

HOW SWIMMERS AFFECT WATER CLARITY

Every time we enter the water our bodies shed millions of small particles that affect the clarity of pool water.

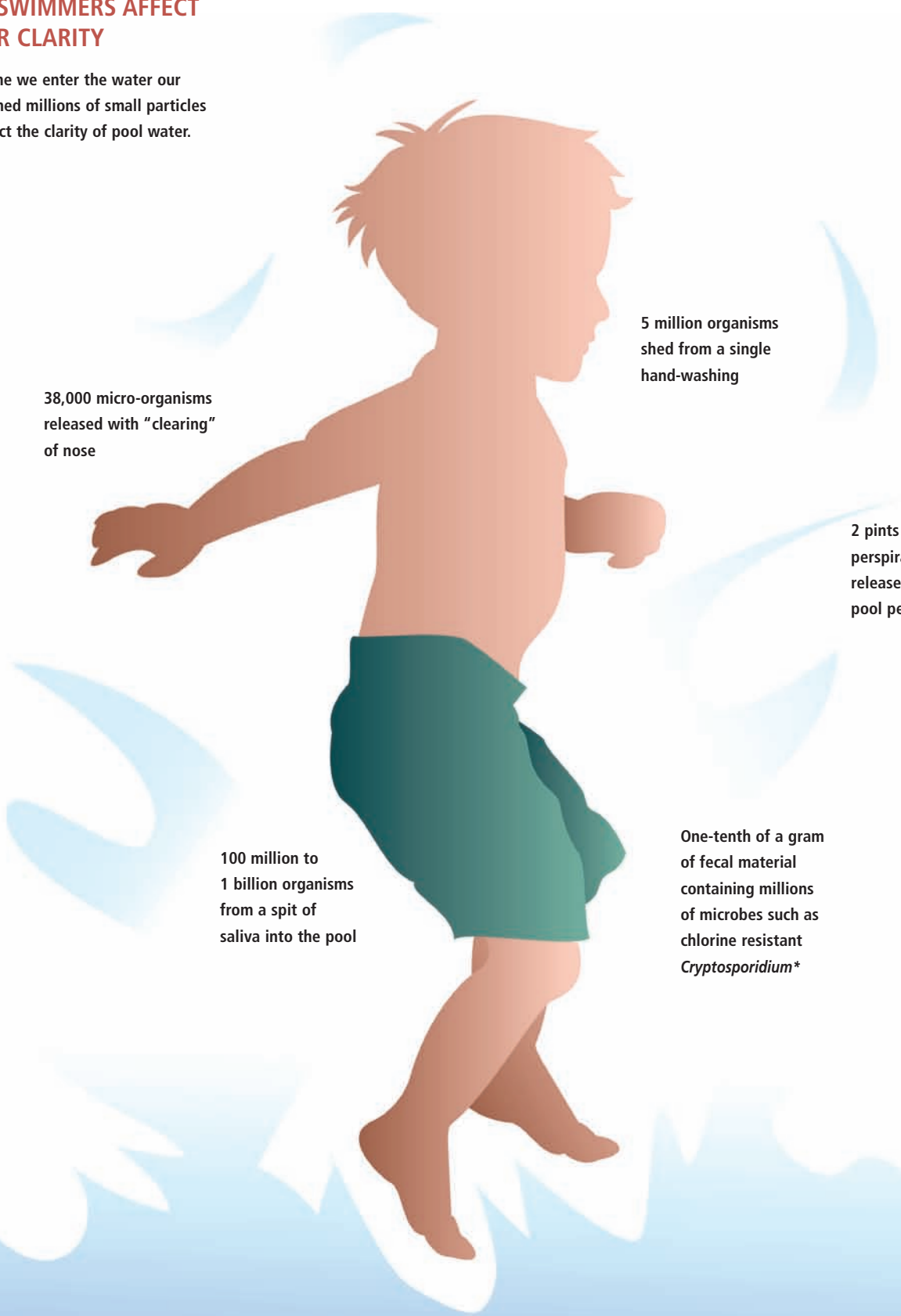
38,000 micro-organisms released with "clearing" of nose

5 million organisms shed from a single hand-washing

2 pints of perspiration released in the pool per hour

100 million to 1 billion organisms from a spit of saliva into the pool

One-tenth of a gram of fecal material containing millions of microbes such as chlorine resistant *Cryptosporidium**



* Dr. Charles Gerba, University of Arizona (Washington State Public Health Association, 1987)

KICK THE SICK

CLEAR YOUR WATERS OF ORGANISMS THAT CAUSE RECREATIONAL WATER ILLNESSES.

