Department of Health Services
Division of Drinking Water and Environmental Management
***Cryptosporidium* Action Plan**
April 1995

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1. Introduction

In 1993, a waterborne illness outbreak in which over 400,000 persons were infected occurred in Milwaukee, Wisconsin. The outbreak was caused by an intestinal parasite called *Cryptosporidium*, which was not even known to cause illness in humans until 1976. The parasite exists in a shell called an "oocyst" which enables it to survive many environmental conditions for extended periods of time and be resistant to disinfection. It is present in most surface water sources at least intermittantly, but it is generally difficult to detect any illness that may result due to the fact that cryptosporidiosis goes away within a week or so, its symptoms are so similar to other intestinal problems, such as stomach flu, and the concentrations of *Cryptosporidium* present are typically much lower than those present in the Milwaukee outbreak, resulting in much smaller populations infected.

The U.S. Environmental Protection Agency (EPA), which has demonstrated its interest in improving the microbiological quality of the water by its adoption of the Total Coliform Rule and the Surface Water Treatment Rule, has proposed an Information Collection Rule (ICR) which includes monitoring for *Cryptosporidium* and an Enhanced Surface Water Treatment Rule which would establish treatment requirements for *Cryptosporidium* as well as other pathogens.

Smaller than giardia, *Cryptosporidium* is more difficult to remove during conventional drinking water treatment. Since it is commonly found in surface water sources, it is important that water systems using suface water optimize the water treatment process in order to maximize the *Cryptosporidium* removal.

The following *Cryptosporidium* Action Plan is intended to facilitate comprehensive compliance with the State's existing Surface Water Treatment Rule (SWTR). The plan does not contain any requirements beyond the scope or intent of current regulation; rather, it clarifies existing requirements to support drinking water utilities in optimizing the treatment process and reducing the risk of a waterborne illness outbreak.

The Department intends to implement the Action Plan by first working with the large systems (>1000 service connections) which serve the most people and then assisting the small water systems as staff resources become available. A limited amount of staff training may be needed if the large water systems are to be properly reviewed in a timely manner. The current number of adequately trained staff will not enable the Department to implement this Action Plan for the water systems with less than 1000 services connections at this time.

Watershed Sanitary Survey- Protection of water source and pathogen source control.

A sanitary survey of the watershed of a public water supply source is required by State regulation every five years. The report documenting the first survey must be completed by January 1, 1996 and submitted to the Department within 60 days of survey completion. AWWA has developed a guidance manual that can be useful. Planning of the required surveys should be completed at this time if adequate water quality data is to be included in the survey report. Seasonal raw water turbidity and coliform data are needed in order to do a thorough evaluation of the source.

If cattle and/or sheep, which are major sources of *Cryptosporidium* contamination, are allowed on the watershed the survey must identify their location, number and the measures that are taken to prevent contamination from the animal waste. Runoff from any animal containment site must not be allowed to flow into the water source. The Department is willing to meet with Utilities and their consultants to develop measures that will help in achieving this goal.

Submission of Available Data to the Department.

The US Environmental Protection Agency's proposed Information Collection Rule which requires pathogen monitoring by large utilities will not officially be in place until late 1995. However some water suppliers are collecting data at this time. The Department will request summaries of the available data so that we may also evaluate the information in a timely manner and provide additional guidance on the steps that may be helpful in minimizing the threat of cryptosporidiosis to the public.

Alternative Technologies

During the first year of operation of an alternative treatment system approved by the Department, the Division of Drinking Water and Environmental Management Field Operations Branch (DDWFOB) will complete a comprehensive review with special attention given to the permit provisions, including the following issues:

Verification of compliance with the Department-specified effluent turbidity standard. (Effluent turbidity performance standards are in most cases lower for approved alternative technologies.)

Verification of compliance with the technology-specific turbidity standard after backwashing or other interruptions in treatment.

Review of the Engineering Report due 60 days after the first year of operation of an alternative technology, section 64653. The problems identified in the Engineering Reports will be summarized and sent to all District offices and Local Primacy Agencies (LPAs). Systems using alternative technologies which have

identified the need for corrective action will be expected to provide the needed improvements.

