OBJECTIVES OF WATER TREATMENT

The function of industrial and commercial nonpotable water systems is to add heat to, or remove heat from, industrial processes and commercial data centers, to generate electric power, and to condition the air in commercial buildings, hospitals, etc.

From this point of view, open and closed cooling and heating systems, and steam generation systems, are all aspects of the same general process. The objectives are to transfer heat from one place to another, using water as the transfer medium, to conserve heat energy, and to discharge waste heat and water to the environment in an acceptable way.

Thus, the general objectives of water treatment must be:

a. To keep heat transfer equipment as clean as possible, in order to maximize water flow and heat transfer efficiency.

b. To protect the heat transfer equipment and associated piping from corrosion and fouling damage.

c. To conserve water and heat, and to meet or surpass all applicable air and water quality regulations.

d. To accomplish all of this in the most technically appropriate, safe and cost-effective way possible, in the best interests of the customer.

These objectives are interrelated and should be considered together as general guidelines for planning comprehensive water treatment programs for industrial and commercial facilities.

COMMERCIAL AND INDUSTRIAL WATER SYSTEMS

Because of its general availability and low cost, water is the world's most widely-used heat transfer medium. Following is a brief description of the major systems that water treatment professionals encounter in commercial buildings and industrial plants.

Cooling Systems

Cooling water systems are defined as either "closed" or "open". A closed loop system is intended to be sealed, requiring makeup only to replace water lost by leakage, construction, etc. An open system, on the other hand, is in contact with the atmosphere and is cooled by evaporation in a

cooling tower or spray pond. Water lost by evaporation is replaced by makeup water, and a fraction of the circulating water is removed continuously to maintain water quality.

Heating, ventilating and air conditioning (HVAC) systems are used to condition the air in commercial buildings and industrial sites. A typical HVAC cooling system includes both a closed and an open cooling water circuit. First, chilled water circulating in a closed loop absorbs heat from building air in large air handling units and fan coils. The warmed water is cooled in a refrigeration machine, or “chiller”, by heat exchange with a refrigeration fluid such as “Freon”. Other types of chillers are also used. Then, the heated refrigeration fluid is cooled by heat exchange with an open circulating cooling water system that transfers heat to the atmosphere.

Open and closed cooling water systems are also required to cool industrial processes such as reaction kettles, furnace hoods and doors, engine jackets, and large steam condensers in electric generating plants. System sizes for both open and closed cooling systems range from a few hundred gallons to several million gallons. All of this water requires chemical treatment to protect the heat exchangers and piping, and to maintain operating efficiency.

Power stations and industrial plants situated on lakes and rivers often use once-through cooling systems. Water is pumped from the source directly through steam condensers, for example, and back to the source. Some large commercial buildings also use once-through cooling water. Many once-through systems have been converted to recirculating systems to conserve water and to protect the quality of natural water sources.

Heating and Steam Generating Systems

Steam and hot water systems can be classified into three groups:

a. Steam and hot water for space heating and humidity control In commercial and residential HVAC systems, and industrial plants.

b. Steam for industrial process heating and for use as a process reactant in chemical plants, paper mills, etc.

c. Steam to drive turbines for electric power generation.

Hot water heating systems are similar to closed cooling loops, but the process is reversed. The hot water adds heat to an HVAC system, or to an industrial process. The hot water temperature is maintained either by heat exchange with a steam source or by direct firing in a hot water heating boiler. This is a misnomer, since no boiling occurs, but these units are similar in appearance to small steam generators.

Steam generators range from small heating boilers to very large and complex systems generating steam for industrial plants and electric utility

stations. As with cooling systems, all boilers operate on the same basic principles. Water is heated in a carefully designed system to produce steam at the desired temperature and pressure. The steam does work, by driving a turbine, heating a building or an industrial process, or becoming a reactant in a chemical process. To conserve water and energy, waste steam is condensed after use and a portion of the condensate is returned to the boiler as feedwater, along with required fresh makeup water. All parts of this system, including feedwater preparation, the boiler and the condensate system, require chemical treatment to protect the equipment, maintain boiler efficiency and prepare steam with the required quality and purity.

THE WATER TREATMENT BUSINESS

Thus, the business of water treatment consists of modifying existing water supplies to make them suitable for specific intended uses as described above.

This general process consists of three parts:

a. External treatment, also called pretreatment, before the water is used.

b. Internal treatment of boiler and cooling water while the water is in use;

c. Waste water treatment to make water removed from the system suitable for discharge or reuse.