

**MWD**

METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

May 11, 1993

(Engineering and Operations Committee--  
Information)

To: Board of Directors (Special Committee on Water Quality and  
Environmental Compliance--Information)

From: General Manager

Subject: Metropolitan's Vulnerability to Outbreaks of Waterborne Disease

### Report

In March and April, 1993, the City of Milwaukee, Wisconsin, had a major outbreak of waterborne disease caused by the pathogen Cryptosporidium. Estimates of the number of cases of illness range from 180,000 to 280,000, with six fatalities potentially attributed to the outbreak. Metropolitan is not vulnerable to a similar outbreak because monitoring has revealed low levels of pathogens in source waters and the high quality design and operation of Metropolitan's filtration plants. While vigilance must be maintained to ensure that pathogens such as Cryptosporidium are not discharged into our source water, the current lack of vulnerability is a direct result of proactive monitoring, design, and operational programs.

Cryptosporidiosis is typically transmitted to humans by the fecal-oral route and can be widely disseminated by drinking untreated or undertreated water. Cryptosporidium is a protozoan parasite that produces a gastrointestinal illness in healthy individuals, with symptoms that include diarrhea, nausea, and cramps, lasting up to several weeks. Currently, there is no effective medication for cryptosporidiosis, but the disease will generally subside on its own. However, persons having compromised immune systems (e.g., AIDS patients or cancer patients) may have chronic, life threatening infections. Evidence for waterborne dissemination of this pathogen can be found in several recent outbreaks, each potentially involving hundreds of thousands of persons: Thames River in England; Carrollton, Georgia; Medford, Oregon; and now Milwaukee, Wisconsin. There are no existing State or Federal regulations that set standards for Cryptosporidium in water.

To ensure that Metropolitan was not vulnerable to waterborne pathogens such as Cryptosporidium, a one-year Pathogen Monitoring Program (PMP) was implemented in March, 1991, to document the levels of several pathogens in source and treated waters. This program also assessed the feasibility of routine

pathogen monitoring by a water utility and evaluated the effectiveness of emerging pathogen detection technologies. New microbial detection technology, such as gene probes and immunofluorescent staining, will lead to the development of rapid, easy-to-perform methods that will reduce the cost of routine pathogen monitoring. The PMP represents the first comprehensive evaluation of this technology by a water utility.

Sample sites for the PMP were chosen to provide a thorough evaluation of all Metropolitan source and treated waters. The sample sites are representative of State project water, Colorado River water, and blends of both before and after treatment. Pathogens assayed for included the enteric viruses, Giardia cysts, Cryptosporidium oocysts, and Legionella bacteria. Over 100 samples were analyzed for each of these pathogens, as well as traditional indicators of microbial contamination, such as coliform bacteria.

Levels of pathogens found in Metropolitan's source and finished water are very low. A summary table detailing results from the PMP has been included (Table 1). In the source waters, the levels of Giardia cysts ranged from 0 to 1.5 cysts/100L (mean of 0.05 cysts/100L); whereas, Cryptosporidium oocyst levels ranged from 0 to 1.8 oocysts/100L (mean of 0.18 oocysts/100L). No Giardia cysts were detected in the finished water samples, and only two samples contained Cryptosporidium oocysts (0.21 and 0.28 oocysts/100L). The occurrence and concentration of Giardia and Cryptosporidium in Metropolitan's source and finished waters appears to be 100 to 1,000 times lower when compared to similar studies by other investigators (Tables 2a, 2b, 3a, 3b). While these results are encouraging, continued vigilance is necessary to ensure that this excellent quality is maintained.

The PMP is also an important source of data for the regulatory process. For example, the American Water Works Association has recently requested all utilities to monitor for Cryptosporidium, and monitoring for pathogens will probably be required by the U.S. Environmental Protection Agency as part of information gathering for the upcoming enhanced Surface Water Treatment Rule.

In addition to low pathogen levels in source waters, Metropolitan must ensure removal of Cryptosporidium and other pathogens at its filtration plants. Two key elements for effective removal are optimized filtration and effective treatment of filter backwash water. Optimized filtration was implemented by the Operations Division on October 9, 1989, at all of our filtration plants and resulted in better effluent water quality (Figure 1). The second key element is removal of pathogens by filter washwater reclamation plants. In 1988, the

Engineering Division embarked upon a program to design and construct capacity increases for Metropolitan's wastewater reclamation facilities at its filtration plants (Figure 2). The result is that current capacities of the reclamation plants are now adequate to remove particles in the size range of pathogens such as Cryptosporidium. Without effective wastewater reclamation, pathogens could be recycled and concentrated in the filtration plants.

Board Committee Assignments

This letter is referred for information to:

The Engineering and Operations Committee because of its authority to study, advise, and make recommendations with regard to the production and treatment of water pursuant to Administrative Code 2431 (c); and

The Special Committee on Water Quality and Environmental Compliance because of its authority regarding Federal and State water quality regulations pursuant to Administrative Code 2551 (a) and (b).

Recommendation

For information only.

