

- The availability of non-destructive tests that can be applied to bag and cartridge filters to verify the removal efficiency of production filters that are not directly challenge tested—EPA requests data or information demonstrating the correlation between a proposed non-destructive test and the removal of *Cryptosporidium* oocysts.

- The applicability of pressure drop monitoring, filtrate turbidity monitoring, or other process monitoring and process control procedures to verify the integrity of bag and cartridge filters—EPA requests data or information demonstrating the correlation between a proposed process monitoring tool and the removal of *Cryptosporidium* oocysts.

- The applicability of bag and cartridge filters to different source water types and treatment scenarios.

- The applicability of the proposed *Cryptosporidium* removal credits and testing criteria to *Giardia lamblia*.

- The use of a 1 log factor of safety for awarding credit to bag and cartridge filters—EPA requests comment on whether this is an appropriate factor of safety to account for the inability to conduct integrity monitoring of these devices, as well as the variability in removal efficiency observed over the course of a filtration cycle for some filtration devices. This inability creates uncertainty regarding both changes in the performance of a given filter during use and variability in performance among filters in a given product line. If the 1 log factor of safety is higher than necessary to account for these factors, should the Agency establish a lower value, such as a 0.5 log factor of safety?

### 13. Secondary Filtration

#### a. What is EPA proposing today?

Today's proposal allows systems using a second filtration stage to receive an additional 0.5 log *Cryptosporidium* removal credit. To be eligible for this credit, the secondary filtration must consist of rapid sand, dual media, granular activated carbon (GAC), or other fine grain media in a separate stage following rapid sand or dual media filtration. A cap, such as GAC, on a single stage of filtration will not qualify for this credit. In addition, the first stage of filtration must be preceded by a coagulation step, and both stages must treat 100% of the flow.

#### b. How was this proposal developed?

Although not addressed in the Agreement in Principle, EPA has determined that secondary filtration meeting the criteria described in this section will achieve additional removal of *Cryptosporidium* oocysts. Consequently, additional removal credit

may be appropriate. As reported in section III.D, many studies have shown that rapid sand filtration preceded by coagulation can achieve significant removal of *Cryptosporidium* (Patania *et al.* 1995, Nieminski and Ongerth 1995, Ongerth and Pecoraro 1995, LeChevallier and Norton 1992, LeChevallier *et al.* 1991, Dugan *et al.* 2001, Nieminski and Bellamy 2000, McTigue *et al.* 1998, Patania *et al.* 1999, Huck *et al.* 2000, Emelko *et al.* 2000). While these studies evaluated only a single stage of filtration, the same mechanisms of removal are expected to occur in a second stage of granular media filtration.

EPA received data from the City of Cincinnati, OH, on the removal of aerobic spores through a conventional treatment facility that employs GAC contactors for DBP, taste, and odor control after rapid sand filtration. As described previously, a number of studies (Dugan *et al.* 2001, Emelko *et al.* 1999 and 2000, Yates *et al.* 1998, Mazounie *et al.* 2000) have demonstrated that aerobic spores are a conservative indicator of *Cryptosporidium* removal by granular media filtration when preceded by coagulation.

During the period of 1999 and 2000, the mean values of reported spore concentrations in the influent and effluent of the Cincinnati GAC contactors were 35.7 and 6.4 cfu/100 mL, respectively, indicating an average removal of 0.75 log across the contactors. Approximately 16% of the GAC filtered water results were below detection limit (1 cfu/100 mL) so the actual log spore removal may have been greater than indicated by these results.

In summary, studies in the cited literature demonstrate that a fine granular media filter preceded by coagulation can achieve high levels of *Cryptosporidium* removal. Data on increased removal resulting from a second stage of filtration are limited, and there is uncertainty regarding how effective a second stage of filtration will be in reducing levels of microbial pathogens that are not removed by the first stage of filtration. However, EPA has concluded that a secondary filtration process can achieve 0.5 log or greater removal of *Cryptosporidium* based on (1) the theoretical consideration that the same mechanisms of pathogen removal will be operative in both a primary and secondary filtration stage, and (2) data from the City of Cincinnati showing aerobic spore removal in GAC contactors following rapid sand filtration. Therefore, EPA believes it is appropriate to propose 0.5 log additional *Cryptosporidium*

treatment credit for systems using secondary filtration which meets the criteria of this section.

c. *Request for comment.* The Agency requests comment on awarding a 0.5 log *Cryptosporidium* removal credit for systems using secondary filtration, including the design and operational criteria required to receive the log removal credit. EPA specifically requests comment on the following issues:

- Should there be a minimum required depth for the secondary filter (e.g., 24 inches) in order for the system to receive credit?

- Should systems be eligible to receive additional *Cryptosporidium* treatment credit within the microbial toolbox for both a second clarification stage (e.g., secondary filtration, second stage sedimentation) and lower finished water turbidity, given that additional particle removal achieved by the second clarification stage will reduce finished water turbidity?

### 14. Ozone and Chlorine Dioxide

#### a. What is EPA proposing today?

Similar to the methodology used for estimating log inactivation of *Giardia lamblia* by various chemical disinfectants in 40 CFR 141.74, EPA is proposing the CT concept for estimating log inactivation of *Cryptosporidium* by chlorine dioxide or ozone. In today's proposal, systems must determine the total inactivation of *Cryptosporidium* each day the system is in operation, based on the CT values in Table IV–19 for ozone and Table IV–20 for chlorine dioxide. The parameters necessary to determine the total inactivation of *Cryptosporidium* must be monitored as stated in 40 CFR 141.74(b)(3)(i), (iii), and (iv), which is as follows:

- The temperature of the disinfected water must be measured at least once per day at each residual disinfectant concentration sampling point.

- The disinfectant contact time(s) ("T") must be determined for each day during peak hourly flow.

- The residual disinfectant concentration(s) ("C") of the water before or at the first customer must be measured each day during peak hourly flow.

Systems may have several disinfection segments (the segment is defined as a treatment unit process with a measurable disinfectant residual level and a liquid volume) in sequence along the treatment train. In determining the total log inactivation, the system may calculate the log inactivation for each disinfection segment and use the sum of the log inactivation estimates of *Cryptosporidium* achieved through the