By Terry Arko

The summer of 2007 proved to be a nightmarish one for many public recreational water facilities across the United States. Reports of recreational water illnesses (RWIs) appeared in media headlines from June to September. In Utah alone, *Cryptosporidium* (Crypto) sickened more than 1,800 people over the summer. Across the state, pool attendance fell by 46,000 participants and revenues dropped by \$84,000 between August and October. It seems despite all the attention, education, and new technology available, a solution to the problem of recreational water illness remains elusive.

Proper Chlorine Levels

There are many different pathogens (disease-causing agents) that may be present in swimming pool water. Some germs are enteric, meaning they cause illness when ingested. Enteric diseases from pool water mainly come from organisms such as *E.coli*, *Giardia*, *Cryptosporidium*, and *Shigella*. These organisms are introduced to the pool

from sick swimmers who unknowingly defecate in the water. Warm-blooded animals such as dogs or deer can contaminate the area as well. Contaminated soil tracked in by swimmers can cause more problems. Diseases may be present in the droppings of birds. Swimmers who ingest the water can become ill with mild to severe gastroenteritis, which causes mild to severe stomach problems and diarrhea.

Gastroenteritis-related illness are the most common pool outbreaks, according to the Centers for Disease Control and Prevention (CDC) and Crypto is the most widely reported cause of gastroenteritis in recreational water. Severe cases can cause death in small children and the elderly.

The total number of reported cases of Crypto increased from 3,505 in 2003 to 3,911 in 2004, and to 8,269 in 2005. Compared with other age groups, a greater number of case reports were received for children ages 1 to 9 years and adults ages 30 to 39 years. Peak onset of illness occurred annually during early summer through early fall.

Other germs present in pool water

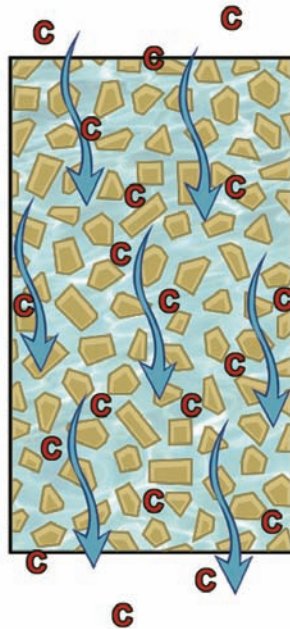
are classified as non-enteric, and are not transmitted through fecal matter. These are largely responsible for skin, eye, ear, and respiratory problems. Some examples of non-enteric diseases are *Pseudomonas*, *Legionella* (Legionnaires' disease), and several types of skin infections.

Most disease-causing organisms thrive when the facility is not properly maintained. This is especially true in situations with incorrect water balance and sanitizer levels. Poor maintenance is often the result of operator error or faulty equipment.

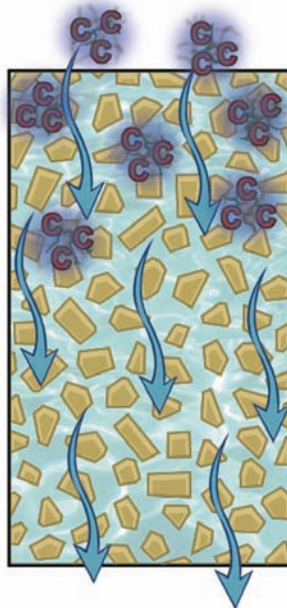
In one outbreak of *E.coli* at an Atlanta waterpark in 1998, it was discovered that the chlorine levels were low. Unfortunately, this occurred during a very hot day when the pools were full of swimmers. A report from Georgia state health officials explains that low chlorine levels at the water park contributed to the *E.coli* outbreak that killed two children and sickened more than two dozen others.

