

# Fecal Accident Response Recommendations for Pool Staff\*

What do you do when you  
find poop in the pool?



\*Check for existing guidelines from your local or state regulatory agency before use. CDC recommendations do not replace existing state or local regulations or guidelines.

- These recommendations are for responding to fecal accidents in chlorinated recreational water venues.
- Improper handling of chlorine-based disinfectants can cause injury. Follow proper occupational safety and health requirements when following these recommendations.
- **Pool Closures:** Fecal accidents are a concern and an inconvenience to both pool operators and patrons. Pool operators should carefully explain to patrons why the pool needs to be closed in response to a fecal accident. Understanding that pool closure is necessary for proper disinfection and protection of the health and safety of swimmers is likely to promote support rather than frustration. Pool closures allow chlorine to do its job—to kill germs and help prevent Recreational Water Illnesses (RWIs).

# Important background info...

## WHAT ARE RECREATIONAL WATER ILLNESSES (RWIs)?

What is the first thing that pops into your head when you think about water safety? Drowning? Slipping? Lightning? All good answers, and all are very important. But, did you know that germs can contaminate swimming water? These germs cause RWIs that have made many people sick.

RWIs are caused by germs such as "Crypto" (KRIP-toe), short for *Cryptosporidium*, *Giardia* (gee-ARE-dee-uh), *E. coli* O157:H7, and *Shigella* (Shi-GEL-uh).

## HOW ARE RWIs SPREAD?

RWIs are spread by swallowing pool water that has been contaminated with fecal matter. How? If someone has diarrhea, that person can easily contaminate the pool. Think about it. Pool water is shared by every swimmer. Really, it's communal bathing water. It's not sterile. It's not drinking water.

The good news is that germs causing RWIs are killed by chlorine. However, chlorine doesn't work right away. It takes time to kill germs and some germs like Crypto can live in pools for days. Even the best maintained pools can spread illness.

## SHOULD ALL FECAL ACCIDENTS BE TREATED THE SAME?

No. A diarrheal fecal accident is a higher-risk event than a formed stool accident. With most diarrheal illnesses, the number of infectious germs found in each bowel movement decreases as the diarrhea stops and the person's bowel movements return to normal. Therefore, a formed stool is probably less of a risk than a diarrheal accident that you may not see.

A formed stool may contain no germs, a few, or many that can cause illness. You won't know. The germs that may be present are less likely to be released into the pool because they are mostly contained within the stool. However, formed stool also protects germs inside from being exposed to the chlorine in the pool, so prompt removal is necessary.

**Germ Inactivation Time for Chlorinated Water\***

Germ	Time
<i>E. coli</i> O157:H7 Bacterium	Less than 1 minute
Hepatitis A Virus	About 16 minutes
<i>Giardia</i> Parasite	About 45 minutes
Crypto Parasite	About 15,300 minutes or 10.6 days <sup>†</sup>

## SHOULD YOU TREAT A FORMED FECAL ACCIDENT AS IF IT CONTAINS CRYPTO?

No. In 1999, pool staff volunteers from across the country collected almost 300 samples from fecal accidents that occurred at waterparks and pools.<sup>¶</sup> CDC then tested these samples for Crypto and *Giardia*. None of the sampled fecal accidents tested positive for Crypto, but *Giardia* was found in 4.4% of the samples collected. These results suggest that formed fecal accidents pose only a very small Crypto threat but should be treated as a risk for spreading other germs (such as *Giardia*). Remember a diarrheal fecal accident is considered to be a higher-risk event than a formed-stool fecal accident.

\* 1 ppm (1mg/L) chlorine at pH 7.5 and 77°F (25°C).

<sup>†</sup> Shields, JM; Arrowood, MJ; Hill, VR and Beach, MJ. (2007) Inactivation of *Cryptosporidium parvum* under chlorinated recreational water conditions. Journal of Water and Health. In Press.

<sup>¶</sup> Prevalence of Parasites in Fecal Material from Chlorinated Swimming Pools — United States, 1999 (2001) MMWR Morb Mortal Wkly Rep (20):410–2.

# What do I do about...

## formed stool in the pool?

Formed stools can act as a container for germs. If the fecal matter is solid, removing the feces from the pool without breaking it apart will limit the degree of pool contamination. In addition, RWIs are more likely to be spread when someone who is ill with diarrhea has a fecal accident in the pool.

## diarrhea in the pool?

Those who swim when ill with diarrhea place other swimmers at significant risk for getting sick. Diarrheal accidents are much more likely than formed stool to contain germs. Therefore, it is important that all pool managers stress to patrons that swimming when ill with diarrhea is an unhealthy pool behavior.

1. **For both formed-stool and diarrheal fecal accidents**, direct everyone to leave the pool. If you have multiple pools that use the same filter—all pools will have to be shut down. Do not allow anyone to enter the contaminated pool(s) until all decontamination procedures are completed.
2. **For both formed-stool and diarrheal fecal accidents**, 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.

