INTERNATIONAL AQUATIC FOUNDATION

Vomit and Fecal Accident Response

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I. INTRODUCTION

Recreational Water Illnesses (RWIs) occur from ingestion of water that contains germs that can infect the gastrointestinal system and cause diarrhea. The primary organisms responsible are *E. coli 0157:H7, Shigella,* Noroviruses, *Giardia,* and *Cryptosporidium* (Crypto). The latter two are actually parasites and are much harder to kill. Because of their microscopic size, they can also pass through many sand and cartridge filters. DE filters can capture most of the *Giardia* and Crypto. *E. coli* 0157:H7 usually infects a person from ingestion of undercooked meat or from touching a food preparation surface that was used to process raw meat. *Shigella* can also be passed by food contamination. *E. coli* and *Shigella* are bacteria that are readily controlled when the free chlorine is maintained between 1 and 4 ppm. Noroviruses, *Giardia,* and *Cryptosporidium* are more resistant to standard chlorine treatments. This document will focus on the special procedures used to deactivate Noroviruses, *Giardia,* and *Cryptosporidium* after a fecal accident has occurred.

Noroviruses are spread through food and water that have been contaminated with feces or vomit. Noroviruses are highly contagious and may also be spread person-to-person during outbreaks. During illness each gram of feces contains hundreds of millions of viral particles. The number of viral particles in vomit is lower but may still be in the millions per milliliter. The symptoms of Norovirus are acute-onset vomiting, watery non-bloody diarrhea with abdominal cramps, nausea, and occasionally low grade fever. Vomiting is more common in children. Symptoms usually start 24 to 48 hours after exposure. Dehydration is the most common complication, especially among children and the elderly. Symptoms usually last 24 to 60 hours and there are no long-term consequences.

Giardia and Crypto exist in an oocyst form until they are ingested. Once in the intestine, they hatch and can form millions of protozoa. As few as 10 cysts can cause giardiasis or cryptosporidiosis, illnesses involving diarrhea, nausea, cramps, and sometimes dehydration. In 1993 Crypto infected 400,000 people who ingested contaminated potable water in Milwaukee. The symptoms begin about 7 days after infection and can last for 2 weeks. An individual may still pass an organism in a stool for up to 2 months after infection. These illnesses can be life threatening to people with weakened immune systems.

These organisms can enter a pool when a person carrying them defecates in the pool or from someone who does not practice good personal hygiene. Noroviruses may also be introduced to the pool by vomit. Children's pools are at higher risk than other areas. The U.S. Centers for Disease Control and Prevention (CDC) has determined that formed stools are not likely to contain Crypto, but may contain *Giardia* and other germs. Within the stool these germs are protected from sanitizers and are free to multiply within the stool and emerge from the stool to infest the pool. Thus it is important to remove the stool as soon as possible. Diarrhea is a higher risk since it may be due to any of the infectious germs.

After a fecal accident, remove the fecal material as quickly and efficiently as possible, evacuate the pool and chlorinate. Guidelines for chlorination are based on something called a CT value (C= free chlorine concentration in ppm and T= contact time in minutes). The CT value for *Giardia* is 45, which means 1 ppm for 45 minutes or 3 ppm for 15 minutes. The CT value for Crypto is 9600, which means 1 ppm for 6.7 days or 20 ppm for 8 hours. The CDC has defined this high level of chlorination to treat Crypto as "hyperchlorination." The table below shows other treatments that can be used to hyperchlorinate the pool.

Treatment concentrations and times for hyperchlorination to a 9600 CT

Free chlorine concentration	Time in minutes needed	Time in hours needed
1	9600	160
4	2400	40
10	960	16
20	480	8
40	240	4

Since most free chlorine test kits cannot measure above 10 ppm, one must use a test strip or titration that can determine higher concentrations. There are FAS-DPD titration kits and iodometric titration kits available that can test higher concentrations. These kits generally range in the 0-200 ppm range and use a titration with a very distinct color change to measure free or total chlorine (with the FAS-DPD test) or simply total chlorine (with the iodometric kits and strips).

II. PREVENTION AND ACCIDENT RESPONSE

The CDC has prepared several documents that outline good practices for prevention of contamination and for sanitizing a pool after a vomit or fecal accident. These are summarized below.

