



## Iron Filters and Septic Systems

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### What is the problem with iron and manganese in drinking water?

Iron or manganese in water does not present a health hazard, although there are some concerns with manganese in high levels it can harm the nervous system. Their presence in water may cause taste, staining and accumulation problems in the plumbing system. Iron and manganese deposits will build up in pipelines, pressure tanks, water heaters and water softeners. This can reduce the available quantity, quality and pressure of the water supply. Iron and manganese accumulations become an expensive problem when water supply or softening equipment must be replaced. In addition, pumping water through constricted pipes or heating water with heating rods coated with iron or manganese minerals increases energy costs. A related problem is iron or manganese bacteria. These nonpathogenic microbes feed on iron and manganese in water. They form red-brown (iron) or black-brown (manganese) slime in toilet tanks and can clog water systems.



*Iron staining in a tub*

Standards for iron and manganese are based on levels that cause taste and staining problems and are set under EPA Secondary Drinking Water Standards. For most individuals, 0.3 parts per million (ppm) of iron and 0.05 ppm of manganese is objectionable. Usually iron and manganese do not exceed 10 ppm and 2 ppm, respectively, in natural waters. Iron and manganese can be found at higher concentrations; however, that condition is rare.



### How do iron filters work?

For household water containing high levels of iron and manganese, the most common solution is a process using oxidation followed by filtration. Oxidation converts soluble contaminants through a chemical reaction creating insoluble products that can be filtered. Oxidation of iron and/or manganese is accomplished by introducing an oxidant such as oxygen from the air, chlorine or potassium permanganate into the raw water. The oxidized compound is a particle that is mechanically filtered. These particles are removed from the filter during the backwash cycle. Most iron filters remove both clear water iron and ferric iron (rust). Even water that is clear in color may contain high levels of iron. This is known as 'ferrous' or clear water iron.

### *In home iron removal system*

Iron filters take this clear iron and transform it to rust or ferric iron in the process known as oxidation in an aerobic environment. These trapped particles are periodically and automatically backwashed out with the flush/backwash of the filter, usually once or twice a week. This typically results in 150 - 200 gallons per backwash cycle resulting in 10,000 – 20,000 additional gallons of wastewater annually with these solids if discharged into the septic systems.

It is uncertain what happens to the particles that are backwashed from the filter, but there are a number of potential options for those connected to septic systems:

1. They settle out in the sludge layer of the septic tank and increase the need for maintenance.
2. During times of turbulence or if sludge depths get too thick this material may travel through the septic tank to downstream components. This material can create challenges in a pretreatment systems and/or the soil treatment area. In the soil treatment area, it may cause growth and plugging in the piping systems and plugging in the soil itself.
3. In the anaerobic environment of the septic tank, the insoluble iron is converted to soluble iron going into solution and traveling out of the septic tank and downstream. There is then the risk in the aerobic environment following the septic tank that the iron will be made insoluble again, form a precipitate and potentially clog piping and the soil treatment system.

### **Can a water softener be used to remove iron?**

Water softeners remove hardness using a resin and remove dissolved clear water iron by a process known as ion exchange. However, iron, manganese and/or hydrogen sulfide gas will eventually overwhelm the resin causing fouling and failure of the ion-exchange resin. If your water contains less than 2.0 ppm of iron and manganese combined, and no sulfur odor, then a good quality water softener with a special type of resin cleaner in the brine tank will work. The resin cleaner will help clean the resin when the softener is being regenerated with the brine solution. If not, a home may need both an initial iron filter followed by a water softener. In this case, the water softener discharge water should be dealt with in the same manner as the iron filter discharge.

### **What problems can be caused by discharge of regeneration water to a septic system?**

There are three potential challenges related to iron filters and septic systems:

1. Iron filter recharge chemicals may contain a bleaching or sanitizing agent, which is detrimental to bacterial action in the septic system.
2. The additional water (150 to 200 gallons to recharge and backwash) several times a week adds additional wastewater into the system. Depending on other use in the home, the additional water to the septic tank and soil treatment area may cause problems with septic system operation or may overload it.

3. If the solids are properly settled and removed in the septic tank or re-solubilized, they may plug downstream components reducing the media filter's and the soil's ability to infiltrate water due to high iron content.



*Iron staining on a lateral system.*

### **What should be done with this wastewater?**

First, if possible the water used for outside use and irrigation should not be filtered. This will reduce the amount of water treated and the amount of particles. Discharge of iron filter backwash to a septic system is not recommended due to the nature of the solids. Below are some options to consider:

1. New home? If an iron filter is needed due to the source water at the home, then the backwash discharge may be incorporated into the design of the septic system. In this case there are two options:
  - a. Preferred: Install a separate soil treatment system for the regeneration water, which includes a septic tank to settle out the solids. If a septic tank is not installed the separate system will likely plug over time. The trench bottom must be above the periodically saturated soil or bedrock and trench must meet water supply well setbacks.
  - b. Secondary option: Discharge to the surface; not directly into a surface water, wetland or intermittent stream where water must soak into the ground where it has been discharged. Discharge must stay on the property and not cause erosion or nuisance conditions.
  - c. Less preferred - Install a larger septic tank (double the capacity is the recommended minimum) with an effluent screen and alarm and clean the septic tank annually while evaluating sludge levels.
2. Existing home? The best solution for an existing home will depend on the plumbing system and the related costs. This may require the installation of a sump in the basement or crawlspace to collect the backwash water.
  - a. Whenever possible the backwash water should be routed to another location (see a and b above)
  - b. Maintain septic tank annually to remove settled particles.

### **For additional information**

Below are links that provide more information on iron removal:

- <http://www.extension.umn.edu/environment/water/property-owners/drinking-water/iron-and-manganese-removal/>
- <http://www.water-research.net/Waterlibrary/privatewell/iron.pdf>



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