Bad Water Bad Air: Public Pool Managers Dive Into Chlorine Issues.

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Christmas Day 2012 was typically frigid in Bellevue, Nebraska, near Omaha. But that didn't stop one family and their 6-year-old boy from joining close relatives for a reunion at a local Days Inn motel, where they played with the child in the indoor pool. After several hours, however, the scene took a terrifying turn when the boy was overcome by a coughing fit. That escalated to breathing difficulties. When his condition grew worse, his parents rushed him to the hospital, where he was admitted into intensive care, putting an abrupt end to the family holiday.

The child's larynx and throat had swollen to a dangerous degree, which could have closed his windpipe and killed him had he not received immediate treatment. Meanwhile, 24 other children and adults also had been sickened with everything from burning eyes and noses, to sore throats, wheezing, and other less serious breathing difficulties. State health inspectors closed the pool the following day, attributing the outbreak to toxic levels of chlorine by products hanging above the pool water and in the air of the enclosed courtyard.

That smell of chlorine might seem synonymous with safe and sanitary swimming pools, but beware, says Michael Beach, a specialist in recreational water-borne illnesses at Atlanta's Centre's for Disease Control and Prevention (CDC). "Pool users and operators need to understand that the smell is not a sign of a well-run pool, but the opposite." The frequency of water-borne diseases is increasing in treated-water venues such as water parks, spray parks, and public swimming pools, resulting in record outbreaks of the parasite cryptosporidium (crypto),and the toxigenic bacterium E. coli in recent years. But there has also been an increase in pools plagued with chemical off-gassing. "It's one of the newest emerging health concerns," says Beach. "We've been focused on pathogens in the past, but we are now paying attention to chemicals accumulating above the pool, in the air swimmers are breathing."

The case of the Nebraska boy isn't unique. In 2004, two other outbreaks at indoor motel pools in Illinois and another in Topeka, Kansas, the same year spotlighted the little-known but potentially life-threatening risk of badly managed swimming pools. In Nebraska, it didn't help that the one exhaust fan at the facility had been turned off at the time of the outbreak; the windows in the courtyard had been tightly dosed to

seal off the cold; and the pool operator was discovered to have no training or certification, which isn't required in Nebraska or in most other states. Sadly, such outbreaks are probably more common than authorities realize because they're seldom reported. "We're seeing them particularly in the dead of winter in indoor pools," says Beach.
Since 2007, USA Swimming--the 300,000-member service organization that helps train Olympic-class swimmers--has averaged 10 complaints a month, with more than 120 pools seeking their advice. Based in Colorado Springs, Colorado, the organization has documented six cases of kids being admitted to hospitals after exposure to bad water and bad air. "If that wasn't bad enough," says Mick Nelson, USA Swimming's club facilities director, "two lawsuits are also pending."
To cope with high numbers of swimmers, the tendency is "for championship events to crank up the chemicals," says Joel Stager, professor of kinesiology at Indiana University. But the issue doesn't just touch elite athletes, he adds. "This is a more widespread problem than we pool managers would like to admit. It's gotten to the point where kids are having some severe reactions." Some of these problems, while not always life-threatening, have hit park and recreation departments as well. Kathy Whitman, aquatics manager for Seattle Parks and Recreation Department, relates how fumes building up in the air became a chronic problem. "You'd walk into the natatorium and be hit with a wall ofchlorine smell that was unmistakable."
The situation worsened when the facility began using pool covers in response to the need to conserve energy, concentrating the chemical's toxicity even more. Many of the pool staffers ended up developing serious sensitivities to the chlorine.
Unfortunately, in the Seattle case, administrators didn't recognize the health concerns until it was too late."It got to the point" says Whitman, "where many of our professionals had to move out of aquatics."

A Toxic Soup

Most pools rely on chlorine--or its close cousin bromine--to provide strong disinfection. Chlorine is good for killing algae and mold as well as many waterborne bacteria that carry diseases. But the powerful oxidizing chemical reacts with organic matter--leaves and dirt that land in outdoor pools, as well as the sweat, oils, lotions, saliva, and urine that people introduce--to form dozens of so-called disinfection byproducts, or DBPs, which can be toxic and can't be biologically degraded in the water. When pools are poorly maintained or badly ventilated, these chemicals can irritate skin, eyes, respiratory tracts, and have much worse effects.

Scientists have known for some time that acute exposure to pure chlorine from swimming pool accidents resulting from improper mixing of chemicals or chemical leaks that lead to chlorine gas explosions--can severely damage the lungs. But during the last few years, more medical studies have linked DBP chemicals to asthma and respiratory problems such as lifeguard lung, or granulomatous pneumonitis.

Researchers from Catholic University of Louvain in Brussels, Belgium, found that young children who swam regularly were more predisposed than others to developing asthma and recurrent bronchitis in later life. Despite spending only 20 to 30 minutes per pool session, says lead researcher Alfred Bernard,infants could be particularly sensitive to trichloramine--the gas that gives indoor swimming pools their characteristic smell--because their lungs are still developing. They recommend that parents avoid taking infants to swimming pools with chlorine in the water and the air, supporting the so-called "pool chlorine hypothesis" that exposure to chlorine in childhood may be partly responsible for the rise in asthma in industrialized countries.

Since the mid-1970s when DBPs were first discovered in chlorinated tap water, the Environmental Protection Agency has stepped in to restrict levels of these chemicals, some of which, like trihalomethanes, have been linked to cancer, miscarriages, reproductive problems, and other diseases.

