

# Cryptosporidium Update

The challenge of Cryptosporidium to swimming pools is under active investigation by the independent Pool Water Treatment Advisory Group. PWTAG's research has already identified areas in disinfection and filtration which update its authoritative advice on dealing with this organism. Pool operators following this advice - from prevention through to cure - give themselves the best chance available of avoiding problems.

## INCIDENCE

Cryptosporidium is a unicellular organism (a protozoa), a well-known source of gastro-intestinal illness in drinking water, but now also recognised as a (much less common) cause of illness from swimming pools. Infection can be serious for people who are HIV positive or immunocompromised, by chemotherapy for example. There were 7 outbreaks officially reported as associated with English pools last year - as many as the total for the previous 5 years - but only a very tiny proportion of the 300 million pool attendances there are each year.

## CHLORINE RESISTANT

There was no clear pattern to the pools affected, and specific reasons for the outbreaks could not always be identified (though problems with pool operation and/or diarrhoea entering the pool were sometimes linked to the outbreaks). The recent increase in numbers of reported outbreaks is most likely due to better recognition of the organism. But Cryptosporidium does present a particular challenge - compared with bacteria and viruses - because its resistant form (a cyst) is not killed by the chlorine levels used in pools. Four hours at 30mg/l free chlorine would be necessary, so typical pool values of under 2mg/l are no use. It must be dealt within the plant room - mainly by effective filtration (and coagulation).

## STRATEGIES & ADVICE

PWTAG has for some time recommended strict procedures to deal with the risk of Cryptosporidium infection. This basic advice was published in the PWTAG's *Swimming Pool Water* (details below). For the past year PWTAG has been investigating the issue in collaboration with the University of Wales at Swansea and University College London. An ambitious 3-year research programme is being planned, but already the work has started to bear fruit. Following a comprehensive study of research and experience world-wide, PWTAG is now able to refine its guidelines on filtration and disinfection to minimise the threat from Cryptosporidium. What is published in *Swimming Pool Water* still holds, but this guidance note gives some new detail.

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## **FILTRATION**

These guidelines apply to filter operation at any time; the fact that fouling with diarrhoea (never mind the introduction of *Cryptosporidium* through poor hygiene) can happen unseen means that optimal filtration is always important.

### **Bed Depth**

Sand filters operate best at filtration rates of 10-25m/h. And the deeper the bed of sand, the better the filtration (1m is a typical depth). Shallow-bed filters operating at 30-50m/h (sometimes called high-rate filters, commonly used in domestic pools) cannot usually be used with coagulants, and so could not be expected to be good at coping with *Cryptosporidium* cysts. They are not recommended for publicly used pools.

### **Coagulant Injection**

A coagulant should always be used prior to filtration, ideally dosed continuously and precisely (not by hand or via the strainer box). The coagulation injection should ensure good mixing and at least 10 seconds for the coagulant to operate before the flow gets to the filter media. The injection point should be as far as practicable before the filter.

### **pH**

Aluminium-based coagulants (eg aluminium sulphate) operate best at pH values towards the bottom of the pH range for disinfection (ie towards 7.2 rather than 7.8). They should be dosed at a minimum of 0.05mg/l as aluminium, except polyaluminium chloride (PAC) which is dosed at about 0.1ml/m<sup>3</sup>. Iron coagulants is dosed at 0.1mg/l as iron.

### **Backwash**

Filters should be backwashed when the pressure loss across the bed reaches the level specified by the manufacturer (but at least once a week). Filters should also be backwashed if the circulation has had to be stopped because of a failure or for maintenance. (Normally, filtration and pool circulation should be 24 hours a day.)

### **Start & Stop**

Rapid changes in flow rate reduce filter performance, forcing dirt and bacteria through the bed and should be avoided. If a filter is being backwashed while other filters are still in service, flow to the filter should start and stop slowly (over 15-20sec) to avoid rapid flow rate change in the in-service filters.

## **Fluidisation**

Backwash flow must be fast enough to fluidise the sand bed (usually at least 30m/h); air scouring first (at about 32m/h) can help. Flow meters should be fitted.

### **Checking**

Fluidisation of the bed should be checked visually if possible, through a viewing window. In any case, backwashing should continue until the backwash water is clear; the manufacturer's recommendations should also be taken into account.

### **Inspection**

Every year or so filters should be opened and the top of the bed examined for tell-tale signs of problems with the under-drains - mud balling, fissures, a very uneven bed, etc.

### **Filter rinsing**

After backwash, the first few minutes of flow should run to waste. As a backwashed filter benefits from a further ripening period (as the sand settles and returns to full working efficiency) of perhaps 30 minutes, backwashing at the end of the day is good practice. This allows the filter to return to optimum efficiency when there are no bathers in the pool

### **Equalised Flow**

If all of a pool's filters are backwashed on the same day, maximum efficiency is maintained. The feasibility of this may depend on how quickly the pool's temperature can be restored afterwards.

### **Plant Log**

Records of flow rates, pressure differentials and backwash procedures should be kept.

### **Removal Effectiveness**

The best swimming pool filter, with good coagulation, might remove up to 99% of *Cryptosporidium* cysts in one pass. (With poor coagulation, that figure might fall to 90%; without coagulation, less than 50%.) A fouling incident might introduce millions of cysts into the pool; and even a few can cause an infection. This is why closing the pool for six pool turnovers (and that is assuming a system of hydraulics that mixes the water well in the pool) is recommended after a fouling with diarrhoea - see Fouling, below.

