

## Responding to Fecal Accidents in Public Swimming Pools Recommended Procedures and Guidelines

These recommendations are solely for management of fecal accidents in chlorine disinfected swimming pools. The recommendations do not address use of other non-chlorine disinfectants because there is limited pathogen inactivation data for many of these compounds. Because improper handling of chlorinated disinfectants could cause injury, appropriate occupational safety and health requirements should be followed.

The pool operator shall have all pool users exit the pool. The pool is to be closed from use while the sanitation procedures are being followed.

### A. **Formed stool** (solid, non-liquid)

1. 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 net or scoop (e.g., after cleaning, leave the net or scoop immersed in the pool during disinfection). Vacuuming stool from the pool is not recommended.\*
2. Raise the free available chlorine concentration to 2 mg/L, pH 7.2-7.5, if it is <2.0 mg/L. Ensure this concentration is found throughout the pool by sampling at least three widely spaced locations away from return water outlets. This free available chlorine concentration was selected to keep the pool closure time to approximately 30 minutes. Other concentrations or closure times can be used as long as the CT (Contact Time) inactivation value<sup>†</sup> is kept constant (see Table 1).
3. Maintain the free available chlorine concentration at 2.0 mg/L, pH 7.2-7.5, for at least 25 minutes before reopening the pool. State or local regulators may require higher free available chlorine levels in the presence of chlorine stabilizers such as chlorinated isocyanurates.<sup>§</sup> Ensure that the filtration system is operating while the pool reaches and maintains the proper free available chlorine concentration during the disinfection process.
4. Establish a fecal accident log. Document each fecal accident by recording date and time of the event, formed stool or diarrhea, free available chlorine concentration at the time of observation of the event and before opening the pool, the pH, the procedures followed to respond to the fecal accident (including the process used to increase free chlorine residual if necessary), and the contact time.

### B. **Diarrhea** (liquid stool)

1. Follow step one (1) above.
2. Follow step two (2) above.
3. Raise the free available chlorine concentration to 20 mg/L<sup>¶</sup> and maintain the pH between 7.2 and 7.5. Ensure this concentration is found throughout the pool by sampling at least three widely spaced locations away from return water outlets. This

chlorine and pH level should be sufficient to inactivate *Cryptosporidium* and should be maintained for at least eight (8) hours, equivalent to a CT inactivation value of 9600. A higher or lower free available chlorine level/inactivation time can be used as long as a CT inactivation value equaling 9600 is maintained for *Cryptosporidium* inactivation. If necessary, consult an aquatics professional to determine and identify the feasibility, practical methods, and safety considerations before attempting the super chlorination of any pool.

4. Ensure that the filtration system is operating while the pool reaches and maintains the proper free available chlorine concentration during disinfection.
5. Backwash the filter thoroughly after reaching the CT value. Be sure the effluent is discharged directly to waste and in accordance with state or local regulations. Do not return the backwash through the filter. Where appropriate, replace the filter media.
6. Swimmers may be allowed into the pool after the required CT value has been achieved and the free available chlorine level has been returned to the normal operating range allowed by the state or local regulatory authority. Maintain the free available chlorine concentration and pH at standard operating levels based on state or local regulations. If necessary, consult state or local regulatory authorities for recommendations on bringing the free available chlorine levels back to an acceptable operating range.
7. Establish a fecal accident log. Document each fecal accident by recording date and time of the event, formed stool or diarrhea, free available chlorine concentration at the time or observation of the event and before opening the pool, the pH, the procedures followed to respond to the fecal accident (including the process used to increase free chlorine residual if necessary), and the contact time.

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\* No uniform recommendations for disinfection of vacuum systems are available. However, if a vacuum system is accidentally used, the waste should be discharged directly to a sewer or other approved waste disposal system and not through the filtration system. The dilution effect of the pool water going through the hose may reduce the risk for high-level contamination of the vacuum system.

† CT refers to concentration (C) of free available chlorine in mg/L or ppm multiplied by time (T) in minutes. If pool operators want to use a different chlorine concentration or inactivation time, they need to ensure that CT values always remain the same. For example, if an operator finds a formed fecal accident in the pool and his pool has a free pH of 7.5, to determine how long the pool should be closed to swimmers, locate 3 mg/L in the left column of the table and then move right and read the pool closure time. The pool should be closed for 19 minutes. Example 2: The CT inactivation value for *Cryptosporidium* is 9600, which equals (20 mg/L) (480 minutes) (i.e., 8 hours). After a diarrheal accident in the pool, an operator determines she can only maintain 15 mg/L. How long would hyper chlorination take? Answer:  $9600 = CT = [(15) (T)]$ ;  $T = 9600/15 = 640 \text{ minutes} = 10.7 \text{ hours}$ .

§ The impact of chlorine stabilizers (e.g., chlorinated isocyanurates) on pathogen inactivation and disinfectant measurement is unclear and requires further investigation. State or local regulations on chlorinated isocyanurates use should be consulted.

¶ Many conventional test kits cannot measure free available chlorine levels this high. Use chlorine test strips that can measure free available chlorine in a range that includes 20mg/L (such as those used in the

food industry) or make dilutions for use in a standard DPD (N, N-diethyl-p-phenylenediamine) test kit using chlorine-free water.

**Table 1:** Free Available chlorine concentrations and pool closure time\* required for disinfection of pools after a formed fecal accident

| <b>Concentration<br/>(mg/L or ppm)</b> | <b>Pool closure time<br/>(minutes)</b> |
|--|--|
| < 0.4                                  | 105                                    |
| 0.6                                    | 72                                     |
| 0.8                                    | 55                                     |
| 1.0                                    | 45                                     |
| 1.2                                    | 39                                     |
| 1.4                                    | 34                                     |
| 1.6                                    | 30                                     |
| 1.8                                    | 28                                     |
| 2.0                                    | 25                                     |
| 2.2                                    | 24                                     |
| 2.4                                    | 22                                     |
| 2.6                                    | 21                                     |
| 2.8                                    | 20                                     |
| 3.0                                    | 19                                     |

\*Theoretical pool closure times for 99.9 % inactivation of Giardia cysts by free available chlorine, pH.5 and 25 C were derived from the Environmental Protection Agency's (EPA) Disinfection Profiling and Benchmarking Guidance Manual, EPA data were generated from original pathogen inactivation data and modeled for use in drinking water treatment facilities. These data were used to develop the pathogen inactivation table from which these pool closure times were derived. The applicability of these data to pools, where water and disinfectant mixing may not be uniform, has not been show. Therefore, these pool closure times do not take into account "dead spots" and other areas of poor pool water mixing.