Operations Plan/Optimized Treatment

The American Water Works Association (AWWA) "goal" for effluent turbidity from all surface water treatment plants is 0.1 NTU. The SWTR requires that all plants be operated in accordance with an approved Operations Plan that is "... designed to produce the optimal water quality from the treatment process." (Section 64661, CCR) "Optimal water quality" should be defined as a minimum reasonably achieveable turbidity, particulate matter density, and pathogenic microorganisms density, including *Cryptosporidium*. Direct and conventional treatment plants must also adjust the coagulation and flocculation processes to "demonstrate that optimum coagulation is being achieved." (Section 64660(b)(8)) Operations plans should be used to insure day-to-day optimization of the treatment process.

The Department agrees with and endorses the AWWA surface water treatment plant effluent turbidity goal of 0.1 NTU. The Department recommends that all water suppliers using a surface water source adopt a philosophy of always optimizing their surface water treatment plant operations in a manner designed to achieve the maximum turbidity removal. The Department believes that water systems which strive to achieve the AWWA goal and are optimizing their plant will be minimizing the risk to exposure of pathogens, including *Cryptosporidium*, in the drinking water delivered to their customers.

In light of the increased concern related to the control of *Cryptosporidium*, the Division of Drinking Water Field Operations Branch (DDWFOB) has made it a high priority to inspect treatment plants on a regular basis to assure that every effort is made to optimize the treatment process. An up-to-date operations plan for treatment optimization should include the following elements:

- Including a statement at the front of the operations manual which clearly states that it is the goal of the purveyor to attempt to optimize performance of all plant unit treatment processes and thereby maximize the turbidity removal. The supplier should endorse the idea that a properly designed and operated plant will be able to consistently achieve an effluent turbidity of 0.1 NTU and thereby achieve an effluent quality which presents the lowest pathogen risk to system customers.

- Monitoring all plant unit processes closely and responding immediately to any indication of a unit treatment process malfunction. The proper operation of all pretreatment processes is critical to achieving optimum filter performance.

- Operating unit treatment processes at hydraulic loading rates that will enable meeting optimization goals. Operating at the loading rates needed to meet peak summer demands is not recommended when the system demand is reduced. This is especially

important when turbidity and coliform data indicate recent runoff may have increased the pathogen concentrations in the water source.

- Establishing procedures for optimizing the coagulation, flocculation and sedimentation processes to enable maximum turbidity removal in the pretreatment units with a turbidity goal of 1 to 2 NTU in the effluent of the sedimentation basin at all times. This includes adjusting the coagulant dosages when plant influent conditions change such as the flow, solids loading, return of properly treated backwash water, temperature, pH, etc. It is important to use jar tests or particle counters to determine proper pretreatment chemical and dose. For those systems with the resources to install particle counting systems, the information obtained has been found to be helpful for adjusting pretreatment chemicals and determining when to backwash filters. The Department encourages the continued development and use of this new monitoring tool for determination of chemical dosages and length of filter runs.

- Expanded monitoring of plant operations to include turbidity monitoring of individual filters on both a continuous basis and intermittent grab samples. Turbidity monitoring of the effluent of all sedimentation processes can also be helpful.

- Calibrating turbidimeters frequently, including proper replacement of both the primary and secondary standards which are used in the calibration. A calibration of the light source used in the turbidimeter and a check of the unit's operating voltage on a regular basis is also important.

- Establishing procedures for optimizing filter operations to avoid turbidity spikes after service interruptions. This can be achieved by filter to waste, by bringing filters on-line slowly, or by the proper use of filter aid chemicals during the backwash process. AWWA research shows that *Cryptosporidium* oocyst breakthrough can occur at much lower turbidity levels than those allowed for by the existing regulations. This is especially true of the turbidity levels (up to 2 NTU) allowed during the first 4 hours after backwash. Attempting to achieve turbidities of 0.3 NTU or less after backwash should be the operator's goal.

- Operating in such a way as to avoid sudden increases in flows through a filter. Such events can result in a short and quick release of filtered material (which can include pathogens) to the plant effluent.

