



July 29, 2015

Environmental Health Section

Steps for Hyperchlorination of a (Diarrheal) Fecal Incident When Cyanuric Acid is Present

Cryptosporidium (or “Crypto”) is an extremely chlorine-tolerant parasite, so even well-maintained pools and interactive fountains can be at risk of spreading Crypto among swimmers. However, when a diarrheal incident or Crypto outbreak occurs in a public pool using a stabilized chlorine product as a disinfectant or if the operator adds cyanuric acid (CYA) to slow chlorine dissipation, the CYA presence significantly increases the time and concentration required to remediate Crypto. The Crypto inactivation value moves from 15,300 to 72,000.

This guidance requires the operator to: a) report the incident to the local health department, b) document the remedial actions taken and c) hyperchlorinate the water using the following steps:

Step 1: Close the pool to swimmers. If you have multiple pools that use the same filtration system — all of the pools will have to be closed to swimmers and hyperchlorinated. Do not allow anyone to enter the pool(s) until hyperchlorination is complete. *(A hyperchlorination alternative is completely draining and cleaning the pool. Please consult an aquatics professional to determine this method’s feasibility.)*

Step 2: Remove as much of the fecal material as possible (using a net or scoop) and dispose of it in a sanitary manner. Clean and disinfect the item used to remove the fecal material.

Step 3: Measure the cyanuric acid level in the pool. If level is less than or equal to 50 ppm continue to step 4. If the concentration is greater than 50 ppm, lower the CYA concentration to 50 ppm or less by partially draining the pool and then refill to the normal operating level.

Step 4*: Raise the free chlorine concentration to 40 ppm and adjust pH to 6.5. Maintain the free chlorine and pH at these levels for at least 30 hours to achieve the Ct inactivation value of 72,000.

Table 1. Use the formula below to calculate time required for Crypto inactivation in the presence of 50 ppm or less of Cyanuric acid

Concentration time inactivation value (Ct)	÷	**Free chlorine concentration (c)	= Time (t)
72000	÷	40 ppm	= 1800 minutes or 30 hours
72000	÷	20 ppm	= 3600 minutes or 60 hours

The Ct inactivation value refers to the concentration of free chlorine in parts per million multiplied by time in minutes that is required to render the crypto parasite infective at a specific pH and temperature.

Step 5: Confirm that the filtration system is operating while the water reaches and is maintained at the proper free chlorine and pH levels for disinfection.

Step 6: Backwash the filter thoroughly after reaching the Ct inactivation value. Be sure the effluent is discharged directly to waste and in accordance with regulations. Do not return the backwash through the filter.

Step 7*:** Allow swimmers back into the water only after the required Ct has been achieved and the free chlorine and pH levels have been returned to the normal regulatory operating parameters.

Rationale for Guidance:

* Crypto Ct is based on killing 99.9% of Crypto. This level of Crypto inactivation cannot be reached in the presence of 50 ppm chlorine stabilizer, even after 24 hours at 40 ppm free chlorine, pH 6.5, and a temperature of 77°F (25°C). Extrapolation of these data suggest it would take approximately 30 hours to kill 99.9% of Crypto in the presence of 50 ppm or less cyanuric acid, 40 ppm free chlorine, pH 6.5, and a temperature of 77°F (25°C) or higher.

Shields JM, Arrowood MJ, Hill VR, Beach MJ. The effect of cyanuric acid on the chlorine inactivation of Cryptosporidium parvum in 20 ppm free chlorine. J Water Health. 2009;7(1):109–14.

Notes:

**Many conventional test kits cannot measure free chlorine levels this high. Use chlorine test strips that can measure free chlorine in a range that includes 20–40

ppm (such as those used in foodservice) or make dilutions for use in a standard DPD test kit.

***CDC does not recommend testing the water for Crypto after hyperchlorination is completed. Although hyperchlorination destroys Crypto's infectivity, it does not necessarily destroy the structure of the parasite.

Table 2. Amount of Chlorine Compound to Introduce 1 ppm Chlorine in Selected Pool Volumes

Pool Volumes in Gallons of Water						
% available chlorine/chlorine compound	1,000 gallons	5,000 gallons	10,000 gallons	20,000 gallons	50,000 gallons	100,000 gallons
12% (Sodium hypochlorite)	1.07 fluid oz.	5.33 fluid oz.	10.7 fluid oz.	1.33 pints	1.67 quarts	3.3 quarts
65% (Calcium hypochlorite)	.21 ounces	1.03 ounces	2.05 ounces	4.11 ounces	10.03 ounces	1.28 pounds

Reference: *Table A, Taylor® Testing & Treatment Guide Part #2004B*
Chlorine products contain different amounts of available chlorine.