oxidize the dissolved iron and manganese. The oxidized particles are then collected on the filter bed. These filters require periodic regeneration with potassium permanganate to replace the oxygen used in the removal process. Backwashing is also required to remove the accumulated iron.

3. **Birm Filters:** Birm is a material containing large amounts of manganese dioxide. Using the dissolved oxygen in the water, manganese dioxide accelerates the oxidation of iron and manganese. With sufficient dissolved oxygen present, only periodic backwashing is required to clean the accumulated iron from the filter. Birm filters cannot be used with water containing hydrogen sulfide.

4. **Water Softeners:** Water softeners remove iron and manganese by replacing them with sodium from the filter bed. Softeners are periodically regenerated with a salt solution to replace the sodium used in iron removal. Extremely high concentrations of iron and manganese may foul the filter bed, preventing regeneration. Always check the manufacturer's recommendations before using softeners for iron removal.

5. **Polyphosphates:** Polyphosphates do not remove iron and manganese. They reduce staining by holding the metals in solution, preventing oxidation. Heating the water will cause the polyphosphates to break down, releasing the metals back into the water. Polyphosphates are only effective on amounts of iron and manganese less than 1 mg/l. The pH should be between 6.8 and 7.4 for optimum performance.

6. **Iron Due to Corrosion:** This type of iron may be eliminated by chemically neutralizing the acidity of the water. Please refer to the Section entitled "Corrosive Water" for further information.

IRON BACTERIA

Water containing iron and manganese in substantial amounts can cause the growth of iron bacteria. Iron bacteria is not a known health problem, but more of a nuisance. When dissolved iron and oxygen are both present in the water, these bacteria derive the energy they need for their life processes from the oxidation of the iron to its insoluble form. These bacteria accumulate within a slime-like substance which covers submerged surfaces. A slimy, rust-colored film on the interior surface of flush tanks of comodes is a fairly good indicator of the presence of iron bacteria.

Iron bacteria can reduce the output of the well by clogging the pump and/or the piping. A gradual decrease in water pressure is a good indicator of this. This bacteria may also cause an unpleasant taste and odor (similar to rotten eggs) to the water or discolor and spot fabrics and plumbing fixtures. A detectable slime also builds up on any surface with which the water containing these organisms comes in contact. Iron bacteria may be concentrated in a specific location and may periodically break loose and appear as bits of rust colored material.

Iron-removal filters or water softeners may remove iron bacteria; however, they often become clogged and fouled very soon because of the slime buildup. A disinfecting solution, such as chlorine bleach, should be poured into the well to control the growth of iron bacteria. The chlorine causes a chemical reaction which makes the iron precipitate out. This deposit can then be removed with a suitable fine filter.

INSTRUCTIONS FOR
DISINFECTING A WELL SYSTEM

1. To disinfect the well, one gallon of household bleach is usually sufficient. Pour the bleach directly into the well and allow to sit for a couple hours. If possible, try to get some along the inner casing of the well.

2. Next, open all cold water faucets inside the house until the odor of chlorine can be detected at the faucet. When the chlorine odor becomes noticeable, turn off all faucets and allow the system to remain idle for 12 to 24 hours. By doing so, you have gotten the chlorine solution in all of the piping. DO NOT USE THE WELL AT ALL DURING THIS PERIOD.

3. At the end of the disinfection period, open either the pressure tank faucet or an outside faucet and allow the water to run until the chlorine odor can no longer be detected, usually an hour is a sufficient time. Using an outside faucet prevents flooding the septic tank system with chlorinated water.

4. Complete the procedure by opening all other faucets until the chlorine can no longer be detected, to remove the last bit of chlorine in the system.

5. Repeat steps 1-4 once a week for three weeks. Further disinfection may be performed as the need arises.