

## **COPPER REMOVAL BY THE REGIONAL WATER QUALITY CONTROL PLANT**

Due to increasingly stringent discharge limits for copper and other metals, the Palo Alto Regional Water Quality Control Plant (RWQCP) has been making changes in plant operations to improve copper removal and has been conducting studies to determine what plant improvement projects may be feasible. In 1989 and 1991, studies conducted by Montgomery-Watson determined that, if required metals discharge reductions had to come exclusively from reductions at the plant, a reverse osmosis unit would have to be added to meet the new metals requirements. Constructing and operating such a facility would quadruple annual RWQCP costs and have significant adverse environmental impacts. Therefore, recent on-site efforts have focused on operational changes, even though such changes would not, by themselves, ensure compliance.

The percentage of copper removal by the RWQCP has increased from 82% in 1988 to 90% in 1994 as a result of changes in plant operations. The Mixed Liquor Suspended Solids ("MLSS," the concentration of bacteria) in the aeration tanks is being optimized, providing more available sites for adsorption and uptake of copper. Effluent copper concentrations are now relatively stable and low, indicating that the recent efforts to thin the MLSS and increase growth rates have provided more copper removal from the process.

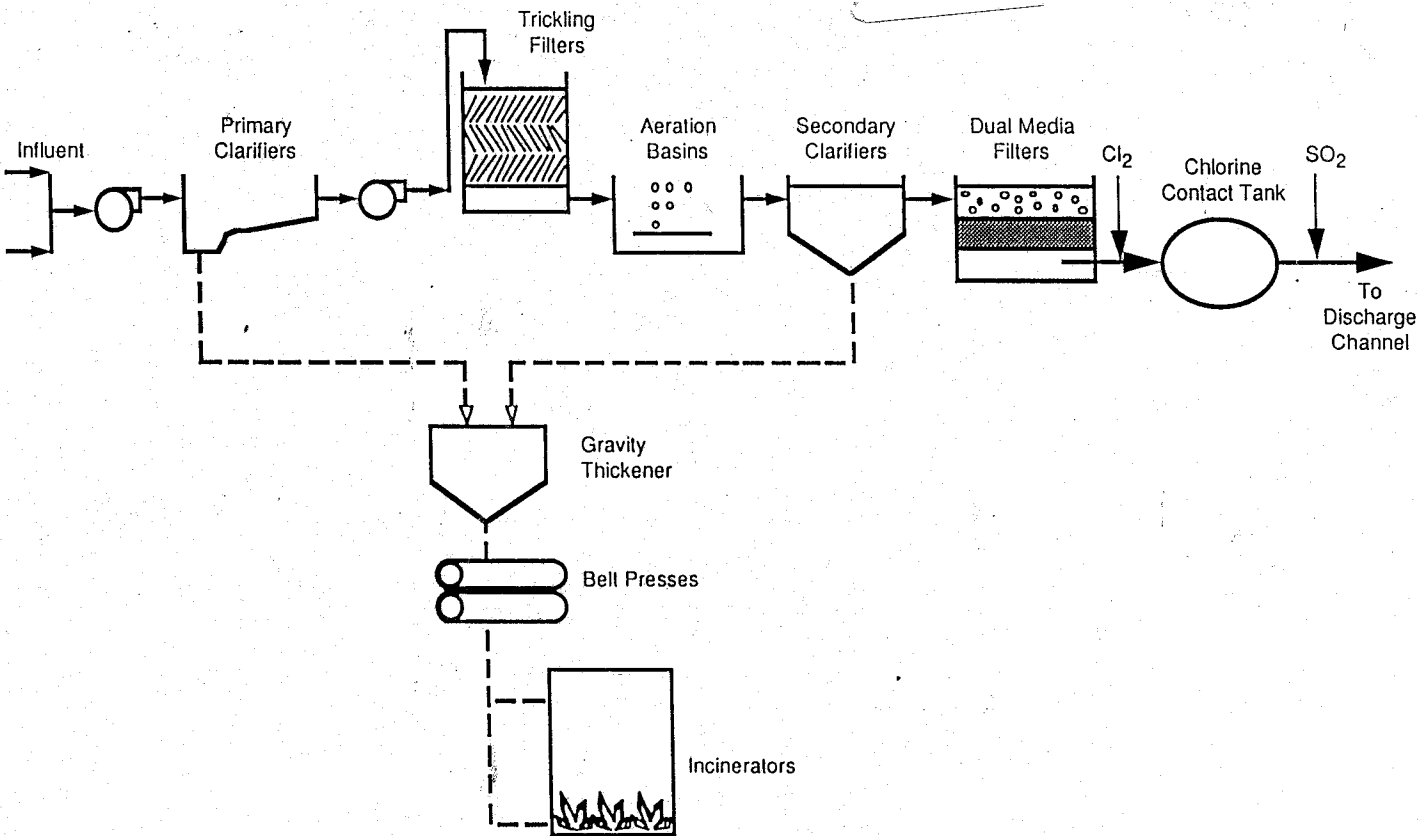
A second change has been the modification of filter backwash procedures. The filters had been chlorinated just prior to backwashing to kill biological growth. The chlorination was, however, apparently solubilizing copper adhering to filtered particles. Ceasing the pre-chlorination has improved copper removal.

A third change has been the installation of bar screens. At the point where wastewater enters the plant, the new bar screens remove large objects and rags from the sewage stream. Removal of rags has increased the copper removal efficiency of the sludge thickeners.

In addition, the RWQCP has studied treatment plants with better removal percentages for copper to determine what can be learned from their design and operation. Nationwide, relatively few plants remove copper more effectively than the RWQCP. On the basis of engineering studies, it appears that removal rate differences relate to basic design features of plants. The most notable design difference is the lack of sludge incineration at all of the plants with higher copper removal rates. Incineration requires metal-carrying return flows to be routed back through the plant. At other facilities, these metals remain with the sludge through disposal. Another design difference occurring at one of the plants is that two activated sludge (aeration basin) units are used in series, as opposed to the RWQCP's single

unit process. A third difference is that some of the identified plants use chemical additives to increase copper removal through flocculation and adsorption.

The RWQCP completed a preliminary study of possible methods of further increasing copper removal. The study suggests pilot testing of chemical addition. To be fully relied upon, such tests would need to be conducted on a fairly large scale. Following finalization of the copper discharge limit (the current standard is being reevaluated by the regulatory agencies) chemical addition will be given further consideration if more copper reduction is required. Any chemical addition designs must be thoroughly studied to avoid upsetting current process and sludge handling systems.



PLANT FLOW SCHEMATIC