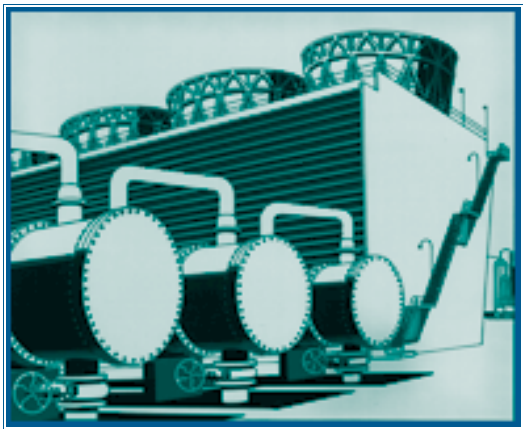
COOLING WATER SYSTEMS
SOURCE CONTROL PROGRAM

Metals From Cooling Water

Several metals including copper, zinc, chrome, and tributyltin can be found in the discharge from some cooling water systems. The Regional Water Quality Control Plant (RWQCP) is working to reduce the discharge of all of these metals to the sanitary sewer and the storm drain system. Copper and zinc are common materials found in cooling water system components and piping; both are susceptible to corrosion. All four metals have been used as cooling water treatment chemicals. Analyses of samples collected from industrial cooling towers have shown that relatively high levels of these metals are often found.



Cooling water systems include one-pass cooling, closed recirculating systems, and open recirculating systems. One-pass cooling systems use source water (typically tap water) once and then discharge it to the drain. The wastewater from these systems is likely to contain lower concentrations of metals than other cooling systems. However, one-pass systems are discouraged and new installations have been banned because they waste water.

Closed recirculating systems have a fixed reservoir of water. This water is only discharged when the system is drained for service. The recirculated cooling water in these systems typically has some chemical treatment and may contain metals from the corrosion of the system components.

Open systems use evaporation to cool process equipment. Open systems normally have frequent water discharge called "blowdown." Chemical treatment, evaporative concentration of the metals in the source water, and metals from corrosion are common in open system blowdown.

Cooling tower graphic courtesy of NALCO
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The Program

The goals of the Cooling Water Systems Program were to collect information about cooling water systems, develop Best Management Practices (BMPs), and distribute the BMPs to cooling tower users within the RWQCP's service area. Certain limited control measures were also included in the Sewer Use Ordinance as they are very important to achieving the discharge reductions required for the RWQCP's own Bay discharge permit.

The information collected included:

- identification of additives containing tributyltin and copper;
- monitoring of cooling tower discharges at industrial facilities;
- special cooling water sampling programs in conjunction with industrial dischargers;
- survey of all industrial dischargers about their cooling water system design, operation, monitoring, maintenance, and replacement plans;
- survey of non-industrial buildings to identify cooling water system locations and discharges; and
- estimates of copper discharge.

Best Management Practice and education efforts included:

- development of Best Management Practices for cooling water system operation;
- creation of a cooling system BMP brochure;
- distribution of BMPs, vendor lists and a list of additives containing copper or tributyltin to all identified facilities using water-containing cooling towers and chiller systems;
- providing cooling system product vendors and other interested parties with copies of the BMPs and information about problem additives (those containing copper and tributyltin);
- notifying both industrial and commercial facilities of the regional sales prohibition for tributyltin-containing additives; and
- providing staff support for the implementation of monitoring and management programs for all local cooling water systems.

Ongoing control measures include:

- directing all identified cooling unit discharges to the sewer, rather than storm drains;
- prohibiting the use of copper or tributyltin-containing cooling water additives;
- checking building plans for new buildings to ensure that design requirements for cooling water systems are met and to educate architects about RWQCP's recommended design practices;
- requiring testing of cooling system cleaning solutions prior to discharge.