- Optimizing the performance of backwash water recovery systems. (NOTE: Recycling of backwash water should not be practiced if it interferes with optimization of the treatment process.) An operational goal of less than 2.0 NTU for the effluent of a plant's reclaimed backwash water and sludge reclamation system should be established. Use of coagulant chemicals to assist in the solids separation is advisable and usually necessary to meet the 2.0 NTU goal. Disinfection of this water should be considered in the reclamation treatment systems if at all possible.

Reliable Removal Treatment Processes

The ability of a plant to provide optimum removal treatment under all conditions and at all times is dependent upon the reliability of the system equipment, availability of on-line back-up equipment, ability to quickly replace failed equipment and the alarm systems provided. All utilities should be capable of quickly replacing or repairing failed equipment including the following:

Filter media and filter underdrains
Backwash pumps and surface wash systems
Pretreatment chemical feed and mixing facilities
Turbidity monitoring units

Regardless of size, water systems should install a continuous turbidity analyzer and chart recorder on the plant effluent. Data from this unit allows an accurate appraisal of treatment plant performance. This unit should be regularly inspected and standardized with the secondary standards or adjusted in accordance with data obtained form a properly calibrated bench unit.

Informing the Public

The Department also believes that an informational notification should be sent to customers of systems which do not have a treatment process in place at this time that provides for physical removal of pathogens. Utilities operating a plant that is hydraulically overloaded or for other reasons unable to achieve the desired effluent turbidity goals until improvements to the plant are made, may also want to inform their customers of possible problems associated with the current system. In such notices it would be wise to list the steps which are being taken to improve the treatment provided. The Department will provide assistance in the drafting of such notices.

FACT SHEET

Cryptosporidium in Drinking Water and Cryptosporidiosis

Human Cryptosporidiosis Cryptosporidiosis is caused by the parasite *Cryptosporidium parvum* which was recognized as a pathogen for a wide variety of vertebrates, but not associated with disease in humans until 1976. Since then, it has been identified as a cause of sporadic human gastrointestinal disease and sometimes of outbreaks, the largest being the 1993 waterborne outbreak in Milwaukee, Wisconsin, in which over 400,000 became ill.

The incubation period is variable, ranging from two to twelve days and averaging seven. The spectrum of illness is also variable, ranging from asymptomatic infection to life-threatening disease. The major symptoms are abdominal cramps and diarrhea; the latter may be profuse (up to 17 liters/day). Less commonly, there are nausea, vomiting, malaise, and low-grade fever. Symptoms tend to wax and wane but remit on their own in two to four weeks in immunologically healthy people. Due to immunodeficiency, AIDS patients tend not to be able to clear their infections; the parasite persists and, commonly but not always, produces a protracted and sometimes fulminant clinical course that contributes to death. In other groups of immunodeficient persons; e.g., cancer chemotherapy patients, illness onset is explosive with cholera-like symptoms, and infection can extend for a slightly longer period than in healthy people. There is no specific treatment of proven value, only supportive care via fluid and electrolyte replacement.

***Cryptosporidium* Findings in California Waters** Although drinking water utilities have not yet been required to do *Cryptosporidium* monitoring, some in California have done so and submitted findings (in terms of oocysts/100 liters of <u>treated</u> drinking water). Reported levels range from less than 1 to 5.3 oocysts/100 liters of <u>treated</u> drinking water and less than 1 to 13.2 oocysts/100 liters of <u>untreated</u> drinking water sources, with one source reporting levels to 235 and the State Project/Delta Waters containing levels from 5 to 132. Although absolute risks cannot be calculated from these limited data, they do show, when combined with the data cited below, that the risks of healthy individuals contracting cryptosporidiosis from drinking water in California is extremely low.

Under current California law, the water bottlers also are not required to monitor *Cryptosporidium* in their sources and products. However, one bottler in Southern California tested source and product waters at a commercial laboratory and found no oocysts.

Infectivity of *Cryptosporidium parvum* The oocysts are considered infective as soon as they are passed out in the stool and can remain infective outside the body for two to six months in a moist environment. The infectious dose for cryptosporidiosis infection is

low. In one small volunteer study 20 percent of those fed 30 oocysts, 38 percent of those fed 100 oocysts, and 88 percent of those fed 300 oocysts became infected; the overall illness rate in those infected was 61 percent. In the USA, the background infection rate is estimated by the Centers for Disease Control at ~1 percent to 4.5 percent in individuals surveyed, while in developing regions of the world the prevalence is significantly higher, 3 percent to 20 percent. There is some evidence to indicate that the antibody may remain in the body for three to five years, but there are questions related to the tests for seroprevalence.