  
General Manager

KJR/ra  
BOARD/AN9

Attachments

**Table 1**  
**Summary of Results of**  
**Pathogen Monitoring Program**

<b>PATHOGEN</b>	<b>RAW WATER</b>	<b>FINISHED WATER</b>
<i>Giardia</i> (per 100 L) Percent Positive Mean Range	14 0.05 0 - 1.5	0 0 0
<i>Cryptosporidium</i> (per 100 L) Percent Positive Mean Range	24 0.2 0 - 1.8	6 0.01 0 - 0.3
<i>Viruses</i> Percent Positive	21	3
Total Samples Collected	58	34

**Table 2a**  
**Comparison of *Cryptosporidium***  
**Surveys (Source Waters)**

	<b>MWD</b>	<b>LECHEVALLIER*</b>	<b>ROSE**</b>
<b>% Positive</b>	24	87	51
<b>Range***</b>	0 - 1.8	0 - 50,000	0 - 29,000
<b>Mean***</b>	0.2	270	43

\*American Water Works Service Co. study

\*\*National Survey of Surface and Groundwaters

\*\*\*Oocysts per 100 L

**Table 2b**  
**Comparison of *Giardia***  
**Surveys (Source Waters)**

	<b>MWD</b>	<b>LECHEVALLIER*</b>	<b>ROSE**</b>
<b>% Positive</b>	14	81.2	15.5
<b>Range***</b>	0 - 1.5	0 - 6,600	0 - 625
<b>Mean***</b>	0.05	277	3.0

\*American Water Works Service Co. study

\*\*National Survey of Surface and Groundwaters

\*\*\*Oocysts per 100 L

**Table 3a**  
**Comparison of *Cryptosporidium***  
**Surveys (Finished Waters)**

	<b>MWD</b>	<b>LECHEVALLIER</b>	<b>ROSE</b>
% Positive	6	27	17
Range*	0 - 0.3	0 - 48	0 - 1.7
Mean*	0.01	1.52	N.A.**

\*Oocysts per 100 L

\*\*Data not available

**Table 3b**  
**Comparison of *Giardia***  
**Surveys (Finished Waters)**

	<b>MWD</b>	<b>LECHEVALLIER</b>	<b>ROSE</b>
% Positive	0	17.1	N.A.**
Range*	-	0 - 64	N.A.**
Mean*	-	4.45	N.A.**

\*Oocysts per 100 L

\*\*Data not available

Figure 1

# AVERAGE FILTER EFFLUENT TURBIDITY AT MWD FILTRATION PLANTS

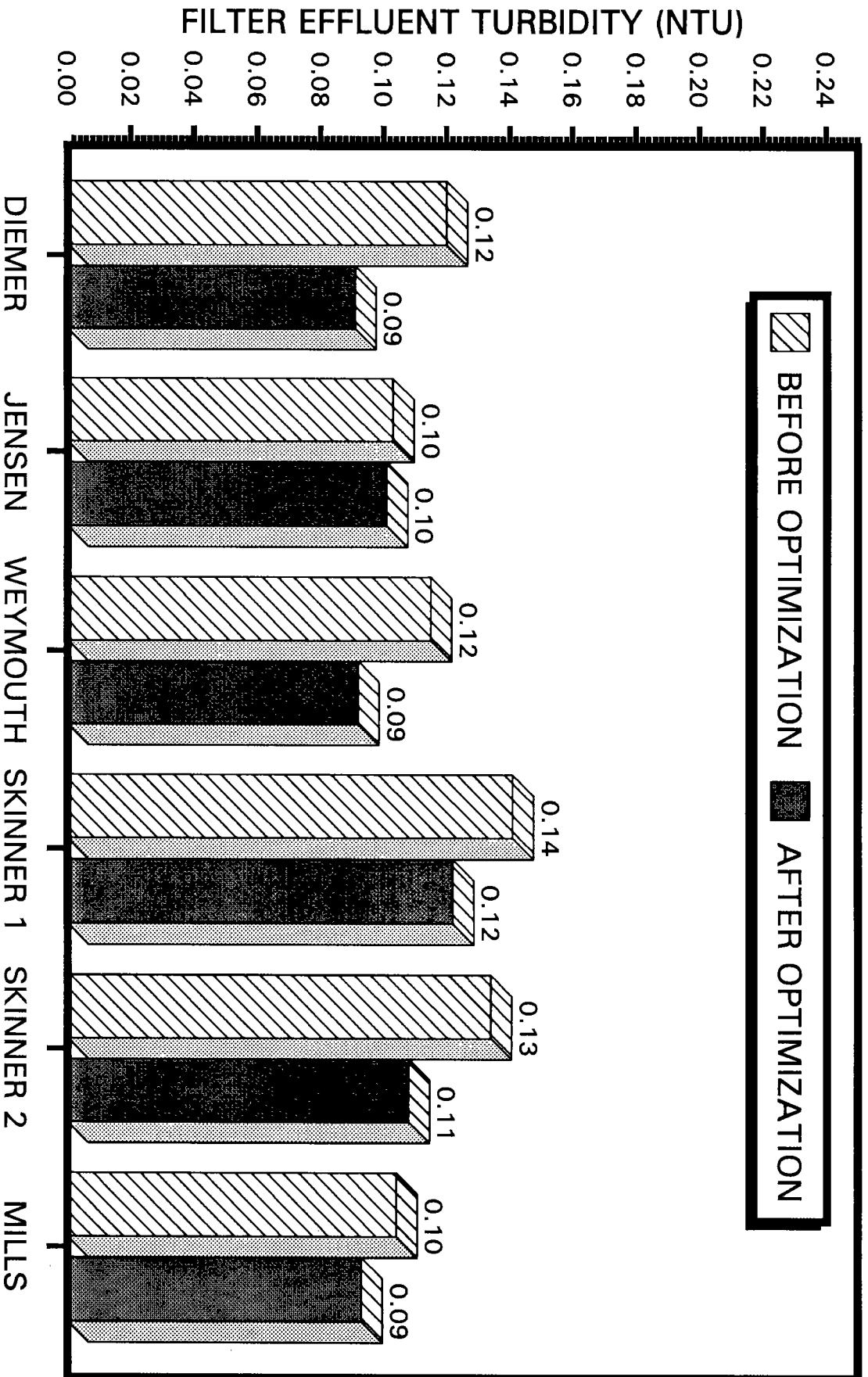


Figure 2

## Increases in Washwater Reclamation Plant Capacities at Metropolitan Treatment Plants

