

By Troy Fraebel

Corrosion: Knowing the Enemy

Corrosion not only threatens water storage tanks, but it can also shorten the life of parts of the water treatment plant and distribution system. Because of the aggressive environment and the presence of hydrogen sulfide gas, wastewater treatment systems fight an even greater battle against corrosion. We most often think about the corrosion of steel, but concrete also corrodes when exposed to aggressive environments. The steel reinforcing bars that give concrete its tensile strength must also be protected to prevent corrosion. Preserving the steel and concrete of water or wastewater assets requires knowing the enemy—corrosion.

Figure 1: The Corrosion Cycle

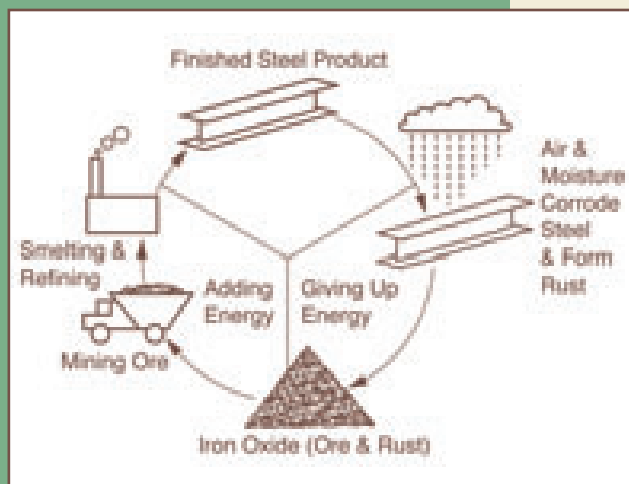
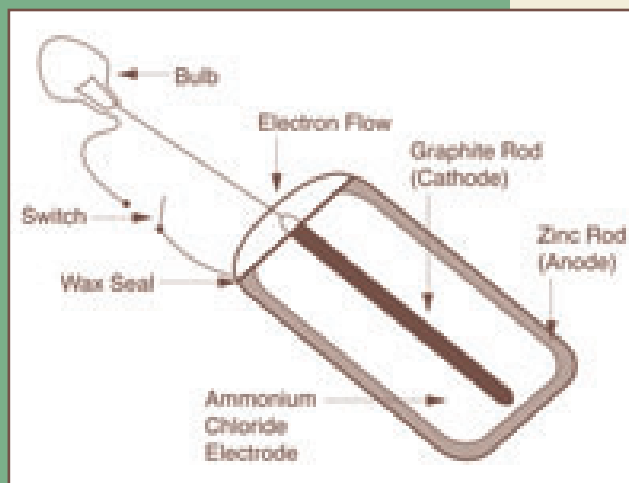


Figure 2: The Dry Cell Battery



The good news is that there are many great resources in the battle against corrosion. The following information is from Unit 1, “Corrosion and Corrosion Control,” of “Fundamentals of Protective Coatings for Industrial Structures (C-1)” from the Society for Protective Coatings (SSPC). Several years ago, SSPC recognized the need to protect concrete from corrosion when it expanded its scope and changed its name from the Steel Structures Painting Council to SSPC: The Society for Protective Coatings.

Based on research by the National Bureau of Standards and the Federal Highway Administration, corrosion of metals in the U.S. costs about 4.2% of the annual gross national product or around \$276 billion annually. About one-third of these costs can be avoided by proper use of currently existing corrosion control technology. Corrosion is the chemical or electrochemical reaction between a metal and its environment that results in the loss of the material and its properties. Put more simply, corrosion is steel or concrete reverting back to its natural state. It is not a mere coincidence that the major component of steel—iron ore—looks and is just like rust.

It takes four things to create a corrosion cell: an anode, cathode, metallic path connecting the anode and cathode, and electrolyte. This can be remembered with the acronym ACME. The common dry cell battery takes advantage of the corrosion process to create electricity.

Preventing Corrosion

Every piece of steel contains the first three things—the anode, cathode and metallic path (ACM)—and water, wastewater and even moisture in the air provide the electrolyte (E). The most direct way to prevent corrosion is to put a barrier between the steel or concrete and the electrolyte (i.e., paints, coatings and linings).

Water and wastewater structures should be designed

to prevent corrosion by making them easy to paint and repaint. That means reducing or eliminating skip welds, edges and angles, overlapping plates and crevices, inaccessible areas and water traps. Since everything cannot be made perfectly smooth, a good painting specification requires the brush application of a stripe coat to critical locations on steel such as welds, corners and edges. Epoxy coatings (NSF/ANSI 61-certified when in contact with potable water) are the predominant means of creating a barrier on water and wastewater structures; however, environmental regulations and technological innovations have produced barrier solutions based on polyurethane, polyurea and other chemistries.

In addition to barrier protection, zinc-rich primers, which are common on the exterior of steel water storage tanks, take advantage of the corrosion reaction to protect steel. If the coating gets damaged and the steel is exposed, the zinc anode corrodes instead of the steel cathode. Galvanizing protects steel in a similar way.

There are other ways to prevent corrosion. When connecting two dissimilar metal surfaces, such as carbon steel and stainless steel, they need to be isolated (i.e., paint or install a gasket) to prevent creating a corrosion cell. The use of incompatible nuts and bolts can create dangerous corrosion cells.

Like zinc-rich primers, cathodic protection (CP) systems take advantage of the corrosion reaction. CP is appropriate for buried structures like pipes and tank bottoms that are not easily exposed for inspection and repainting. Sometimes, impressed current CP is used in the submersed interior of water storage tanks. When water storage tanks are regularly cleaned and inspected as part of a tank asset preservation program, a CP system is not as critical.

In very aggressive environments, it may be necessary to move away from coated steel and concrete construction to high-tech plastics, fiber-reinforced plastics or expensive corrosion resistant metals such as stainless steel.

Once a better understanding of corrosion is attained, time and resources need to be committed to prevent this enemy from shortening the useful life of water and wastewater assets. As responsible stewards, utility owners need to establish and fund asset preservation programs, including scheduled cleaning, inspections and strategic maintenance, or hire a professional firm to provide these services. **www**

Troy Fraebel is manager of Caldwell's Tank Asset Preservation programs. Fraebel can be reached at 502.964.3361 or by e-mail at tfraebel@caldwelltanks.com.

For more information, write in 1103 on this issue's Reader Service Card.

WEBresources >>>

Related search terms from www.waterinfonlink.com: corrosion, tanks, coatings

For more information related to this article, visit www.wwdmag.com/lm.cfm/wd010903

..... Resources in
the battle against corrosion