ISRM
Managing and Developing Sport

INFORMATION

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Pool water microbiological testing – further update

1. Previous guidance and sources

In addition to the subject being included in its training manuals, ISRM has issued two previous information notes on the subject of microbiological testing of swimming pool water:

- Information note 151: The responsibility of pool managers for the safe bacteriological quality of pool water.
- Information note 284: Pool water microbiological testing – update.

This information note summarises, updates and supersedes the advice previously given in the previous notes, with particular reference to who has responsibility for testing.

ISRM's guidance on this subject has been informed by both its own expertise and body of knowledge, and the following:

- The work of the independent Pool Water Treatment Advisory Group, of which ISRM is a founder member. Specifically, their definitive guide 'Swimming Pool Water' plus their BSI publically available specification PAS 39.
- The guidance of HSG 179 'Managing Health and Safety in Swimming Pools', plus the Health and Safety at Work Act and other relevant legislation.

2. Testing responsibility

Introduction

As with most health and safety issues, there is no legislation specifically detailing the responsibility for microbiological testing of swimming pool water.

Instead, it is the responsibility of the pool operator to carry out their business within the requirements of general health and safety law and other available guidance. In this case, the context is:

- Health and Safety at Work Act 1974.
- Environmental Protection Act 1990.
- The Control of Substances Hazardous to Health Regulations (COSHH) 2002.
- Health and Safety (Enforcing Authorities) Regulations 1998.
- PAS 39: 2003. Management of Public Swimming Pools, Water Treatment Plant and Heating and Ventilation Plant – Code of Practice.
- HSG 179 - Managing Health and Safety in Swimming Pools.

The responsibility for ensuring compliance with health and safety legislation at swimming pools falls to either the HSE or the Environmental Health Departments depending upon the main activity of the premises. Pools owned, managed or occupied by local authorities and those in educational establishments or schools are enforced by the Health and Safety Executive (HSE). Privately operated (not domestic) pools, for example those in hotels, holiday camps and fitness clubs are the responsibility of Environmental Health Departments (EHDs). The following extract from HSG 179 outlines this point.

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Enforcement of health and safety law
13 Under the Health and Safety (Enforcing Authorities) Regulations 1998 the local authority is the enforcing authority for all pools unless it is the owner and/or occupier who has any extent of control of the activities or the equipment. HSE is the enforcing authority in pools occupied by local authorities, in educational establishments and at Ministry of Defence premises. Where there is doubt, seek clarification from the local HSE office.

The role of Environmental Health Departments
Remember also that Environmental Health Officers have right of entry into all pools under the Environmental Protection Act 1990 and therefore may undertake bacteriological sampling if they deem it necessary.

Depending on local practice and available resources, your local authority's Environmental Health Department may choose to carry out regular routine testing at the pools in its area, including those operated by local authorities.

However, the actions of local EHDs do not take away the operator's responsibility for arranging regular microbiological testing by an accredited laboratory.

This responsibility stems from the general responsibilities under HASAW and COSHH regulations, and is clearly outlined in the standard guidance, HSG 179, as the following extract explains:

Disinfectants and bacteriological water quality
359 In order to establish that the pool is without risks to the health of those using it, pool operators will need to ensure, under the COSHH Regulations, that they have adequately controlled the risks from exposure to micro-organisms. To do this, adequate disinfecting of the pool will need to take place and bacteriological sampling will be required.

360 Bacteriological sampling will need to be undertaken monthly in pools in use all year round. Constant checking of the correct disinfectant level and pH value will ensure the bacteriological quality of a well-run pool. Bacterial levels should be zero (or near zero) as a 'baseline'. More frequent samples will be necessary where a deterioration in water quality occurs. Pools that are less frequently used should be checked before use and then monthly throughout their operational period.

In-house analysis of results
In the interests of independently validated, accurate and robust record keeping, which may be vital in the case of litigation, ISRM recommends that the operators of swimming pools **DO NOT** carry out the analysis of microbiological tests themselves.

The analysis of samples should instead be carried out by a reputable and independent organisation. This will most likely be either an accredited laboratory or through the local Environmental Health Department.

3. Extract from BSI Code of Practice PAS39:2003

5.5.2 Microbiological

5.5.2.1 General

Microbiological contamination of the pool water can result in pathogenic (disease producing) microorganisms causing infections to bathers. These contaminants can be introduced into pool water from bathers, from the pool filters or occasionally from defects in pool engineering (e.g. that allow the water to be contaminated with sewage).

Tests should be performed monthly to monitor the presence of indicator microorganisms. These can indicate operational problems that could result in infections. Additionally, tests should be performed:
a) before a pool is used for the first time;
b) before it is put back into use, after having been shut down for repairs;
c) if there are difficulties with the treatment system;
d) if contamination has been noted;
e) as part of any investigation into possible adverse effects on bathers' health; and
f) to validate changes made to the pool treatment regime, e.g. change in disinfectant, or frequency of addition, or engineering.

More frequent sampling will be necessary if there is a problem, or for particularly heavily loaded pools. Hydrotherapy pools should be tested twice weekly as the people using these pools are immersed for longer periods (as are staff) and may be more vulnerable to infection.

Microbiological sampling should be performed by trained and competent personnel to prevent sample contamination. Microbiological analysis should be carried out in appropriately accredited laboratories, e.g. UKAS laboratories. The pH value and the concentration of free and total disinfectant in the pool water should be measured when the microbiological sample is collected. Microbiological samples should be taken beginning at a depth of 200 mm to 400 mm below the surface of the pool.