3. Raise the chlorine to 2 ppm (if less than 2 ppm), and ensure the water's pH is between 7.2–7.5 and temperature is about 77°F (25°C). This 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 inactivation value\* is kept constant (see next page).
4. Maintain the chlorine concentration at 2 ppm, pH 7.2–7.5, for at least 25 minutes before reopening the pool. State or local regulators may require higher chlorine levels in the presence of chlorine stabilizers,† which are known to slow disinfection. Ensure that the filtration system is operating while the pool reaches and maintains the proper free chlorine concentration during the disinfection process.
3. Raise the free chlorine concentration to 20 ppm (mg/L)<sup>§</sup> and maintain the water's pH between 7.2–7.5 and temperature at about 77°F (25°C). The chlorine and pH should remain at these levels for at least 12.75 hours to achieve the CT inactivation value\* of 15,300. **Crypto CT values are based on the inactivation of 99.9% of oocysts. Laboratory studies indicate that this level of Crypto inactivation cannot be reached in the presence of 50 ppm chlorine stabilizer,<sup>†††</sup> even after 24 hours at 40 ppm free chlorine, pH 6.5 at a temperature of about 77°F (25°C).**
4. Ensure that the filtration system is operating while the pool reaches and maintains the proper chlorine level during disinfection. If necessary, before attempting the hyperchlorination of any pool, consult an aquatics professional to determine the feasibility, the most optimal and practical methods, and needed safety considerations.
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. Allow swimmers back into the pool after the required CT value has been achieved and the chlorine level has been returned to the normal operating range allowed by the state or local regulatory authority.



Establish a fecal accident log. Document each fecal accident by recording date and time of the event, whether it involved formed stool or diarrhea, and the free chlorine and pH levels at the time or observation of the event. Before reopening the pool, record the free chlorine and pH levels, the procedures followed in response to the fecal accident (including the process used to increase chlorine levels if necessary), and the contact time.

\* CT inactivation value (or contact time) refers to concentration (C) of free chlorine in ppm multiplied by time (T) in minutes at a specific pH and temperature.

† Chlorine stabilizers include compounds such as cyanuric acid, dichlor, and trichlor.

§ 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 ppm (such as those used in the food industry) or make dilutions with chlorine-free water when using a standard DPD test kit.

§ If pool operators want to use a different chlorine concentration or inactivation time, they need to ensure that CT values always remain the same (see next page for examples of how to accomplish this).

\*\* CDC, unpublished data.

# Pool disinfection time...

How long does it take to disinfect the pool after a fecal accident? This depends on what type of fecal accident has occurred and at which chlorine levels you choose to disinfect the pool. If the fecal accident is formed stool, follow Figure 1, which displays the specific time and chlorine levels needed to inactivate *Giardia*. If the fecal accident is diarrhea, follow Figure 2, which displays the specific time and chlorine levels needed to inactivate Crypto.

**Figure 1-*Giardia* Inactivation for a Formed-Stool Fecal Accident**

Chlorine Level (ppm)	Disinfection Time*
1.0	45 minutes
2.0	25 minutes
3.0	19 minutes

\* These closure times are based on 99.9% inactivation of *Giardia* cysts by chlorine at pH 7.5, 77°F (25°C). The closure times were derived from the U.S. Environmental Protection Agency (EPA) Disinfection Profiling and Benchmarking Guidance Manual. These closure times do not take into account "dead spots" and other areas of poor pool water mixing.

**Figure 2-Crypto Inactivation Time for a Diarrheal Fecal Accident**

Chlorine Level (ppm)	Disinfection Time*†
1.0	15,300 minutes (255 hours)
10	1,530 minutes (25.5 hours)
20	765 minutes (12.75 hours)

\* Shields, JM; Arrowood, MJ; Hill, VR and Beach, MJ. (2007) Inactivation of *Cryptosporidium parvum* under chlorinated recreational water conditions. Journal of Water and Health. In Press.

† At pH 7.5, 77°F (25°C).



The **CT inactivation value** is the concentration (C) of free chlorine in ppm multiplied by time (T) in minutes (CT value = C x T). The CT value for *Giardia* is 45 and the CT value for Crypto is 15,300 (both at about pH 7.5, 77°F [25°C]). If you choose to use a different chlorine concentration or inactivation time, you must ensure that the CT values remain the same.

For example, to determine the length of time needed to disinfect a pool after a diarrheal accident at 15 ppm, use the following formula:  $C \times T = 15,300$ .

Solve for time:  $T = 15,300 \div 15 \text{ ppm} = 1020 \text{ minutes}$  or 17 hours. It would take 17 hours to inactivate Crypto at 15 ppm. You can do the same for *Giardia* by using the CT inactivation value of 45.