Copper Discharge Estimates

A survey conducted in 1994 identified approximately 210 cooling towers in the industrial sector. In the non-industrial sector various means to identify buildings with cooling water systems were explored, such as aerial photographs, building permit records, cooling system vendor contacts, real estate data, and utilities usage. It was determined that field surveys may be the only method available to identify the presence off cooling water systems at specific non-permitted facilities. Surveys conducted at a sample of various local businesses were used to estimate that approximately 200 towers existed at these facilities and contributed an estimated 50% of the cooling water-related copper discharge.

Using tower specific data for industrial cooling systems and survey results for industrial cooling systems it was estimated that the copper discharge from cooling tower systems comprises approximately 6% of the RWQCP's influent copper.

Best Management Practices

Proper operation and maintenance of cooling water systems reduces the amount of toxic pollutants released while simultaneously lowering cooling system costs. In 1993 the RWQCP developed BMPs to convey this idea and to identify the practices that can be used to reduce metals discharges. Detailed investigation of corrosion in cooling water systems lead to preparation of updated BMPs in 1995. The topics covered in the BMPs include:

- sources of metals;
- typical systems;
- chemical treatment and feed systems;
- system cleaning and maintenance;
- recommended monitoring; and
- system design and installation.

The BMPs provide comparison values for several chemical parameters including metals. Results from cooling water sampling can be compared to these numbers and used to identify systems that may need to be adjusted to optimize the chemical controls and reduce the discharge of metals. The RWQCP has also prepared a brochure that highlights the major issues identified in the BMPs.

This literature was distributed to the regulated industries in the RWQCP's service area in 1993. The brochure was updated and distributed again to all identified facilities with water-based cooling systems in 1995.

Public Involvement

Several public meetings were held to request input from industrial dischargers, facilities managers, and treatment chemical suppliers. Mailings and meeting announcements were sent to both industrial and commercial facilities. Information and feedback from these groups was used to develop BMPs and ordinance requirements.

Additives Containing Copper or Tributyltin

Informal investigations by the RWQCP in 1994 found that use of tributyltin-containing cooling water additives in only a few cooling towers could have explained the then regular measurements of tributyltin levels in RWQCP effluent at levels exceeding the permitted discharge standard of 0.005 micrograms per liter. At the same time, RWQCP and industry chemical testing of cooling water discharges found a high correlation between discharges exceeding RWQCP discharge limits and the presence of copper in cooling water additives. In California, copper only occurs in cooling water additives as an "inert" (not pesticidal) ingredient, which means that its presence is not required to be listed on the label. The RWQCP found that local businesses were inadvertently contributing to their own copper discharges and to the RWQCP's ongoing copper discharge compliance difficulties. In 1995, Cities in the RWQCP service area prohibited the use of cooling water additives containing tributyltin or more than 2 parts per million of copper.

Because local authority to control cooling water additives (which are registered pesticides) has been questioned, in 1994 RWQCP staff drafted and co-sponsored legislation to prohibit the sale, use, and discharge of these problem products. While the bill did not become law, its partial success in the legislature convinced the California Department of Pesticide Regulation to restrict copper and tributyltin-containing cooling water additives in the San Francisco Bay Area. On December 11, 1995, the Department of Pesticide Regulations issued emergency regulations prohibiting the sale and use of tributyltin-containing cooling water additives in the nine Bay Area counties. These regulations became permanent on November 7, 1996.

While the Department chose not to regulate copper in additives because it is an "inert" ingredient, it did initiate an effort asking manufacturers to remove copper voluntarily. In 1998, the RWQCP obtained a list of copper-containing additives via a Freedom of Information Act request to the U.S. EPA. That list was provided to all identified cooling water system managers.

Requirements

Several of the items outlined in the BMPs were incorporated into the 1994 Sewer Use Ordinance revisions. The use of chemical treatment additives that contain copper, chromium, and tributyltin is prohibited by local ordinance. The most notable requirement is a 0.25 mg/L copper concentration limit for cooling water discharges greater than 2,000 gallons per day that became effective on July 1, 1998. In 1998, cooling tower users in this category were identified, sampling locations were selected, and sampling programs were initiated.