The results of routine microbiological sampling should always be interpreted in conjunction with:
- chemical tests performed on site and/or in the laboratory at the time of sample collection; and
- a review of the maintenance records for the pool, including records of the pH, residual disinfectant levels, mechanical failures and water appearance and other untoward events.

It should be noted that failure to comply with the target levels for one or more of the parameters is often a passing phenomenon.

Subclauses 5.5.2.2 to 5.5.2.7 give the limits for the various tests, and indicate what action should be taken if unsatisfactory results are obtained. Samples should be tested for aerobic colony count, coliforms, Escherichia coli and Pseudomonas aeruginosa.

If the microbiological results are unsatisfactory the microbiological tests should be repeated immediately. If the results of the second microbiological tests are still unsatisfactory, an investigation into the management and operating conditions of the pool should be undertaken and a third series of microbiological tests should be made.

NOTE The investigation may require the help of the laboratory that does the tests, the district council Environmental Health Department, or an independent consultant.

If results are still unsatisfactory after the investigation and a third series of tests, immediate remedial action is required that may necessitate the pool is closed (see 5.5.2.6).

5.5.2.2 Aerobic colony count

The aerobic colony count (ACC), sometimes called the total viable count, colony count, or plate count, is a general test that indicates whether the pool disinfectant regime is effective in controlling contamination under operational circumstances. The colony count should be carried out in accordance with BS EN ISO 6222 (BS 6068-4.5) but with incubation at 37°C for 24 hours.

NOTE These test conditions are set to isolate the range of organisms that can colonize the mouth and skin of bathers.

The ACC can become increased where there is a higher bather load, reduced chlorine residual or where there are defects in water treatment.

The aerobic colony count should normally be 10 or less colony forming units (cfu) per millilitre of pool water. If a colony count above 10 cfu/ml is the only unsatisfactory microbiological result, and residual chlorine and pH values are within recommended ranges, the water should be retested.

5.5.2.3 Total coliforms

Coliforms within swimming pools can be considered as an indication of faecal contamination or poor hygiene (e.g. contamination from shoes or leaves in outdoor pools). Their presence indicates that the treatment has failed to remove this contamination.

NOTE 1 In themselves, coliforms do not usually cause disease.

NOTE 2 The presence of Escherichia coli is a better indication of faecal contamination (see 5.2.2.4).

Coliforms are sensitive to disinfectant and should be absent in 100 ml of pool water. A repeat sample should be taken whenever coliforms have been detected.

A coliform count of up to 10 cfu/100 ml is acceptable provided that:

a) coliforms are not found in the repeat sample;
b) the aerobic colony count is less than 10 cfu/ml;
c) there are no E. coli present;
d) the residual disinfectant and pH values are within recommended ranges.

5.5.2.4 Escherichia coli

Escherichia coli is normally present in the faeces of most humans, mammals and birds. It is widely used as a specific indicator of faecal contamination as it is unable to grow within the environment. The presence of E. coli in swimming pool water is an indication that faecal material has entered the pool water from contaminated skin, or from faecal material that has been accidentally or deliberately introduced. It also indicates that the treatment has failed to remove this contamination.

E. coli should be absent in a 100 ml sample. However, because most bathers will have some faecal contamination of their skin, particularly if they have not showered before bathing, a single positive sample may be the result of recent superficial contamination by a bather that has not yet been decontaminated by the disinfectant residual. A repeat sample should then be taken.

5.5.2.5 Pseudomonas aeruginosa

Pseudomonas aeruginosa can grow within untreated waters and in biofilms. It can cause skin, ear and eye infections when present in large numbers and outbreaks of skin infections have been linked to swimming pools and spa pools.

Well operated pools should not normally contain P. aeruginosa. If the count is over 10 P. aeruginosa per 100 ml, repeat testing should be undertaken. Where repeated samples contain P. aeruginosa the filtration and disinfection processes should be examined to determine whether there are areas within the pool circulation where the organism is able to multiply. Where counts exceed fifty, pool closure should be considered (see 5.5.2.6).

5.5.2.6 Closing pools

Pools should be closed following a routine microbiological test if:

a) the result suggests gross contamination (see below); or
b) there is other chemical or physical evidence that the pool disinfection system is not operating correctly (e.g. if the records show that residual disinfectant levels were inadequate or erratic and frequently too low, or the pool water is of unsatisfactory appearance).

Where there is evidence of gross contamination the pool should be closed to prevent illness in pool users. The local Consultant for Communicable Disease Control (CCDC – via health authority) should be contacted.

The following should be considered as gross contamination:

a) greater than 10 E. coli per 100ml in combination with:
    1) an unsatisfactory aerobic colony count (>10 per ml); and/or
    2) an unsatisfactory P. aeruginosa count (>10 per 100ml); and
b) greater than 50 P. aeruginosa per 100ml in combination with high aerobic colony count (>100 per ml).

5.5.2.7 Additional testing in outbreaks

In the event of an outbreak of illness associated with a swimming pool, additional microbiological testing may be considered necessary. This needs to be discussed with the CCDC and the chairman of the outbreak control team. If disinfection is adequate then bacterial and viral tests are unlikely to represent the conditions at the time of the infectious event. Cryptosporidium or Giardia contamination may still be detectable through examination of backwash water and filter material (routine testing for Cryptosporidium and Giardia is not considered useful).