

# 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 waterborne 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 accidentally swallowing pool water that has been contaminated with germs that cause diarrhea. How? If someone has diarrhea, that person can easily contaminate the pool. Think about it. Pool water is shared by every swimmer and is not sterile.

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
<i>Cryptosporidium</i> Parasite	about 9600 minutes (6.7 days)

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

## 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. CDC then tested them 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.

# 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 decrease the likelihood 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 a 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 diarrhea, 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 diarrhea, 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 2ppm), and ensure the pH is between 7.2 - 7.5. 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<sup>1</sup> is kept constant (see back page).

4. Maintain the chlorine concentration at 2.0 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 such as chlorinated isocyanurates. Ensure that the filtration system is operating while the pool reaches and maintains the proper free available chlorine concentration during the disinfection process.



3. Raise the free available chlorine concentration to 20 ppm<sup>†</sup> (mg/L) and maintain the pH between 7.2 and 7.5. This chlorine and pH level should be sufficient to inactivate *Cryptosporidium* and should be maintained for at least 8 hours, equivalent to a CT inactivation value of 9600.
4. Ensure that the filtration system is operating while the pool reaches and maintains the proper chlorine level during disinfection. If necessary, consult an aquatics professional to determine and identify the feasibility, practical methods, and safety considerations before attempting the hyperchlorination of any pool.
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 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.

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

<sup>1</sup> CT refers to concentration (C) of free available chlorine in 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 (See Figure 1 for examples).

<sup>†</sup> Many conventional test kits cannot measure free available chlorine levels this high. Use chlorine test strips that can measure free available chlorine up to 20 ppm. For more information on how to use these test strips, visit [www.poolchemicals.com](http://www.poolchemicals.com).

# 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 level 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 Formed Fecal Accident**

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

\*These closure times are based on a 99.9% inactivation of *Giardia* cysts by chlorine, pH 7.5, 77° F (25°C). The closure times were derived from the 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 Diarrheal Accident**

Chlorine Levels (ppm)	Disinfection Time*
1.0	6.7 days
10	16 hours
20	8 hours

**CT value** is the concentration (C) of free available chlorine in ppm multiplied by time (T) in minutes (CT value = C x T). The CT value for *Giardia* is 45 and the value for Crypto is 9600. 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 at 15 ppm after a diarrheal accident use the following formula:  $C \times T = 9600$ . Solve for time:  $T = 9,600 \div 15 \text{ ppm} = 10.7 \text{ hours}$ . It would take 10.7 hours to inactivate Crypto at 15 ppm. You can do the same for *Giardia* by using the CT of 45.

## ~ Pool Closures ~

Fecal accidents are a concern and an inconvenience to both pool operators and patrons. Pool operators should carefully explain to swimmers the need to close the pool in response to a fecal accident for their own health and safety. Understanding that pool closure is necessary for proper disinfection and protection of the health of swimmers is likely to promote support rather than frustration. Pool closures allow chlorine to do its job and protect your swimmers from RWIs.

For more information go to:

[www.healthyswimming.org](http://www.healthyswimming.org)