Child care and health care workers who come in direct contact with feces, parents of diaper-aged children who attend day care centers, persons exposed to human feces by sexual contact, and those (like veterinarians and animal handlers) with extensive animal contact need to be aware of the risk of *Cryptosporidium parvum* and take necessary preventive measures.

Diagnosis Diagnosis is made by special stain of stools. The fewer the organisms, the more difficult the diagnosis. Excretion is somewhat intermittent, not with every stool, and most excretion occurs within the first 72 hours of infection. Due to intermittent excretion, the fact that no treatment is available for suspected cases and a certain insensitivity in the test method itself, doctors rarely request stool analysis for *Cryptosporidium parvum.*

Prevention Personal prevention measures: Washing hands after using toilet and after contact with animals or soil and before handling food, avoiding raw milk/products, avoiding untreated water, especially surface water supplies (treatments that may remove *Cryptosporidium parvum* include ozonation, microfiltration, and optimized conventional filtration), and avoiding sexual practices that could result in contact with feces. Persons with immunodeficiency may need to take additional precautions.

Cryptosporidiosis in California Cryptosporidiosis became a reportable disease in California in 1989. Annual data: 1989 (since May) - 46 cases; 1990 - 165 cases; 1991 - 210 cases; 1992 - 276 cases; 1993 - 372 cases; and 1994 (through 9/24) - 327 cases. Of the 1396 total cases since 1989, 42 percent were from San Francisco County alone and 25 percent from Los Angeles County. Of the 1119 whose gender was reported, 80 percent were males, primarily in the 20 to 50-year-old range, peaking at 30 years. In females, there was a bimodal peak at infancy and at age 30. In approximately 4 percent of the AIDS cases in California, cryptosporidiosis was the AIDS-defining illness.

Waterborne Outbreaks There have been a number of identified waterborne outbreaks of cryptosporidiosis in the USA: Milwaukee, Wisconsin; Carrolton, Georgia; Braun Station, Texas; Jackson County, Oregon; and one in New Mexico. A recent outbreak in Las Vegas ultimately may be determined to have been waterborne; it is still being investigated.

Federal Regulatory Background Related to Water Treatment

EPA has been focusing on the risk of waterborne illness from pathogens in its regulatory activities:

1. Adoption of the Total Coliform Rule (TCR) to address the presence of pathogens via a surrogate (the total coliform group of bacteria);

2. Adoption of the Surface Water Treatment Rule (SWTR) to address *Giardia* and viruses as surrogates for other pathogens found in surface waters;

3. Draft proposal of a Groundwater Disinfection Rule (GWDR) to reduce pathogens found in groundwaters (proposal possibly late 1995);

4. Draft proposal of the Enhanced Surface Water Treatment Rule (ESWTR) to address all pathogens including *Cryptosporidium* (to be effective in 1997); and

5. Consideration of an emergency *Cryptosporidium* rule in response to public and water industry concerns raised by the recent Milwaukee outbreak and media coverage implying significant risks from contaminated surface water supplies throughout the country. (Might be made available for review in June 1995, and would focus on physical treatment optimization through tighter performance criteria.) Alternatives are also being considered, such as more rigorous guidance for existing regulations.