E.coli can be easily handled when chlorine sanitizer is in the correct range between 1 and 3 parts per million

**CRYPTOSPORIDIUM
IN POOL WATER**



**CRYPTOSPORIDIUM
IN TREATED POOL
WATER**



(ppm). Many health departments may allow even higher residuals to keep bacteria inactivated in pools. For most germs, chlorine at proper levels still remains one of the most effective ways to keep pool water safe.

When chlorine sanitizer is used against contaminants in pool water, there are varying CT (contact time) values required to disinfect specific types of pathogenic micro-organisms. For example, the protozoa *Giardia* has a CT value of 45 minutes at 1 ppm of chlorine. This means that *Giardia* is inactivated in 45 minutes of contact with pool water carrying a 1 ppm residual of chlorine.

The Difficult Germ

Dr. Jeff Williams is a microbiologist with pool products company SeaKlear. “You have a set of organisms that should never cause a problem, but they do on a regular basis because people don’t keep the sanitizer in the right range or other conditions in the pool, or the water is not optimal for the sanitizer to work,” he explains. “Then there’s Crypto.”

He says that Crypto is the problem child of pathogenic micro-organisms, which has a CT value of 9,600 minutes, or 6.7 days. So it remains active for a week or longer in normally chlorinated pools. Crypto is introduced in pool water primarily from ill swimmers who release diarrhea. One Crypto diarrhea “release” puts enough of the microorganism in the water of a 55,000-gallon pool that adults are exposed to up to half a dose when swimming.

Recent studies conducted by the Environmental Protection Agency (EPA) have shown that the average adult swimmer swallows up to an ounce of water when swimming. Children usually swallow twice as much as adults. With the possibility of millions of chlorine-resistant Crypto present in pool water, it is easy to see how swimmers become infected. This is especially true in pools with a high bather load.

DEPUTY DIRECTOR OF PARK OPERATIONS
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PROFESSIONAL ANNOUNCEMENT

Deputy Director of Park Operations and Development Division – Department of Parks, Recreation, and Neighborhood Services (PRNS). The City of San Jose, California (population 926,200) seeks a highly qualified Parks and Recreation Services Executive to become a key member of the Department’s Executive Team.

The PRNS department operates with 753 (FTE) personnel and a \$65 million operating budget. Over \$400 million in the 5-year Capital Improvement Program, including over \$20 million in grant funds, are within the Department’s purview or jointly managed by PRNS and other related Departments in the City. Traditional recreation functions are found in the direct management of 30 community centers, 5 senior centers, 12 youth centers, and 6 city-owned municipal pools. Under the Park Operations and Development Division, the City operates and maintains a total of 3,678 acres of parks and open space. The Division’s operating budget is \$27 with 313 FTE’s. Responsibilities of the position include park operations, maintenance, departmental programs, and administration, encompassing management of the department’s capital budget.

The successful candidate must possess a record of achievement in professional parks and recreation organizations. A starting salary within the range of \$104,332 - \$162,531 is negotiable, depending on qualifications. Apply at once with a complete résumé and confidential references to the City’s Recruitment Consultant: The PAR Group – Paul A. Reaume, Ltd., 100 N. Waukegan Rd., Ste. 211, Lake Bluff, IL 60044-1694. TEL: 847 / 234-0005; FAX: 847 / 234-8309; Email: resume@pargroup ltd.com. The City of San Jose, California is an Equal Opportunity Employer – women and minorities encouraged to reply. Additional information can be found at www.pargroupltd.com.

Because Crypto is highly chlorine-resistant and is small compared to other micro-organisms (4–6 micron), it is extremely difficult to deal with. The majority of public facilities still use sand filters that only filter to 25 micron. Some facilities use D.E. (diatomaceous earth) -type filters that can pick up organisms less than 4 micron. This may appear to be a solution but a recent study in *Water Science & Technology* showed that the Crypto cysts actually have the ability to elongate and press through filtration media and return to the pool in an infectious state.

