MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

BOARD ACTION

- **Board of Directors**
  Engineering and Operations Committee

July 12, 2005 Board Meeting

7-8

Subject

Appropriate $630,000 to determine algae control strategies for water treatment plants (Approp. 15429)

Description

Metropolitan, in response to stricter water quality regulations, implemented process changes at the water treatment plants to meet the Stage 1 Disinfectants/Disinfection By-Products Rule. Short-term changes included moving the primary chlorine application downstream from the plant influent to the filter influent. This downstream chlorine application (also known as delayed chlorination) was implemented at all Metropolitan plants, except Skinner. Ultimately, ozone will be constructed at all facilities (ozone is on-line at Mills and Jensen) and chlorine will be relocated to the filter effluent.

Under delayed chlorination, chlorine has been removed from the flocculation and sedimentation basins resulting in the growth of algae on surfaces exposed to sunlight. If uncontrolled, algae can produce taste-and-odor compounds, clog the sampling and solids removal systems, and interfere with emergency disinfection operations (where a chlorine residual is needed in the basin quickly to respond to equipment failures).

The current algae control practice uses a weekly application of chlorine for several hours to the basins. This practice of intermittent chlorination results in a short-term increase in disinfection by-products and occasionally releases taste-and-odor compounds that are detected by consumers. The proposed study would evaluate alternative methods that may be more effective at controlling algae and do not release taste-and-odor compounds or do not increase disinfection by-products.

The proposed study consists of two phases. The first phase screens various algae control methods including basin shading, copper lining of surfaces, ultrasonic inhibition, and intermittent chlorination (the benchmark algae control method). These control techniques will be tested in a small portion of one basin at the Mills water treatment plant. The second phase of the study will further evaluate the most promising algae control technique in one full-scale basin. This board action authorizes these two phases of the study by Metropolitan staff.

This project has been evaluated and recommended by Metropolitan's Capital Investment Plan Evaluation Team, and the funds have been included in the fiscal year 2005/06 capital budget. See **Attachment 1** for the detailed report and **Attachment 2** for the financial statement.

Policy

Metropolitan Water District Administrative Code Section 5108: Capital Project Appropriation

California Environmental Quality Act (CEQA)

CEQA determination for Option #1:

The proposed actions are categorically exempt under the provisions of CEQA and the State CEQA Guidelines. The proposed actions involve the funding of a study and minor modifications to existing public facilities with negligible or no expansion of use and no possibility of significantly impacting the physical environment. In addition, the proposed actions consist of basic data collection and resource evaluation activities that do not result in a serious or major disturbance to an environmental resource. This may be strictly for information gathering purposes, or as part of a study leading to an action that a public agency has not yet approved, adopted, or funded.

Accordingly, the proposed actions qualify for both Class 1 and Class 6 Categorical Exemptions (Sections 15301 and 15306 of the State CEQA Guidelines).

The CEQA determination is: Determine that pursuant to CEQA, the proposed actions qualify under two Categorical Exemptions (Class 1, Section 15301 and Class 6, Section 15306 of the State CEQA Guidelines).

CEQA determination for Option #2:

None required

Board Options/Fiscal Impacts

Option #1

Adopt the CEQA determination and

a. Appropriate $630,000 in budgeted funds; and
b. Authorize studies and investigations for Treatment Plant Algae Control project.

Fiscal Impact: $630,000 in budgeted capital funds under Appropriation 15429

Option #2

Do not authorize studies and investigations. Continue with intermittent chlorination as the only algae control method. Implementation of this option increases the likelihood of taste-and-odor incidents.

Fiscal Impact: None

Staff Recommendation

Option #1

6/20/2005

Jill T. Wicke *Date*
Manager, Water System Operations

6/21/2005

Dennis B. Underwood *Date*
CEO/General Manager

Attachment 1 – Detailed Report

Attachment 2 – Financial Statement

BLA #3658

Detailed Report

Purpose/Background

In response to stricter water quality regulations, Metropolitan implemented process changes at the water treatment plants to meet the maximum contaminant levels and treatment technique requirements of the Stage 1 Disinfectants/Disinfection By-Products Rule. The initial modifications included moving the primary chlorine application point from the plant influent to the filter influent. The practice of delayed chlorination—no chlorine application until the filter influent—was implemented at Mills and Jensen in 2001. Delayed chlorination was recently implemented at Weymouth and Diemer. The long-term process changes include the construction of ozone at all facilities (ozone is on-line at Mills and Jensen). With ozone, the chlorine application point will be relocated to the filter effluent.

Moving the primary chlorination point left some unit processes such as flocculation and sedimentation without a continuous chlorine residual. As expected, this reduced the formation of disinfection by-products, but led to algae growing within the process basins (chlorine is an effective algaecide). Algae proliferation in the water treatment plants causes three major problems:

Production of taste-and-odor-causing compounds. When the process basins do not receive a continuous chlorine residual, algae growth can proliferate within the basins. Algae can produce chemicals that impart objectionable taste-and-odor (T&O) to the water. The most common compounds are 2-methylisoborneol (MIB) and geosmin, which cause earthy/musty odors.

Treatment and operational issues. Excessive algae growth within a plant can result in various types of mechanical problems. Large masses of algae can break off and clog various pieces of equipment including water quality sampling and sludge removal systems. Certain algae are known to cause clogging of filter media, resulting in early termination of filter runs and reduction in plant production. Also, long-term degradation of filter performance may occur due to the buildup of algae on sand and anthracite particles or the formation of mud balls from algae clumps reaching the filter media.

