original condition. Most manufacturers offer either a manual or an automatic regeneration cycle in their softeners.

Ion exchange softeners produce a water with near zero hardness. Because a moderate amount of hardness is desirable, some individuals choose to soften a portion of the water and blend it with unsoftened water to produce a final hardness of 50 to 100 mg/l.

NOTE: WATER SOFTENING INCREASES THE SODIUM CONTENT OF THE WATER BY AN AMOUNT EQUAL TO ONE-HALF OF THE HARDNESS REMOVED. PEOPLE WHO MUST RESTRICT THEIR SODIUM INTAKE FOR MEDICAL REASONS SHOULD CONSIDER THIS ADDED SODIUM IN THEIR DIET. ADVISE YOUR DOCTOR OF THE CHANGE IN THE SODIUM CONTENT OF YOUR WATER BEFORE DRINKING OR COOKING WITH THE WATER.

In cases where the water hardness exceeds 200 mg/l or where elevated levels of chlorides are present, softening may produce a salty taste in the water. In these instances, a by-pass line can be installed from before the softener to a kitchen faucet; or a point-of-use treatment device can be used (see below).

If excessive iron and manganese are present, it may be necessary to remove these metals prior to softening. While water softeners will remove small amounts of iron and manganese, excessive amounts will foul the water softener. As a rule of thumb, the total amount of iron and manganese should not exceed 1.0 mg/l for every 140 mg/l (8 gpg) of hardness.

1. Point-of-Use Devices: Where the taste of the water or the increased amount of sodium due to softening is a concern, a point-of-use device may be used to produce a limited amount of water per day for drinking and cooking. These devices are small, multi-step treatment system designed to fit under the kitchen sink. They produce up to 15 gallons per day of treated water. The treated water is stored in a small pressure tank, piped to a special faucet on the sink. Each of the treatment steps is in a cartridge form and requires periodic replacement.

2. Laundry Water Softening: Water for laundry may be softened in the washing machine by using a group of chemicals known as non-precipitating water softeners. This group includes borax, washing soda, trisodium phosphate, and ammonia. Always follow the manufacturer’s instructions in using these chemicals. Under no circumstances should these chemicals be used for softening drinking water.

Hydrogen Sulfide

Hydrogen sulfide is a flammable gas produced by the decay of organic material. Because it vaporizes almost instantly, hydrogen sulfide is very difficult to detect analytically in a water sample. Generally, the odor of hydrogen sulfide is enough to determine its presence. Although an official limit has not been established for hydrogen sulfide in drinking water, a recommended limit of 0.05 milligrams per liter (mg/l) has been proposed.

CAUSES:

Hydrogen sulfide is a dissolved gas that occurs naturally in water supplies as a result of the decomposition of underground deposits of organic material.

Hydrogen sulfide can also appear suddenly in wells as a result of the growth of a
group of bacteria known as “sulfate reducing” bacteria. These bacteria break down the naturally occurring sulfate compounds in the water, producing hydrogen sulfide as a by-product. Disinfection of the well system is generally sufficient to remove the sulfate reducing bacteria.

In some cases, hydrogen sulfide will occur only in the hot water as a result of a chemical reaction in the water heater itself. Most water heaters contain a corrosion protection device known as a “sacrificial anode.” When dissolved sulfate compounds come in contact with the anode, the resulting chemical reaction converts the sulfates into hydrogen sulfide.

Removal of the sacrificial anode will generally eliminate the problem. However, this may void the warranty on the water heater. The manufacturer’s service representative can best advise you in this regard.

EFFECTS:

The most noticeable effect of hydrogen sulfide is the “rotten egg” odor and sulfur taste it gives to water. The odor and taste of hydrogen sulfide can be detected at levels as low as two-hundreths of a milligram per liter. At the levels normally occurring in drinking water, hydrogen sulfide is not considered a health hazard.

The presence of hydrogen sulfide speeds up the corrosion of metal plumbing materials. It will attack iron, steel, copper, and galvanized plumbing, producing a black color in the water. The effects of corrosion by hydrogen sulfide may go unnoticed for as long as several months, then suddenly become severe.

In combination with dissolved iron, hydrogen sulfide can produce black stains in plumbing fixtures and laundry. A black deposit may also collect in piping and on fixtures.

TREATMENT:

Activated carbon filters, sometimes sold as “taste and odor” filters, are not effective for hydrogen sulfide removal. Some form of chemical oxidation is the most effective method of removal. In chemical oxidation, the hydrogen sulfide is converted to an insoluble sulfur particle, which is then collected on a filter. Some of the sulfide may be converted to a sulfate compound which remains dissolved in the water. The following methods are generally acceptable for sulfide removal:

1. **Automatic Chlorination and Filtration:** With this method, small amounts of a chlorine solution are continuously added to the water using a small metering pump. The chlorine chemically oxidizes the hydrogen sulfide to an insoluble sulfur particle which can then be filtered. The filter must be periodically backwashed to remove the accumulated sulfur.

2. **Manganese Zeolite (Greensand) Filters:** Greensand filters use a filter material that contains manganese dioxide. This compound releases an atom of oxygen to oxidize the hydrogen sulfide. 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 sulfur.

3. **Water Softeners:** Water softeners may be used for hydrogen sulfide removal only under certain conditions. Always check the manufacturer’s recommendations before using softeners for sulfide removal.