## **DISINFECTION - OZONE & UV**

Both ozone and ultraviolet irradiation have been shown (in laboratory experiments) to kill *Cryptosporidium* about as effectively as optimal filtration removes it (ie perhaps 99% in one pass). It is too soon to know whether this will necessarily be the case in pools. For whatever reason these systems are installed, it is important that the full flow is treated in the plant room. The ozone concentration should be at 0.8-1mg/litre and the contact time at least 2 minutes. The minimum UV dose should be 60mJ/cm<sup>2</sup>, based on the actual circulation rate.

As with filtration, it would take a number of pool turnovers for a reassuring proportion of the pool water to pass through the plant room. But either system seems likely to provide valuable additional protection by combining inactivation with the essentials of good filtration.

## **FOULING**

The basic recommendations about how to react to faecal fouling incidents are little changed.

### **Solid Matter**

Solid stools can simply be scooped out; as long as the pool is operating as it should in terms of disinfectant residual etc, no further action is needed.

### **Diarrhoea**

If it's diarrhoea, clear the pool of people immediately. Most viruses and bacteria that cause diarrhoea would be killed within minutes once the disinfectant residuals have been turned up to the top of their normal range. But operators will not know whether or not chlorine-resistant *Cryptosporidium* is involved. So the safest option (particularly if the person involved is known to have had diarrhoea for days) is to proceed as follows.

### **Shut & Shower**

Close the pool - and any other pools whose water treatment is linked to the fouled pool. If people transfer to another pool, they should shower first.

### **Disinfect & Clean**

Maintaining disinfectant levels at the top of the operating range, vacuum and sweep the pool.

### **Close for 6 cycles**

Using good coagulation, filter for six turnover cycles (which may mean closing the pool for a day). This assumes good hydraulics and well maintained filters, operating in line with PWTAG's book, *Swimming Pool Water*.

## **Backwash**

Backwash the filters as recommended above.

## **Check & Open**

Check free chlorine residuals and pH and if they are satisfactory reopen the pool.

## **HYGIENE**

PWTAG's hygiene recommendations - ideally enforced through publicity aimed particularly at parents - also remain largely unchanged:

### **Babies**

Discourage children under six months old from swimming in public pools too big to be drained if there is a fouling accident. Pools for young children should ideally have separate filtration.

### **Cleaning**

Ensure pollution from outdoor shoes is not brought into the vicinity of pools; thoroughly cleaning pool surrounds daily; where appropriate washing down with pool water frequently.

### **Showering**

Make sure young children use the toilet and have a shower before they swim. Adults, too, should shower ideally, for the sake of the pool water generally. Nude showering is best: a quick rinse over a swimsuit will not do much good. Encourage swimmers to shower with soap and water: this can reduce the risk by removing invisible faecal matter.

### **Nappy Issues**

Encourage very young children to use special swimming trunks - not nappies. These do not, however, allow a child with diarrhoea to swim. Nappy changing area should be convenient - in changing areas, cleaned regularly and equipped with sinks nearby for handwashing and with special bins for nappy disposal.

### **Ill with Diarrhoea**

Do not let children (or adults) swim if they've been ill with diarrhoea in the previous 14 days.

### **Concern**

Qualified, competent pool operators need not be over anxious about the threat of infection. But to be on the safe side, good hygiene should be encouraged - and getting swimmers used to the idea of showering before they swim will help pool water quality in any case. Pool operators and managers who follow these guidelines and take seriously the issue of pool fouling, will be able to keep this problem under control.

## Testing for Cryptosporidium

Managers and operators should not be over-zealous: for example, there is no point in thinking about testing the pool water for Cryptosporidium unless a problem is suspected.

### Written Procedure

It is important that you have written down as part of the pool's safe operating procedures (NOP and EAP) how to respond to faecal incidents. This guidance note from PWTAG can be the basis for such a plan. As our further research unfolds, ISRM & PWTAG will keep people informed.

*SWIMMING POOL WATER Treatment & Quality Standards* (ISBN 0 9517007 6 6) is £35 (including p&p), £45 abroad. It is 144 pages. It is distributed by Greenhouse Books, Holly Lodge, Botesdale, Diss, Norfolk IP22 1BZ (fax 01379 898244, phone 01379 890721).

### About PWTAG

The Pool Water Treatment Advisory Group is in its seventeenth year of providing independent advice and guidance. Individual members have a variety of skills relevant to water treatment. They represent Sport England, Department of the Environment, Transport & the Regions, Department of Health, Department for Education and Employment, Ministry of Defence, Amateur Swimming Association, British Water, Chartered Institute of Environmental Health, Public Health Laboratory Service, Institute of Sport & Recreation Management, Swimming Pool & Allied Trades Association, Institute of Engineers of Ireland, Chartered Institute of Building Services Engineers. PWTAG's annual report is available from the secretary, and is also featured on the website.

## We're working to keep swimming fresh - are you?

ISRM is waging a campaign to improve bather hygiene and help eliminate diseases like cryptosporidia from pools.

**Q** - What can you do?

**A** - Proactive prevention planning:

- Evaluate pool hygiene design
- Encourage bather awareness of healthy swimming practices
- Educate children in a simple, effective pre-swim routine
- Ensure effective pool water management
- Enable staff to promote good hygiene and safety.

ISRM has specially commissioned a set of leaflets and posters to help you be proactive:

- Bright, informative and fun A4 leaflets for child bathers
- Encapsulated, fully waterproof A2 posters designed for displaying in changing areas.

Call our orderline on Tel: 01664 565531

**Join ISRM in the battle to improve bather hygiene and keep dirt and bacteria out of your pool!**