In addition, in February 1994, the U.S. Environmental Protection Agency (EPA) proposed the Information Collection Rule (ICR) which is expected to be promulgated this year and will require large water system monitoring to start in the spring of 1996 for *Cryptosporidium*, other pathogens, and various disinfection byproducts. The intent of the rule is to collect data to be used in formulating subsequent federal regulations for pathogen and disinfection byproduct control (the final Stage I Disinfectants/Disinfection Byproducts and Enhanced Surface Water Treatment Rules expected June 1996, and the Stage 2 versions of these rules to be proposed later). The analytical methodology for *Cryptosporidium* is a major issue in the ICR because analytical methods for detecting the oocysts provide incomplete information in that recoveries range from 1 percent to 50 percent in samples tested and average less than 20 percent; there is subjectivity involved in "reading" the slides in terms of identification and enumeration; oocysts found may be of six different species of *Cryptosporidium*, but only *Cryptosporidium parvum* is known to be pathogenic for humans; oocysts are most often found with no internal structure intact; there is no way to assess the viability and infectiousness of detected oocysts, and the detection limits vary with the quality of the water analyzed. The method required by the ICR (Fluorescence Antibody Test) has an anticipated best recovery rate of 20 percent. Most surface water utilities monitoring are expected to detect *Cryptosporidium*.

California Department of Health Services
Fact Sheet

What You Should Know About CRYPTOSPORIDIOSIS (crip-to-spor-id-i-o-sis)

What is cryptosporidiosis?

Cryptosporidiosis is a disease of the intestinal tract caused by the parasite *Cryptosporidium parvum*. It has only been known to cause disease in humans since 1976. *Cryptosporidium* lives in a protective shell called an oocyst. This enables it to survive many environmental conditions and be resistant to disinfection.

How is cryptosporidiosis spread?

Cryptosporidiosis is spread by putting something in the mouth that has been contaminated with the stool of an infected person or animal. It can be spread in the following ways:

- ✓ drinking contaminated water
- ✓ swallowing water while swimming in contaminated waters
- ✓ contact with the stool of infected animals (e.g., pets and farm animals)
- ✓ contact with the stool of infected persons (e.g., changing diapers, sexual practices)
- ✓ eating contaminated undercooked foods (rarely happens)
- ✓ hand-to-mouth transfer of oocysts from surfaces that may have become contaminated with infected stool

The levels of *Cryptosporidium* present in a public drinking water system in California are very low and should not be of health concern to the general public.

What are the symptoms of cryptosporidiosis?

Two to 10 days after infection by the parasite, symptoms may appear. Although some persons may not have symptoms, others have: watery diarrhea, headache, abdominal cramps, nausea, vomiting, low-grade fever. These symptoms may lead to weight loss and dehydration.

In otherwise healthy persons, these symptoms usually last 1 to 2 weeks, at which time the immune system is able to stop the infection. In persons with a suppressed immune system, the infection may continue and become life-threatening. Examples of persons with a suppressed immune system are individuals who have AIDS, persons who recently had an organ or bone marrow transplant, or persons who are undergoing chemotherapy.

Is there a treatment for cryptosporidiosis?

There is no specific treatment for cryptosporidiosis. For people with a normal immune system, the disease is short-term. For persons with AIDS, some drugs may provide relief from symptoms.

What steps can be taken to prevent cryptosporidiosis?

The decision whether to take any special precautions rests with the individual. However, most citizens need not take any special precautions because the disease is not life-threatening to persons with a healthy immune system. There are a number of precautions persons can take:

- Avoid swallowing lake, river and swimming pool waters.
- Avoid sexual practices that could result in contact with feces.
- If you have cryptosporidiosis yourself, wash your hands after using the toilet to prevent spreading the infection.
- If you are a caregiver of patients with cryptosporidiosis, wash your hands after bathing patients, emptying bedpans, changing soiled linen, or otherwise possibly coming in contact with the stools of patients.
- Wash your hands after using the toilet or changing diapers and before handling food. If you use gloves during diaper changing, change them between each child.
- If you work on a farm, wash your hands before eating and at the end of every work shift. Check to see that fecal material from the workplace is not being transported elsewhere via boots, clothing, tools, etc.
- Wash your hands after gardening or other contact with soil.

In addition, it is recommended that persons with a serious immune system problem (for example, if you have AIDS and your CD4 count is less than 200) drink distilled water or water that has been brought to a rolling boil for one minute. Ice should also be made from boiled or distilled water.

If you suspect that you have cryptosporidiosis. . .

See your physician as soon as possible, especially if your immune system is suppressed, so that the disease can be properly identified and monitored.

For more information about. . .

Cryptosporidiosis: call the Department of Health Services' Division of Communicable Disease Control at 510/540-2566

Local drinking water quality: contact your local drinking water utility

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