ALABAMA COOPERATIVE Extension SYSTEM

ALABAMA A&M AND AUBURN UNIVERSITIES

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Typical Contaminants And Problems

Corrosion

Corrosion is a chemical process that eats away metals commonly used in plumbing, making them fail. One type of corrosion attacks and gradually thins the entire metal surface, often causing red water in iron or steel water systems or blue-green stains in copper or brass systems. Lead from solder is the greatest health risk from this type of corrosion. Another type of corrosion attacks small areas, and deep pits develop and penetrate pipe or tank walls. This type of corrosion usually does not add iron or copper to the water, but even a single hole in a pipe length or a tank can destroy its usefulness.

Causes Of Corrosion

Corrosion is a natural process of chemical/electrical degradation that occurs when metals are in contact with water. All water is corrosive to some degree. The rate of corrosion depends on the water's electrical conductivity, oxygen concentration, temperature, and acidity.

Electrical conductivity. Electrical conductivity does not cause corrosion problems where mineral concentrations are low; corrosion is a problem where mineral concentrations are high. Water that has few dissolved minerals is a poor conductor, but water containing high mineral concentrations is a relatively good conductor. Water containing sodium salts is more corrosive than water containing calcium salts. Hard water usually coats the inside of pipes and reduces corrosion.

Two different metals in contact with each other and a solution that conducts electricity create a galvanic cell. This cell generates electricity and one metal dissolves or corrodes in proportion to the electricity generated. This galvanic corrosion occurs very close to the joint between the metals. It is common where copper and galvanized iron pipes are joined together.

Oxygen concentration. Oxygen dissolved in water will also enhance the process of corrosion. Deep well water is usually free of dissolved oxygen, but oxygen is present in surface water.

Water temperature. Corrosion is faster at higher temperatures. Above 140°F the rate of steel corrosion doubles with every 20° increase in temperature.

Acidity. The acidic or or basic condition of water is measured on a scale known as the pH. The pH can vary from 0 to 14 with a pH of 7 being neutral. If the pH is below 7, the water is acidic; above 7, it is basic.

Alkalinity is often confused with basic pH of water, but they are not the same. Total alkalinity of water is a measure of capacity of all its combined chemical components to neutralize acid. It is measured as the calcium carbonate equivalent for neutralizing acid, but includes bicarbonate, carbonate, and even some phosphates and silicates. For ideal corrosion control, water should have moderate alkalinity (30 to 70 mg/L) and a pH from 7.9 to 8.2. Values of pH below 6.5 indicate corrosive water, especially with low alkalinity. Surface water in Alabama is naturally corrosive because pH is usually slightly acidic to neutral and alkalinity is low. Values of pH above 7.5 are also corrosive when alkalinity is low.

In surface water common causes for acidity are runoff from mining spoils, decomposition of plant materials, and acid rainfall caused by atmospheric carbon dioxide and other airborne pollutants, especially oxide gases of sulfur and nitrogen.

In groundwater the cause of acidity is usually dissolved carbon dioxide, decaying organic matter, or acid rainfall. In some cases, especially in mining areas, water may contain free mineral acid—hydrochloric, sulfuric, or nitric.

Treatment Of Corrosion

When the prime cause of corrosion is a high concentration of dissolved minerals, there is no feasible, economical method of removing the minerals from small water systems. However, their corrosiveness can be controlled by feeding polyphosphate compounds with a chemical feed pump. Feeding polyphosphate forms a protective film in the water system.

When the corrosion is caused by acid water, the most obvious solution is to neutralize the acidity. One of the simplest ways to do this is to install a neutralizing filter. Most of these filters contain marble chips or some other slowly dissolved liming agent. Neutralizing filters must be backwashed periodically because they serve as mechanical filters to remove solid particles from the water.

Another method of neutralizing acid water is to feed a soda ash solution, or sodium carbonate, to the water supply through a chemical feed pump. This pump can operate with a well pump to produce an adequate amount of soda ash in the water flow. Feeding a soda ash solution ahead of the pressure tank produces the best results. Because neutralizing acid water with soda ash produces water high in sodium, an alternative drinking water supply would be advisable for those people on a low sodium diet.

Corrosion in household water systems is controllable. The best treatment method results from careful consideration of factors such as economics, water quality characteristics, water temperature variance, and the inherent limitations of the available treatment technology.

Corrosion At A Glance

Symptoms: Green residues or stains on faucets, pots, and sinks; leaks in pipes.

Causes Of The Problem: Acidic water, electrical conductivity, oxygen concentration, water hardness, and high temperature.

Suggested Treatments: For Acidity: Mechanical (neutralizing) filter or chemical feed pump (feeding soda ash or polyphosphate).

Prevention: Set water heaters no higher than 140°F. Use similar metals where possible in plumbing systems. Use plastic plumbing.

References

Haman, Dorota Z., and Del B. Bottcher. 1986. Home Water Quality And Safety. Circular 703. Florida Cooperative Extension Service. University of Florida. Gainesville, FL.

Hermanson, Ronald E. 1991. Corrosion From Domestic Water. EB1581. Washington Cooperative Extension Service. Washington State University. Pullman, WA.

Shaw, Byron H., and James O. Peterson. 1990. Improving Your Drinking Water Quality. G3378. Wisconsin Cooperative Extension Service. University of Wisconsin. Madison, WI.

Tyson, Anthony, and Kerry Harrison. 1990. Water Quality For Water Systems. Georgia Cooperative Extension Service. The University of Georgia. Athens, GA.

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For more information, call your county Extension office. Look in your telephone directory under your county's name to find the number.

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