General negative effect on the aesthetic appearance of the plant. The general appearance of a plant is negatively affected by the growth of algae in the basins. Long strings and mats of algae in a drinking water treatment plant can create the perception that it is an inadequately maintained water treatment plant.

Prevailing Algae Control Strategies

Algae in raw water reservoirs are often controlled by applying algaecides such as copper sulfate, or by taking water from different levels of an intake structure. However, within a treatment plant, such measures are not feasible, and other strategies must be used.

Metropolitan employs an intermittent chlorination strategy where chlorine is added to the raw water for several hours once or twice per week. Enough chlorine is added to the raw water so that chlorine residual is detected at the effluent of the basin being treated. Intermittent chlorination leads to temporarily higher disinfection by-product levels and may contribute to taste-and-odor problems if large amounts of algae are present and the amount of chlorine added is sufficient to release the taste-and-odor compounds from the algae. Metropolitan has used this method of algae control for several years. Though the intermittent chlorination practice is acceptable, a passive method for algae control is desired. An ideal method would minimize chemical use, reduce operator involvement, and always control algae to non-problematic levels.

Utilities have tried various other strategies to control algal growth within the plant. Copper is known to be an inhibitor of algal growth, and some utilities have installed copper sheeting or plates along the walls of basins or along weirs and launder troughs. The effectiveness of copper, however, decreases with time as the copper surface corrodes and the copper surface has to be renewed periodically adding to plant maintenance costs.

Another algae control option is to install a cover over the basins, restricting the amount of sunlight. About five years ago, Castaic Lake Water Agency installed floating covers over their flocculation and sedimentation basins. The cover significantly reduced algae problems. This also reduced their chlorine costs significantly as they did not need to use intermittent chlorination any more for algae control.

Ultrasound technology is used in the United States in a limited number of ponds and small lakes for algae control. The technology is more commonly used in Europe in reservoirs and some water treatment plants. In the U.S., ultrasound is used more often for scale removal in industrial applications. Ultrasound waves disrupt the vacuoles of algal cells, thereby weakening the cell membranes and causing cell lyses.

There are certain coating materials that may inhibit the growth of attached algae. One particular coating has been found to reduce algal growth by 99 percent over three months compared to the control. For concrete mixes, the inhibition of algal growth has been found to be directly proportional to the zinc concentration in the mix.

Proposed Study

The objective of the proposed study is to evaluate promising algae control techniques and identify the optimum alternative for Metropolitan's five water treatment plants. The benchmark algae control technique is intermittent chlorination. The benefits, costs, and risks of other techniques will be evaluated and compared to intermittent chlorination to determine the optimum method or methods for algae control. The techniques to be evaluated include:

- Intermittent chlorination (Metropolitan's current practice);
- Basin shading;
- Lining baffle/basin walls with copper;
- Using alternative materials or coatings for baffle/basin walls to reduce algal attachment; and,
- Using ultrasound transducers in the basins.

The algae control study will consist of two phases. The initial phase will focus on screening the algae control techniques listed above. The second phase of testing will be a more detailed evaluation of the technique(s) identified as most promising during screening. The initial study will be conducted in one flocculation/sedimentation (floc/sed) basin of the Mills plant. The testing period for each technique will depend on the type of technique. Long-term screening for copper, other baffle/basin materials and covering will be necessary. Shorter-term evaluation of ultrasound will be sufficient to assess its performance. All study data will be collected by the end of 2005 in order to integrate the study into the second phase, which will involve full-scale testing of the selected algae control strategies.

For the purposes of the screening study, three of the four flocculation/sedimentation basins in the Mills plant will be designated as "benchmark" basins and will continue to receive maintenance chlorination for algal control/mitigation. The final Mills basin will be designated as the "test/control" basin. During the screening phase of testing, the test/control basin will be subject to the various algae control techniques other than maintenance chlorination. The algae control techniques will only be deployed in a small section of the basin. Thus, the test basin will also serve as a control basin. For the second phase, the most promising algae control technique will be deployed over an entire basin.

This board action authorizes the algae control screening study by Metropolitan staff. At the conclusion of the study, staff will return to the Board with the findings and recommendations for full-scale implementation.

Project Milestones

August 2005 – Commence screening test
September 2006 – Commence full-scale test
October 2007 – Complete algae control study

Cost Estimate

Attachment 2 shows the breakdown of the total estimated cost of $630,000 for the treatment plant algae control study.

Financial Statement for Water Treatment Plants Algae Control Program

A breakdown of Board Action No. 1 for Appropriation No. 15429 for the Water Treatment Plants Algae Control Program is as follows:

	Board Action No. 1 (Jul 2005)
Labor	
Studies & Investigations	$ 434,000
Final Design	
Owner Costs (Project Management)	38,000
Construction Inspection & Support	
Metropolitan Installation & Construction	
Materials and Supplies	64,000
Incidental Expenses	2,000
Professional/Technical Services (laboratory analyses)	10,000
Contracts	-
Remaining Budget	82,000
Total	**$ 630,000**

Funding Request

Program Name:	Water Treatment Plants – Algae Control Program		
Source of Funds:	Revenue Bonds, Replacement and Refurbishment or General Funds		
Appropriation No.:	15429	**Board Action No.:**	1
Requested Amount:	$ 630,000	**Capital Program No.:**	05066-W
Total Appropriated Amount:	$ 630,000	**Capital Program Page No.:**	E-62
Total Program Estimate:	$ 630,000	**Program Goal:**	W- Water Quality