PRIVATE DRINKING WATER IN CONNECTICUT

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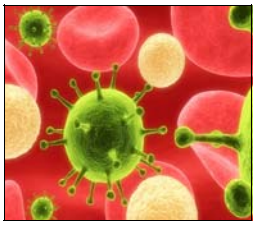
Problem



Sometimes a local health department will get a call from a local homeowner complaining that their well water smells "funny". The noxious smell could resemble rotten eggs (hydrogen sulfide) or have a septic/hydrocarbon odor and the water will have some discoloration or turbidity due to oxidized iron or manganese. If they discover a brown/black gelatinous floc and/or an oily sheen on the water's surface in their toilet tanks they have a high probability of an iron, manganese/sulfur bacteria problem. While not being pathogenic they are nuisance organisms that cause staining problems on fixtures, appliances, dishware and laundry. High populations in the well itself will reduce well yield by clogging the well pump screen and fouling the impellers.

Background

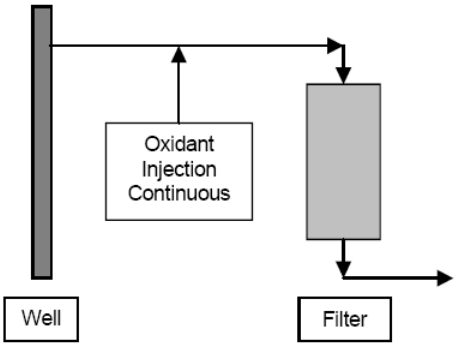
All well waters that have elevated levels of iron/manganese do not necessarily have iron bacteria also. But, any well water with these nuisance organisms present will have some iron (Fe) or manganese (Mn) to act as a food source for these microbes. There are no formally established maximum contaminant levels (MCL) or action levels for these organisms but, most homeowners will opt to remove these microbes from their water so they may properly maintain the sanitary/aesthetic quality of the drinking water in their homes. To check for presence of these bacteria have the water analyzed by the state laboratory or a private laboratory that is capable of performing the test. The test is relatively simple consisting of filtering the sample through a proper size, 0.45 micron membrane filter, and viewing the residue under a microscope. The results are somewhat quantitative being reported in numbers of CFU (colony forming units) /milliliter (ml) of sample. The highest populations can be reported up to greater than 10,000 CFU/ml.

Treatment Systems

Treatment for these organisms must consist of the addition of an oxidizing agent, e.g. chlorine, that will hamper the proliferation of these bacteria. If the levels of the bacteria are relatively low semi-annual superchlorination of the well may work. If the homeowner wishes to remove the iron/manganese from the well water, the presence of these nuisance bacteria requires the addition of an oxidizer ahead of the iron removal treatment, regardless of the type of treatment; simple sand or fiber filters, a softener or a Burgess Iron Removal Method (BIRM) type system. BIRM filters use an oxidizer but it is only aspirated air. When iron/ sulfur bacteria are present the filter media or softener resin becomes clogged due to the colonization of these bacteria within the filter beds and it is rendered useless as the cation exchange capabilities in the media ceases. One apartment complex had a BIRM type of iron removal system, with aeration only, that was rendered ineffective by iron bacteria (Gallionella) in only 8 months time.

Produced by The State of Connecticut Department of Public Health
Environmental Health Section, Private Well Program

Before the advent of the BIRM type treatment system, Mn Greensand filters, with potassium permanganate feed was the treatment of choice for iron removal and, of course, the universal water softener. The potassium permanganate not only helped oxidize the ferrous/manganous metals to their filterable form but also, as a mild oxidizer, disinfected the greensand and helped keep the iron bacteria from recolonization. When the BIRM type technology and resin was developed it then became the treatment of choice because it uses no chemicals for oxidation, only aspirated air. The discharge of backwash water was no longer a problem: dissolved metals in-filterable metals out, a seemingly simple process.



Manganese Greensand Process with Continuous Regeneration

Another way of controlling iron bacteria must be found, other than periodic shock chlorination of the well itself, usually with marginal success. A large apartment complex in a northeast CT town had a serious iron problem with its 2 production wells and its quarterly compliance samples were failing to meet the color and turbidity MCLs. A typical BIRM type system was installed and soon iron breakthrough was occurring. Both wells had extremely high levels of iron bacteria, >10,000 CFU/ml. Working with the management of the complex, it was suggested a hypochlorinator be installed upstream of the filters and storage tanks. Even though the Clack Corporation who manufactures the BIRM resin, only recommends 0.5ppm of free chlorine residual going through the filter beds, the hypochlorinator was set to dose the filters at 1ppm with a free chlorine residual of 0.5ppm coming out of the pressure tank.

The treatment w/chlorination was put on-line on 8/10/00 and to date, it is still working fine. The results are encouraging as the treatment is producing water of excellent quality. Even when the iron bacteria levels are still present in the filtered water in excessive amounts, >10,000 CFU/ml (the highest that can be estimated), the color, turbidity, iron and manganese levels are negligible.

The bacteria reproduce by binary fission. It is suspected that keeping a low consistent free chlorine residual (hypochlorous acid) in the water, somehow attacks the cells as the cell wall splits and prevents the microbes, by altering their metabolism, from colonizing and precipitating iron. This prevents the water from becoming visually and taste/odor aesthetically unacceptable. Maybe its because their food source has been eliminated that keeps them from colonizing. There is still some Fe/Mn in the treated water and studies have shown that iron bacteria proliferates in water with iron as low as 0.01 ppm.

While the resin manufacturer frowns on chlorination of the BIRM media, the low levels employed in this case has not affected the media's integrity. By now, without disinfection, the media would be ruined by the iron bacteria's colonization of the filters' media.

For more information please click on the following links:
EPA Office of Groundwater and Drinking Water
http://www.epa.gov/ogwdw/
EPA New England
http://www.epa.gov/region01/

Adapted from *Healthy Drinking Waters for Rhode Islanders*, University of Rhode Island Cooperative Extension, *April 2003*.