Existing preventative measures for Crypto seem hardly effective, ranging from ensuring that swimmers shower and thoroughly wash before entering the pool, to keeping sick swimmers out.

Hyperchlorination methods are recommended by health departments to deal with the suspicion of possible Crypto in pools. The hyperchlorination method typically subjects pool water to 20 to 30 ppm of chlorine for eight to 12 hours. This method may vary depending on local health regulations. The CDC reported in 2004 at the World Aquatic Health Conference that there was not conclusive evidence to prove complete eradication of Crypto using this recommended method.

New Methods for Dealing With Crypto

Ozone is becoming popular as a possible back-up means of eradicating Crypto. Ozone kills bacteria and Crypto cysts 3,125 times faster than chlorine. To be effective, ozone needs to be maintained at proper output levels so it comes in contact with Crypto cysts. Crypto present in the pool is not affected until it comes in contact with the ozone.

UV (ultraviolet light) is another system that is gaining popularity. After an outbreak of Crypto at a splashpark in New York during the summer of 2006, the state mandated the use of UV for all public splashpark facilities.

“Crypto is certainly susceptible to some other things, such as ozone and UV, but those introduce complications to management that people are not used to having as part of water sanitation,” Williams says.

For example, high turbidity (murki-

ness) of the water is a problem that can cause UV systems to become ineffective against Crypto. Health departments regulate turbidity levels in public pools for safety reasons. In the EPA study of Crypto outbreaks, three out of four of the cases displayed turbidity beyond



Did one of them swim in your pool?

SeaKlear® PRS traps algae, *E. coli*, *Cryptosporidium* & *Giardia* in the filter

According to the Centers for Disease Control*, *Cryptosporidium* is the leading cause of recreational water illness and can survive for days in swimming pools even with adequate chlorine levels.

SeaKlear PRS is the only EPA-approved product that traps algae, *Cryptosporidium*, *E. Coli* and *Giardia* in the pool filter. PRS allows the pool filter to trap particles that are too small to be trapped by conventional filtration methods.



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U.S. Patent Nos. 7,157,009 / 5,362,717 / 5,204,452

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*Surveillance for Waterborne Disease and Outbreaks Associated with Recreational Water – United States, 2003 – 2004

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regulated levels in finished water during the outbreaks. UV performs better in clearer water.

Regular dilution of water is another means of reducing illness risk. This is already done at public pools in Europe, where pools are required to be diluted with fresh water every month.

The biggest problem with many public facilities is they rely only on chlorine and use sand filtration that allows Crypto to seep through. To effectively deal with Crypto, pools need to install ozonators and UV units. Many private and publicly funded aquatic facilities simply don't have the budget to make these improvements.

Enhanced Filtration

Another viable method that any facility or pool can begin using immediately is enhanced filtration through pool additives. The CDC and many aquatic ex-

perts have long considered filter enhancement with use of specialty clarifiers. One EPA-approved product uses two opposing biopolymers that effectively entrap micro-organisms such as algae, E.coli, and Cryptosporidium.

This method was soundly proven at independent studies conducted at Auburn University and presented at the World Aquatic Health Conference in 2005. This study showed that live Crypto formed and were held in simulated sand filters. Another presentation at the 2006 World Aquatic Health Conference proved that there was a 99.99 percent removal of Crypto from pool water using sand filtration treated with the two-stage polymer.

Williams agrees, and says that typical filter systems are made more efficient through the polymer system, which aggregates not only particles that cloud the water, but are "part of the infectious

disease problem."

And after the summer of 2007, agencies are looking for methods to prevent this problem from hitting their pools. Williams says a multi-layered approach is most effective. "You can't just increase the chlorine content. You're going to have to reach for some other technical approaches. In my view, a combination approach makes a lot of sense and prevention makes a lot of sense," he says.

RWIs, especially Crypto, continue to be a major challenge to pool professionals. Multiple technology layers will be the key to providing safe and disease-free swimming pools. The proper residual of chlorine sanitizer, ozone, or UV, regular dilution of pool water, and enhanced filtration of micro-organisms using a polymer system are important to consider as a comprehensive attack on the illnesses that lurk in local pools.

PCR



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