

HEALTH RISKS

In poorly maintained swimming pools and spa pools, people may be at risk from infections caused by a number of microorganisms. Some of which may be naturally present on our hair or skin or in our ears, mouths, and noses, intestinal and uro-genital tracts. The infections may be transmitted by inadequately treated pool water or surfaces (such as shower floors).

Bacterial Pathogens

Pseudomonas aeruginosa is the most common disease-causing agent associated with waterborne disease outbreaks. It is an opportunistic pathogen and has been identified as the causative agent of eye, ear and skin infections. Its normal habitats are water, soil and vegetation but may also be of human origin. Although relatively resistant to a range of disinfectants, chlorination of normal swimming pools should be sufficient to kill the bacterium. However, in environments that are peculiar to spas such as water turbulence, elevated temperature and heavy bather-loads, considerably greater care is needed to ensure their safe operation and the eradication of this organism.

Legionella spp. causes a serious pneumonic disease known as Legionnaires' disease and a less debilitating disease called Pontiac fever. They are found in the natural environment, such as soil, rivers, lakes and creeks. The great majority of outbreaks have been associated with air conditioning cooling systems although spa pools have also been implicated. Legionellosis is caused through inhalation of contaminated aerosols.

Coagulase positive staphylococci have been regularly isolated from swimming pools and spa pools as they are normal microflora of the skin, ear and nose. These microorganisms can cause skin infections, such as boils, carbuncles and wound infections. They are fairly resistant to disinfection but have not been shown to be a public health problem in well-maintained pools.

Mycobacterium marinum causes chronic skin ulceration known as "swimming pool granuloma" which may last up to three years if untreated.

Shigella, Salmonella and Campylobacter have been implicated as causative agents of gastrointestinal diseases but outbreaks as a result of swimming in properly treated pools are uncommon.

Protozoan Pathogens

Cryptosporidium and *Giardia*, are protozoan single celled organisms which may be excreted by infected humans into swimming pools through fecal accidents and may cause outbreaks of diarrhea. A carrier state exists where humans may be infected without showing obvious symptoms. **Chlorination** at recommended residual levels has limited effect on *Giardia* and is completely ineffective against *Cryptosporidium* oocysts.

Regular "dumping" and filtration using flocculation and coagulation agents of pool water and regular superchlorination to 10 mg/L aid in the removal of these parasites. It is more important to prevent the entry of these organisms into the pool and strategies such as exclusion of incontinent persons should be considered as appropriate strategies.

Naegleria fowleri is a pathogenic free-living amoeba that has been shown to cause a fatal disease called **primary amoebic meningo-encephalitis**. The disease is contracted by the invasion of the amoeba through the nose into the brain. In nature, the organism thrives in mineral springs, thermal bores, rivers and lakes. These waters are generally heated above 77° F, which assists the parasite in its metabolism and survival.

VIRAL PATHOGENS

Enteroviruses are the major causative agents of swimming pool **gastroenteritis**. They are most frequently found in wading pools used by infants and young children where bather hygiene is poor and water volume is small.

Adenoviruses types 3 and 4 cause **pharyngo-conjunctival fever** amongst bathers. The disease is characterized by sore throat, fever and conjunctivitis frequently associated with diarrhea.

The Herpes simplex virus causes fever and an unwell feeling. It has been reported to be able to survive for long hours in warm, humid conditions and is spread by persons with cold sores.

Plantar warts are caused by a papovavirus through contaminated floor surfaces.

Yeast And Fungal Pathogens

Large numbers of fungi can be found in indoor swimming pools. Trichophyton mentagrophytes, which has been isolated from the wooden flooring of shower stalls, causes athlete's foot or tinea pedis.

The yeast, *Candida albicans*, causes urino-genital, skin and nail infections in individuals with normal immune defenses, as well as serious systemic infections in debilitated patients.

Heat Illness

In natural sunlight, the main forms of heat illness are heat exhaustion and severe sunburn. The body has no mechanism to warn of overheating. In saunas, dehydration, heat exhaustion and fainting may occur.

On entering a heated pool or sauna, the skin blood vessels dilate to help lose heat and keep the body cool. The heart has to pump faster and so the heart rate increases. If there is insufficient blood going to the brain, there is a lack of oxygen and a person may feel dizzy and even faint. Deaths have resulted when alcohol has been consumed and the body subjected to heat stress.

Heat exhaustion is caused by a loss of water and electrolytes. Any sustained muscular exertion can cause this. It is relieved by rest, fluid and electrolyte (salt) replacement.

No heated swimming pool or spa pool should be operated at a temperature greater than 102 F and exposures at greater than body temperature should not exceed 20 minutes for a healthy adult. Children and those with medical conditions (heart conditions) are particularly at risk and should seek medical advice. A suitable warning sign should be used, such as “Children under the age of 6 years and persons with medical conditions should not use the heated spa pool. Seek medical advice.”

Chemical Conditions

While too little residual chlorine will allow bacteria to grow, too much chlorine, bromine or prolonged swimming can cause conjunctivitis (eye irritation) and dermatitis (skin allergy) and dry scaly skin. Bromine particularly in the form of BCDMH is believed to cause permanent skin sensitivity.

Bacteriological Standard For Treated Water Public Pools

To ensure that a public swimming pool or public spa pool does not pose a risk to the health of the general public the pool water can be tested for *E. Coli* and *Pseudomonas aeruginosa*, both of which in a properly operated pool should be absent. A heterotrophic plate count is also used and there should be less than 100 cfu. .

The results of a single sample do not give an indication of overall pool management. The bacterial results obtained should be entered into a database together with the complimentary chemical analysis so that baseline data is obtained on the pool management performance. These results should also be compared to bathing loads at the time of sampling to reflect the impact of this important pool operating parameter.