



ADVANCED WATER SYSTEMS GROUP

Proudly Presents

Frequently Asked Questions (FAQs) About Residential Water Quality

Is Manganese (Mn) something to worry about?

Manganese is a metal commonly found in natural water supplies. Manganese (Mn) behaves very similarly to iron (Fe) in ground water systems (see FAQ for Iron). In fact, it is very common to find manganese and iron together. If your water has iron, it should also be tested for Mn.

The EPA sets a maximum contaminant level (MCL) for Mn at 0.05 mg/L. This relatively low MCL indicates that Mn can be problematic in the home and for your family at very low levels.

The most obvious sign of manganese is the presence of black stains or particles in the house, or even black colored water in severe cases.

Manganese, like iron, has variable oxidation states. Unlike iron which can be either Fe^{2+} or Fe^{3+} , manganese can be Mn^{2+} , Mn^{3+} , Mn^{4+} , Mn^{6+} , or Mn^{7+} . In most private well supplies where chlorine is not being used, the Mn will be soluble Mn^{2+} . Being soluble, this type of manganese is invisible to the eye. However, once it reacts with air, it forms Mn-oxide, which is black. This is often seen in the toilet tank as shown in Figure 1.



Figure 1. Mn-oxide formation in a toilet tank

Mn-oxides are black in color and can also be found in faucet aerator screens.

In some water supplies, manganese will already be oxidized into fine black particles. This is especially pronounced in many Community Well Systems in the Triangle area. This is because these water supplies, operated by AQUA-NC, use chlorine as a sanitizing agent. The chlorine turns most of the Mn into Mn-oxides. The particles are heavy and settle out in the water distribution network as well in the household plumbing.

As the Mn-oxide particles accumulate there is a critical point where high water flow conditions can cause the particles to move through the system causing black water like that shown in Figure 2. This type of water may appear in your home when the AQUA-NC is flushing their system.



Figure 2. Mn-oxides causing black water in an AQUA-NC supply

Black water due to Mn-oxides can be damaging to the home and can ruin white laundry and badly stain fixtures.

Health Risks of Manganese

In recent years there have been new studies that show that elevated Mn levels in water can have negative health effects for selected populations.

A summary article by Reynolds (*Water Conditioning & Purification*, November 2010) discusses a paper by Bouchard et al., (*Environ Health Perspect* 119:138-143 (2011)) and other research that highlights the main health issues associated with elevated levels of manganese intake. These are summarized below.

HEALTH RISKS OF MANGANESE

- Causes adverse neurological effects resembling Parkinson's-like illness
- Absorbed and retained at higher rates in children and pregnant women
- Causes intellectual impairment in children
- Showed Mn uptake much higher from drinking water compared to eating food
- Showed decreased IQ with elevated Mn intake
- Aerosol intake during showering may be a possible risk



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Is Manganese (Mn) something to worry about?

For the aesthetic and health reasons, it is important to consider Mn removal at the whole house level.

Treatment for Manganese

The treatment for Mn is similar to that of iron. For soluble Mn^{2+} , the best solution is a properly designed water softener. The **Kinetico** series of non-electric, twin-tank softeners offer the following advantages which are critical to removing Mn and keeping the softener system from fouling and minimizing leakage of Mn into finished water.

ADVANTAGES OF KINETICO SOFTENER

- **Non-electric** No expensive printed circuit boards to degrade, short out, repair or replace. No electric solenoids to fail or timers to set.
- **Twin-Tank system** Demand-operated system means treated water available in the home 24 hours a day, 7 days a week.
- **Conditioned Mn-free water used to regenerate** The regeneration cycle is done using Mn-free water from the tank that is in-service. This means no Mn-fouling of resin bed or the valve parts.
- **Counter-Current Regeneration** Using a "counter-current flow" during cleaning means thorough Mn cleaning giving better salt usage efficiency and longer media life. No more iron fouling or hardness build-up in beds or valve.

For chlorinated supplies, like AQUA-NC Community Wells sources, nearly all the manganese will be oxidized to Mn^{4+} . This means the accumulation of fine black particulate in the distribution system and in your household plumbing.

To avoid black water from your water heater or black staining ruining laundry and other aspects of the home, a whole-house filter should be installed that is capable of filtering to the 5-micron level.

One excellent option for this is the **Kinetico Super-Kit** cartridge filter assembly with the integrated by-pass for easy filter changes

and control. This system has distinct advantages over regular cartridge filters:

KINETICO SUPER-KIT FILTER ADVANTAGES

- Professional robust construction
- 1.25" porting for high flow with minimal pressure drop
- Choice of reusable or disposable filter cartridges
- Positive O-ring seal for filter element - water must go through the filter, cannot go around
- Large integrated by-pass valve for easy water flow control
- No tools needed for filter change - can change by hand
- 10-year factory warranty on all parts

A second option is the automatic **Kinetico backwashing filter** described in the FAQ sheet for iron. Here are the advantages of this system.

KINETICO BACKWASHING FILTER ADVANTAGES

- Non-electric fully automatic control valve - driven by water flow and pressure. No timers!
- Parallel service flow increases contact time with media and lengthens media life
- Twin-Tank, Metered, demand-operated provides continuous 24/7 supply of clean filtered water
- Countercurrent backwashing flow using only filtered water- increases efficiency, water quality, and the life of the media bed
- Efficient cleaning cycles use less time and less water. Backwashes with filtered water
- Effective filtration of particles down to 5 microns

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