But no regulations exist to test for and restrict these chemicals from swimming pool water; most local regulations only require that the water contain safe pH and chlorine levels to guarantee sanitation.

Researchers have found that swimming in chlorinated pools increases the risks of bladder cancer. InBarcelona, Spain, scientists have found that some DBPs are more carcinogenic when absorbed through the skin or lungs because--unlike ingested chlorinated water--they aren't detoxified by the liver.

While some of the latest studies examining pool-chlorine chemicals are increasingly alarming, Dr. MichaelGoodman, a physician and epidemiologist at Emory University's Rollins School of Public Health offers some reassuring research. He concludes that it is too soon to say for sure that swimming in chlorinated pools can actually cause asthma, as opposed to triggering or worsening it. Asthma is significantly more common among elite swimmers than among other high-level athletes, Goodman found, but he suggests that asthmatics may choose swimming as an alternative to other sports such as running or cycling, which tend to induce more bronchial problems.

"We're in the steep part of the learning curve in terms of reallyunderstanding the complexities of the water chemistry in swimming pools," says Ernest "Chip" Blatchley, a Purdue University engineering

professor and leading researcher of the disinfection by products that crop up in pools. So far, says
Blatchley, hundreds of such byproducts have been identified, and new technologies are beinginvestigated to break down these pollutants.
In certain parts of Europe, particularly France and Germany, the public is well educated on the issues offiltering out disinfection byproducts in pools, and they're demanding more sophisticated and expensive systems that include flocculation and filtration. Europeans have more of a culture of showering and bathing before entering the pool, thereby removing the chance that these byproducts can be formed in
the first place, notes Tom Lachocki, director of the National Swimming Pool Foundation (NSPF) in Colorado Springs. By contrast, Americans are less aware of these problems. Aquatics experts like
Lachocki and CDC's Michael Beach argue that better sanitation--and better enforcement of it in pools--could go a long way toward making pools safer.

Tech Alternative

According to the CDC, cases of crypto have doubled in recent years, an indication that the condition has become resistant to chlorine. In 2008, Phoenix, Arizona, shut down all 29 of its public pools after a hundred people got sick. In Utah more than 1,900 people were stricken by the parasite in a statewide outbreak in 2007. And a 2005 crypto outbreak at a spray park in New York's Seneca Lake State Park caused as many as 4,000 people to seek medical help.
In response to this crisis, a growing number of pool and recreation managers are adding supplemental systems, such as ultraviolet (UV) light filters and ozone, or switching out chlorine for other systems altogether. Salt Lake County recently installed UV systems at 18 of its swimming pools to loll cryptosporidium microbes, chloramines, and other toxic byproducts of chlorine, a move that will help them avoid a repeat of last summer's crypto outbreak as well as combat incidences of lifeguard lung and swimmer's asthma.
Seattle's aquatics program began working with an environmental lab at the University of Washington as well as local health departments to study their chlorine problem. Following a growing trend, they invested millions in improved air circulation and a natural gas system that uses less energy to heat the water and air. They also installed a UV system that eliminates toxic chlorine byproducts in the water while reducing the need to "shock," or superchlorinate, the pool to destroy buildup, all reducing the cost of chlorine and adding up to a net savings of about $13,000 a year.

Within 24 hours of introducing a UV Filter, Portland, Oregon's parks and recreation department saw chloramine levels drop 85 percent. Their investment has not only created a healthier environment for swimmers by improving air and water quality, but they're cutting costs associated with the corrosive affects of chlorine on fixtures and equipment such as handrails, ladders; and heating, ventilation, and air conditioning systems.

Stroke by Stroke Solutions

As a sport, swimming is enjoying new glamour and popularity, partly due to the Michael Phelps Effect.USA Swimming expects the rising interest to bring in some 7 to 15 percent more swimmers, including young and beginning swimmers. That's also going to add to the growing demand for aquatic facilities. With the current mortgage and credit crises, pool construction for the residential market is suffering. Still,many new, large water parks and indoor pools remain in the pipeline, driven in part by the dwindling markets for skiing and snow sports in northern U.S. cities. While that's a positive thing for swimmers, it adds urgency to the growing concerns about air and water quality hazards.

For now, there are no federal standards regarding pool operations, which are regulated by state health departments and have widely varying levels of strictness. The CDC has uncovered rather appalling violations in those standards, which vary from state to state. In the latest federal survey, more than half the pools inspected had at least one violation, many related to water chemistry, filtration, and recirculation. Some violations were so severe that pools in more than 8 percent of cases were immediately shut down. "As the aquatic industry moves indoors, with pools open 365 days a year, we need to be pushing for solutions to these problems" says Beach. "The fry cook at a local motel or an untrained teenage lifeguard at a public swimming pool shouldn't be in charge of ensuring health andsafety."

In response, the CDC is working with the NSPF and industry trade groups to design a Model Aquatic

Health Code based on uniform safety guidelines enforced by state and local agencies. In 2007, New York State--in response to crises such as the Seneca Lake crypto outbreak--became the first to mandate UV in its spray parks.In the meantime, pools operated by park and recreation departments like those in Seattle and Portland are serving as success stories. "People are so complimentary about the water now," says Seattle's Kathy Whitman. "They say it feels fresh, even silky on their skin. They walk into the natatorium and can breathe easy.