

# *Pseudomonas aeruginosa*

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***Brought to you by the APSP Recreational Water Quality Committee (RWQC)***

## **I. INTRODUCTION**

*Pseudomonas aeruginosa* (abbreviated *P. aeruginosa* and pronounced sood- o -`mo - nez airoo- gin-o-sa) is a bacterium that causes the majority of skin rashes and infections from pool and spa use. *P. aeruginosa* infections are easily preventable if appropriate water treatment practices are applied. In the 2009-2010 report on waterborne disease outbreaks from the U.S. Centers for Disease Control and Prevention (CDC), 12.8 of the outbreaks were dermatitis (itchy, sore skin). In that summary, the CDC found 4 confirmed and 5 suspected outbreaks of dermatitis caused by *P. aeruginosa*. *P. aeruginosa* is also the cause of most cases of “swimmer’s ear” acquired in swimming pools. Swimmer’s ear is not tracked by the CDC, so cases are not reported in the biennial report. It is generally believed that *Pseudomonas* rashes are the most common Recreational Water Illness (RWI) in treated waters.

## **II. SUMMARY OF CHARACTERISTICS**

- The best way to prevent bacterial infections from pool and spa use is to maintain the recommended level of an EPA-registered sanitizer at all times;
- *P. aeruginosa* is a common bacterium found in water;
- *P. aeruginosa* is the most common cause of skin rashes and infections (dermatitis and folliculitis) as well as ear infections (*otitis externa*) associated with the use of pools and spas;
- The incubation period for rashes and infections is from 1 day - 10 days.
- Rashes, skin and ear infections from *P. aeruginosa* are irritating but are not life threatening in otherwise healthy individuals. Most cases resolve within 2 weeks without medical treatment.
- Immuno-compromised individuals and cystic fibrosis patients should seek medical treatment.

### III. GENERAL DESCRIPTION

#### A. What It Is

*P. aeruginosa* is a very common bacterium found in water, soil and on many plants. It can grow on the inside surfaces of PVC pipes used for pool and spa construction and garden hoses used to fill pools and spas. It is adapted to live in water, even when that water is not rich in nutrients. It is not particularly resistant to sanitizers used in pools and spas (Highsmith, et al, 1985). If a pool is operated without an adequate sanitizer residual, *P. aeruginosa* can multiply rapidly and reach potentially infective levels overnight. Because it grows faster at high temperatures, it can reach infective levels in spas even more rapidly. *P. aeruginosa* is one of a group of *Pseudomonas* species. The other species are not significant causes of water-borne disease (Gilligan, 1995).

#### B. What It Does

*P. aeruginosa* is a major cause of skin inflammation and infection (dermatitis and folliculitis, respectively) spread through water. Bacteria from the water attach to the skin and enter in the hair follicles. In the follicles, the bacteria multiply and their waste products cause an inflammation. The affected area may appear as a red, itchy rash or like a burn. The affected area resembles a chemical rash (contact dermatitis). The areas of the body most frequently affected are the groin, the armpits and the area covered by the swimsuit. The incubation period of rashes varies from 1 to 10 days. Because of the long incubation period, some cases are misdiagnosed as chemical rashes rather than bacterial infections. Most cases of dermatitis and folliculitis are not diagnosed properly and are not reported. All seven outbreaks in spas investigated by the CDC in 1995 and 1996 were caused by *P. aeruginosa* (Levy et al, 1998).

*P. aeruginosa* is a major cause of “swimmer’s ear” (*otitis externa*). *Otitis externa* is the inflammation of the portion of the ear from the tympanic membrane (eardrum) outward. Not all cases of *otitis externa* are related to pool and spa use (Seyfried and Fraser, 1978). *Otitis externa* is the most frequent cause of infant and toddler visits to the doctor.

Individual susceptibility and the type of activity pursued are factors determining whether an infection will occur. Periods of swimming underwater and diving increase the possibility of infection. *P. aeruginosa* is also a cause of pneumonia in cystic fibrosis patients, cornea infections in contact lens users, and systemic infections among IV drug users (Gilligan, 1985).

It is also a major cause of urinary tract infections, surgical infections, and wound infections in burn patients (Boyd and Hoerl, 1986). These are very serious infections that may be life threatening if not properly treated. These infections have not been proven to be associated with the use of pools and spas. Because of the potential for infection from *P. aeruginosa*, and other water-borne diseases, immuno-compromised individuals and individuals with broken



skin should be cautious in using pools and spas where the history of proper sanitation is unknown.

## **IV. PREVENTION, PRECAUTIONS, DECONTAMINATION AND MEDICAL TREATMENT**

### **A. Prevention**

Nearly all water-borne infections can be prevented by the proper maintenance of an EPA-registered sanitizer. The sanitizer level should be maintained at recommended levels at all times. If the level is allowed to remain low for extended periods of time infestation may occur and treatment should be initiated before use. Sanitizers displaying an EPA registration number on the label have demonstrated effectiveness for the control of bacteria. You may verify the registration number with the appropriate state regulatory agency (usually a branch of the department of agriculture) or a regional office of the U.S.-EPA. The federal government does not presently regulate devices for the treatment of pools and spas. Questions about the effectiveness of a particular device should be addressed to the manufacturer.

### **B. Precautions**

Pools and spas not maintained according to proper guidelines should be treated before use. This is especially important for pools and spas that have not been treated for a week or more. After treatment with the sanitizer, the pool or spa should be allowed to circulate thoroughly. In the case of pools, circulate the pool overnight. With spas, circulate at least thirty minutes after treatment before entry. Circulation of the water in both the filtration and booster pump systems allows the sanitizer to kill bacteria in the water and to treat bacteria that have begun to grow in the plumbing.

Many water treatment methods suggest periodic shock treatments. Products labeled as shock-oxidizers should not be used to kill or control germs. Products labeled as shocks both kill germs and oxidize contaminants. Do not substitute shock treatments for maintaining an adequate sanitizer treatment.

Periodic cleaning of the filter is strongly recommended. Follow the manufacturer's recommendations. Improperly maintained filters have been shown to be a major source of bacteria outbreaks (NCEH, 1997). Filter cleaning compounds are not designed to kill bacteria. Cleaning the filter will increase the potential of the sanitizer to control bacteria.

### **C. Decontamination**

In case of suspected bacterial infestations, decontaminate the pool or spa. Infestations are gross contaminations of the system. Infestations described here are rare and not associated with well-maintained systems. Some signs of possible infestation include slime formation (especially in spas), cloudy water, musty odors, bather rashes, and flu-like symptoms



suspected to have originated from spa use. Any incidents of fecal or vomit contamination require immediate decontamination. Decontamination guidelines are available from APSP.

#### **D. Medical Treatment**

If rashes or ear infections are suspected, seek medical attention. Severe infections may cause scarring or lead to other more serious secondary infections. Most mild cases of *P. aeruginosa* skin infections run their course and resolve themselves in less than 2 weeks without medical treatment. Approximately 5% are major medical events that require intravenous antibiotics. After an outbreak, it may not be possible to culture live *P. aeruginosa* from the suspected water source. Correct diagnosis requires culturing the infected follicles and the recovery of *P. aeruginosa* from the exudate.

### **V. REFERENCES**

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