



TECHNICAL NOTE

29 Notes on the hygiene of pool play equipment

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Swimming pool play equipment includes inflatable toys, foam rafts or other rigid buoyant structures, and inflatable play equipment of all sizes and shapes. Inflatables present the greatest hygiene challenge and are the chief focus of this note.

Inflatables

Inflatables are of two types:

- sealed equipment which is inflated and plugged to prevent air escaping
- constant-flow inflatables which have an air blower permanently connected and running when the inflatable is in use. These can be large and complex and include water slides, obstacle runs and bouncy castles.

Equipment design

Where mats and floats are used in a pool, the materials of construction often allow water absorption and thus colonisation of bacteria on inner surfaces.

Effective disinfection of the inner surfaces of such materials is difficult and not very successful. Consequently, each time these mats or floats are used they can provide an additional source of bacteria in the pool water. In order to minimise this, where possible only closed cell materials should be used and they should be cleaned regularly so that the exterior surfaces remain free from bacteria.

Armbands, rubber rings, toys and inflatables may also be constructed of materials conducive to bacterial growth. Where the exterior surfaces are inadequately disinfected, *Pseudomonas aeruginosa* can proliferate and then contaminate the pool water. If water can get inside the object the problem becomes even worse as it is virtually impossible to disinfect adequately.

So it is important when purchasing swimming aids and play equipment to select those that do not readily get wet internally, that are easy to clean and disinfect, and can be stored dry. Inflatables too big to be laid out unfolded for cleaning are unsuitable. So are toys with valves and/or openings that allow water inside.

Large inflatables

There have been problems with the large constant-flow inflatables (some over 10m long). Because they are by design pervious to water and air, both the inside and outside can be wet and support bacterial growth within biofilms. They are obviously very difficult to dry inside and out, and to disinfect. When children slide down such an inflatable colonised with *P aeruginosa* their skin will be exposed to contamination with consequent risk of infection particularly if they have any abrasions. There have been cases of *P aeruginosa* folliculitis associated with such inflatables. For this reason pool operators are advised to use sealed pool inflatables instead.

Pool microbiology

Changes in swimming pool design – particularly the advent of leisure pools incorporating features such as flumes, rapids, wave machines, water cannons and open slides – have coincided with a boom in leisure swimming. The general public are more frequent visitors to complexes which offer such extras – but there is a resulting hygiene challenge. There are greater demands on the water treatment systems that have to cope, not only with the pollution introduced to the pool water by the bathers, but also any dirt or growth on the additional equipment.

It is very important to prevent bacterial infection of bathers. *Pseudomonas aeruginosa* (which can cause otitis externa, swimming pool folliculitis and eye infections) and *Staphylococcus aureus* (linked to rashes, wound infections, otitis externa and impetigo) are commonly carried by bathers.

They are normally killed by chlorinated water, but present a challenge if play equipment becomes colonised. *P aeruginosa* can be found on all damp surfaces – colonising mats, armbands and other pool furniture, even when the pool water has a satisfactory free chlorine concentration. *S aureus* and *P aeruginosa* infections may not become apparent for 48 hours after a visit to a contaminated pool.

The use of flumes and open slides in modern leisure pools can cause minor knocks which may lead to an increase in cuts and grazes. If *S aureus* is present this can lead to wound infections.

Disinfection

All swimming aids and play equipment should be disinfected regularly to minimise the potential for bacterial growth. This includes inflatable play devices, canoes, sub-aqua equipment, arm bands, floats etc. The simplest way of doing this for fixed items is to ensure disinfected water is circulated over or through them. In the case of toys, swimming aids and inflatable play equipment, it is very important to avoid storing moist equipment on the pool surround. Instead, items should air dried where possible, off the ground but avoiding stacking.

They should be disinfected from time to time in a solution of at least 10mg/l free chlorine for 20 minutes, then air dried. If equipment has been contaminated with faeces, a 50mg/l solution should be used.

(The underside of pool covers should be checked regularly for microbiological contamination – a lab will use swabs – and both sides for algal growth, and the covers cleaned as necessary.)



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Bacteriological monitoring

The PWTAG Code of Practice gives the following requirements for the microbiological quality of pool water.

Pseudomonas aeruginosa should be absent in a 100ml sample. If the count is over 10cfu/100 ml, the test should be repeated.

Where **repeated samples** contain *P aeruginosa*, the filtration and disinfection procedures should be examined to determine whether there are areas within the pool circulation where the organism is able to multiply. When counts exceed 50cfu/100ml, pool closure is advised.

The pool should be **closed** if microbiological testing discloses **gross contamination**, which means one of two things:

- 1 *Escherichia coli* over 10 per 100ml PLUS **either** colony count over 10 cfu per ml **or** *P aeruginosa* over 10 per 100 ml (**or, of course, both**)
- 2 *P aeruginosa* over 50 per 100ml PLUS colony count over 100 per ml.

Where *P aeruginosa* is identified in the pool water and this is not resolved by the measures given above then it will be necessary to identify where the cause lies. If *P aeruginosa* persists despite intensive cleaning of the structures and equipment in contact with water, then a swab test (by a UKAS accredited laboratory) can check for it on the surfaces of play equipment etc.

Biofilms

P aeruginosa thrives in relatively nutrient-poor environments at a range of different temperatures and can become one of the species in biofilms where a slime layer binds a mixed bacterial population to surfaces. Although most bacteria will remain fixed within the biofilm, some will become detached resulting in free-floating (planktonic) forms that can cause contamination of the water layer above the biofilm.

So cleanliness is the best protection against biofilms that can contain *P aeruginosa* (and other pathogenic bacteria). Biofilms are generally visible to the naked eye and show themselves as a slime or a slippery flexible coating to a surface.

Physical safety

Pool operators with play equipment and water features should be familiar with certain requirements:

- Management of Health and Safety at Work regulations (MSHW) 1999, Regulation 3 'risk assessment' and Regulation 5 'safety arrangements'
- Manual Handling Operations Regulations 1992
- Electricity at Work Regulations 1989; IEE Regulations 2008

In order to ensure the safe operation of play equipment and water features in swimming pools it is necessary first to assess the risk with each item of equipment and to apply control measures to minimise the risk associated with its use.