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METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

EXECUTIVE SECRETARY

March 25, 1996

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

From: General Manager

Submitted by: Mark D. Beuhler
Director of Water Quality

Subject: *Cryptosporidium* Action Plan Update

RECOMMENDATION(S)

For information only.

EXECUTIVE SUMMARY

Metropolitan's *Cryptosporidium* Action Plan, approved by the Board in September 1995, includes source water monitoring, methods development, treatment evaluations, and public outreach. This letter describes source water monitoring results and progress made in methods development and treatment studies.

DETAILED REPORT

On September 12, 1995, your Board approved a *Cryptosporidium* Action Plan to address issues related to *Cryptosporidium* in the water supply. The Action Plan focuses on source water monitoring, improving analytical methods and treatment techniques, and providing public outreach/education. This letter describes highlights of the Action Plan results to date.

Higher *Cryptosporidium* Sampling Results

Results of a recent (1994-95) year long survey of *Cryptosporidium* levels in the influent of our five water treatment plants indicate higher concentrations than observed in the 1991-92 sampling survey. The average *Cryptosporidium* concentration was about 7 times higher than the previous average (see Table 1). While these mean concentrations are about 40 to 270 times lower than reported by other investigators conducting similar surveys in other parts of the country, they suggest that *Cryptosporidium* levels in our source waters are not as low as the 1991-92 survey suggested (see Table 2). The higher levels of *Cryptosporidium* in the 1994-95 sampling versus the 1991-92 sampling may be attributed to improved detection methods and potential changes in activities in the watersheds.

During a recent high turbidity incident at the Henry J. Mills Filtration Plant, the *Cryptosporidium* levels in the plant influent were over 100 times greater than the previous highest measurement at the Mills plant and was the highest value (200 oocysts/100 liters) recorded in our source waters to date. These results indicate that there are point and/or nonpoint sources of *Cryptosporidium* entering our water supplies. These data also highlight the importance of the prompt actions taken by staff at the Mills plant to handle this high turbidity, including a brief plant shutdown.

Our filtration plants continue to provide a high degree of protection through removal of *Cryptosporidium.* Using existing methods, *Cryptosporidium* was not detected (<1 oocyst/100 L) in the finished water samples from the 1994-95 sampling period. Levels in Metropolitan's finished water are less than that observed in other surveys (see Table 3). However, as the existing EPA-approved method only has a detection sensitivity of 10 to 15 percent, we cannot be completely assured of the absence of *Cryptosporidium* in our treated waters.

We will continue monthly monitoring of the plant influent and effluent at each of our five treatment plants. In the coming fiscal year, with the emphasis on cost containment, we plan to handle this issue by diverting resources away from other important but less urgent areas in applied research to enable expanded monitoring to assess the sources and levels of *Cryptosporidium* contributed from the watershed. In addition, we have requested the Department of Water Resources' assistance in investigating the sources of *Cryptosporidium* in the State Water Project system, particularly in the southern California reservoirs.

Methods Development (Including Patent Application)

The *Cryptosporidium* detection method cannot determine if the *Cryptosporidium* oocysts recovered from the environment are alive or dead. Moreover, this method cannot distinguish between the *Cryptosporidium* species that infects humans and those that do not. New detection methods using molecular biology techniques are being developed by staff to address the issues of specificity, viability, and infectivity of *Cryptosporidium* oocysts. Gene probes,

specific for the species that infects humans, have been developed and empirically tested. Cell cultures to determine the infectivity of the oocysts have been selected and are being optimized. A patent application is being prepared for these new detection methods, and we expect to have a "patent pending" status by April/May, 1996. In addition, proposals for funding methods development have been submitted to the National Water Research Institute, the EPA, and the American Water Works Association Research Foundation.

Treatment Evaluations

Sampling methods and analytical techniques have been developed for determining potential *Cryptosporidium* surrogates. These microbial surrogates are similar in size to *Cryptosporidium,* are also resistant to conventional disinfection, but are much easier to detect than *Cryptosporidium.* These surrogates may be used as an adequate measure of the *Cryptosporidium* removal by our treatment processes so that removal can be optimized.

Additional work has been performed on a bench-scale to select coagulants and polymers needed for optimal turbidity removal through the treatment plants and at the washwater reclamation plants. These results will be verified with pilot-scale testing.

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Attachments

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Table 1

Comparison of *Cryptosporidium* Concentrations
Metropolitan versus National Surveys

Source Waters

	Metropolitan		National Surveys	
	1991-92	1994-95	LeChevallier[a]	Rose[b]
Number of Samples	58	60	85	181
Percent Positive	24	43	87	55
Range (oocysts/100 L)	ND[c]-1.8	ND[c]-127	ND[c]-50,000	ND[c]-29,000
Average Concentration (oocysts/100 L)[d]	0.14	1.0	270	43

[a] LeChevallier et. al. (1991)--Occurrence of *Giardia* and *Cryptosporidium* spp. in Surface Water. Appl. Environ. Micro. 57:2610-2617.

[b] Rose et. al. (1991)--Survey of Potable Water Supplies for *Cryptosporidium* and *Giardia*. Environ. Sci. Technol. 25:1393-1400.

[c] ND--None detected (detection sensitivity in Metropolitan samples approximately <5 oocysts/100 L, detection sensitivity <13 to <358 oocysts/100 L in LeChevallier study, and <1 oocysts/100 L for surface waters in Rose study).

[d] Geometric mean based on all samples, with exception of LeChevallier data which included only positive samples.

Table 2

Cryptosporidium Concentrations in Filtration Plant Influents[a]
1994-95 Survey Results

Plant	Percent Samples Positive	*Cryptosporidium* Average[b] (oocysts/100 L)		*Cryptosporidium* Range (oocysts/100 L)
		Arithmetic	Geometric	
Jensen	42	13.5	1.8	ND[c]-127
Weymouth	42	3.6	1.2	ND-21.7
Diemer	58	3.2	1.6	ND-14.6
Mills	42	0.5	0.4	ND-1.5
Skinner	33	0.7	0.5	ND-3.9
Overall Average	43	4.3	1.0	---

[a] Twelve samples per plant between October 1994 and September 1995.

[b] Non-detect samples considered "0" for calculations.

[c] ND--None detected (detection sensitivity approximately <5 oocysts/100 L).

Table 3

Comparison of *Cryptosporidium* Concentrations
Metropolitan versus National Surveys

Finished Waters

	Metropolitan		National Surveys	
	1991-92	1994-95	LeChevallier[a]	Rose[b]
Number of Samples	34	60	82	17[c]
Percent Positive	6	0	27	12
Range (oocysts/100 L)	ND[d]-0.3	ND[d]	ND[d]-48	ND[d]-0.7
Average Concentration (oocysts/100 L)[e]	0.01	ND[d]	1.5	0.04

[a] LeChevallier et. al. (1991)--Occurrence of *Giardia* and *Cryptosporidium* spp. in filtered drinking water. Appl. Environ. Micro. 57:2617-2621.

[b] Rose et. al. (1991)--Survey of potable water supplies for *Cryptosporidium* and *Giardia*. Environ. Sci. Technol. 25:1393-1400.

[c] Includes conventional treatment only.

[d] ND--None detected (detection sensitivity in Metropolitan samples approximately <1 oocysts/100L; detection sensitivity not reported in LeChevallier and Rose studies).

[e] Geometric mean based on all samples, with exception of LeChevallier study which included only positive samples.