A. Prevention

1. Prepare and implement a written fecal accident policy for your facility. Teach this to all employees and strictly enforce it. Have lifeguards monitor the pool for fecal accidents and risky behavior, such as rinsing diapers in the pool. Be certain that the staff knows the fecal accident procedure.
2. Because diarrhea is a likely source of infection, train staff to report illnesses they experience or those observed in bathers.
3. Establish good hygiene rules. Require all bathers to shower before using the pool. All showering should involve a thorough cleansing with warm water and soap.
4. Have all diaper-aged children use plastic “swim diapers” that have elastic around the legs and waist. An adult caring for a child in a wading pool should shower before entering another pool.
5. Regularly monitor the disinfection, circulation, and filtration systems for proper performance. Ideally a children’s wading pool should be on a separate filtration system.
6. Maintain a chlorine residual of 1-3 ppm in pools and 2-4 ppm in wading pools and spas. Maintain pH between 7.2 and 7.6. Superchlorinate regularly (generally weekly is recommended).
7. Inform bathers that if they have diarrhea or abdominal cramps, they are not to use the pool before 14 days after all symptoms have ended.
8. Encourage frequent restroom visits for children.
9. Have adults wash hands with soap and water after changing diapers or using the toilet and have children do the same.
10. Do not swallow pool/spa water. It is very important that all toddlers and children be taught not to swallow the water and this lesson be re-enforced frequently.

B. Clean-Up of a Vomit or Formed Stool Fecal Accident

Note – check for state or local regulatory guidelines regarding fecal accidents.

1. Evacuate the pool immediately. Shut down all pools using the same filter and do not allow anyone to enter until all areas are decontaminated.
2. Promply remove as much of the vomit or fecal matter as possible using a net or a scoop and dispose of it in a toilet. Leave the scoop in the pool during chlorination. Do not vacuum the vomit or feces.

3. Raise the free chlorine to at least 2 ppm and ensure pH is 7.2-7.5.
    - Maintain the chlorine level at >2 ppm for 30 minutes.
    - At the end of 30 minutes re-test the free chlorine level. If it is not >2 ppm add more chlorine and extend the test for another 30 minutes.
    - State regulations may require higher chlorine values if the pool uses a chlorine stabilizer.
    - Make sure filter is operating during clean-up.
4. After the CT value has been achieved, backwash the filter. Discharge the effluent to waste following local regulations. Where appropriate, replace the filter media.
5. Document the date, time, and chlorine concentration at the time of the accident. Note the type of accident (vomit, formed feces or diarrhea). Record the pH, procedures followed for the accident, and contact time.

C. Clean-Up of a Diarrheal Accident

1. Evacuate the pool immediately. Shut down all pools using the same filter and do not allow anyone to enter until all areas are decontaminated.
2. Remove as much of the fecal matter as possible using a net or a scoop and dispose of it in a toilet. Leave the scoop in the pool during chlorination. Do not vacuum the stool.
3. Raise the free chlorine to 20 ppm and adjust pH to 7.2-7.5. This level of treatment is called “hyperchlorination” by the CDC.
    - Maintain the free chlorine and pH for at least 8 hours.
    - During the eight-hour treatment, test the chlorine level several times and add more chlorine if needed. If the free chlorine level drops below 20 ppm the treatment time must be increased.
    - Other concentrations and times may be used as long as the CT value of 9600 is achieved.
    - Make sure the filter system is operating during clean-up.
4. After the CT value has been achieved, backwash the filter. Discharge the effluent to waste following local regulations. Where appropriate, replace the filter media.
5. Adjust the Free Chlorine level to 1 to 4 ppm, or according to local regulatory guidelines. Swimmers may return to the pool after the above steps have been accomplished.
6. Document the accident by recording date, time, and chlorine concentration at the time of the accident. Note the type of accident vomit, formed feces or diarrhea). Record the pH, procedures followed for clean-up, and the contact time.

III. SUMMARY

- Microorganisms can enter recreational water and infect bathers causing recreational water illnesses (RWIs). Fecal accidents and improper food handling are the primary source for these organisms to enter the water.
- Two of these organisms, Noroviruses and *Giardia*, are somewhat resistant to chlorine.
- One of these organisms, *Cryptosporidium*, is very resistant to sanitizers
- Recreational water facilities should adopt and maintain plans to prevent the spread of these microorganisms and to address clean up of fecal accidents.

IV. REFERENCES

1. Centers for Disease Control and Prevention, Division of Parasitic Diseases, Healthy Swimming website, http://www.cdc.gov/healthyswimming/
2. Centers for Disease Control and Prevention fecal accident brochure, http://www.cdc.gov/healthyswimming/fecalacc.html.
3. Centers for Disease Control and Prevention vomit and blood spill accident brochure, http://www.cdc.gov/healthyswimming/bloodandvomit.htm
4. Environmental Protection Agency Disinfection Profiling and Benchmarking Guidance Manual from http://www.epa.gov/safewater/mdbp/mdbp.html