

PWTAG Technical Note 46

Swimming Pool Technical Operation after Covid-19 shutdown

This guidance is specifically for public pools, as defined in European Standard BS EN 15288-1 *Swimming Pool Design*. It is the fourth in a series of PWTAG technical notes dealing with the current pandemic: TN43 dealt with temporary pool closure; TN44 with coronavirus disinfection; TN45 with the immediate steps in reopening.

This note deals with the ongoing challenge of managing a swimming pool during a subsiding pandemic. It provides a framework of good practice, recommendations and alerts – to be adapted by pool managers to the specific requirements of their swimming pool.

How managers should deal safely with users, in terms of distancing etc throughout the building and pool, is to be found on the websites of the Department of Digital, Culture, Media & Sport (DCMS, <https://www.gov.uk/government/organisations/departments-for-digital-culture-media-sport>) and Swim England (*Return to Pools Guidance*; <https://www.swimming.org/swimengland/pool-return-guidance-documents/>).

Domestic pools used by household families are not covered here; they have different types of Covid-19 risks associated with their use.

1. Risk assessment

Each pool manager or person in overall charge of health and safety must ensure there is a Covid-19 risk assessment in accordance with the Health and Safety at Work Act and associated legislation. They should then make sure that the risk assessment recommendations are developed and implemented to safeguard the health and safety of staff, users and visitors. Coronavirus is likely to be with us for some time, so the risk assessment will need to be reviewed regularly, in response to changes. (Section 3 covers extra considerations for risk assessing pools using cyanuric acid or chlorinated isocyanurates.)

2. Management of the technical pool operation

Managers should adapt their Pool Technical Operational Procedures (PTOP) to the changes in swimming pool water requirements (signed off by a senior manager). Changes should be recorded, including the date and the person making them. Staff should be trained to ensure they understand the changes to the PTO, Emergency Action Plan and Pool Safety Operating

Procedures – and the reasons why they are important. New requirements from PWTAG and other relevant authorities should be followed.

3. Primary disinfection

With adequately disinfected pool water, the main risk from Covid-19 is through airborne respiratory transmission from a person carrying this virus to others within a critical vicinity – not from waterborne transmission. The available evidence shows that the physical effect of the pool water and an appropriate relationship between free chlorine and pH value should inactivate the virus within 15-30 seconds. The dilution of virus in the pool water volume will also reduce the risk of exposure and transmission.

There is more on the scientific background to this in section 12.

The table below gives details for safe pool operation during this pandemic, for a range of disinfectants. (There is also a note on cyanuric acid and chlorinated isocyanurates at the end of this section.)

Disinfectant	Minimum residual	pH value
Chlorine gas	1.5mg/l	7.0-7.4
Sodium/calcium hypochlorite	1.5mg/l	7.0-7.4
Trichloroisocyanuric acid/ dichloroisocyanurate dihydrate	5mg/l	7.0-7.2
BCDMH	4mg/l	7.0-7.4
Sodium bromide with sodium hypochlorite	3.5mg/l as bromine 1.5mg/l as chlorine	7.2-8.2

The lower the pH the more easily chlorine kills microorganisms. To deal with the Covid-19 virus, a chlorine residual between 1.5 and 3mg/l is believed to be effective at a pH between 7.0 and 7.4. The characteristics of the particular pool and its treatment regime may influence how closely it is possible to follow these recommended levels. If the pool cannot realistically achieve a pH below 7.4, the minimum free chlorine residual (from hypochlorite or chlorine gas) may have to be as high as 2.7mg/l as long as the pandemic continues.

The table below gives some details.

pH value	Minimum free chlorine concentration
7.0	1.5mg/l
7.2	1.7mg/l
7.4	2.0mg/l
7.6	2.7mg/l

Operators should test the pool water for free and combined chlorine and pH at frequent, regular intervals. PWTAG recommends testing before bathing starts and every two hours

after that. Results should be recorded and initialled, and senior staff immediately notified if they are not within the specified range. All resulting actions should be documented.

Combined chlorine concentrations should be maintained at less than half the free, never more than 1.0mg/l and as low as possible.

NOTE *Cyanuric acid and chlorinated isocyanurates*

Cyanuric acid is known to reduce the disinfectant efficacy of free chlorine, significantly increasing the contact time needed to kill a range of pathogens (eg adenovirus, hepatitis A virus and the protozoan *Cryptosporidium*). It is therefore reasonable to assume that this is also the case for Covid-19 virus. Such reduction in efficacy is likely to provide the potential for virus survival and thus cross infection via the pool water.

PWTAG's recommendation during this pandemic is that pools using cyanuric acid or chlorinated isocyanurates including outdoor pools– should maintain cyanuric acid levels below 100mg/l and minimum free chlorine of 5mg/l. This may mean dumping and diluting pool water more than usual. It is important that the risk assessment (involving the manufacturers) takes account of the use of chlorinated isocyanurates during this pandemic.

4. Secondary disinfection (UV and ozone)

The recommended free chlorine levels and pH values (in the tables above) are required whether secondary disinfection is used or not, as it is the amount of residual disinfectant present in the pool water that is crucial to deactivating the virus in the pool water.

5. Circulation and hydraulics

In order to get good dilution of any released virus particles and to ensure the distribution of free chlorine such that the risk of infection is minimised, it is important to maintain the circulation of the pool water at 100%.

As the virus is probably inactivated more quickly than it can be physically removed, the emphasis should be on maintaining sufficient residual of free chlorine throughout the pool water. If the circulation is sufficient to ensure the desired free chlorine residual in all parts of the pool, then the prime objective (disinfection) is achieved.

It is also important to remove any contaminated water from the pool as soon as possible, through the pool hydraulics and circulation system. This is more readily achieved in a deck-level pool with 80-100% surface water removal. Pools that use circulation systems utilising scum channels or skimmers will not achieve the same contamination removal rate, so it is important that they are kept clean and free from debris.

6. Aerosols created by pool equipment

Covid-19 is readily carried and transmitted via droplets and aerosols. Whirlpools, water slides and other water features can produce aerosols. And they are another source of contamination by bathers. In order to minimize the formation of aerosols, pool managers should consider not using such equipment until the pandemic is over.

If not, it is clearly vital that all pool water systems are maintained in line with PWTAG recommendations, in this note and online. Ventilation (see section 9) is also important here.

If there is the potential for standing water within any such equipment, it should be regularly flushed to reduce the risk of other waterborne pathogens including *Legionella*..

7. Distancing – bather capacity

The main areas of infection risk in a pool environment are confined spaces and changing rooms. In the pool itself, as well as the necessary levels of free chlorine and pH values, there is also the need to preserve appropriate distances between bathers. And the pool's designated bather load must be observed.

In the face of Covid-19, each pool needs to calculate the bather capacity appropriate to its dimension, shape and type of use, while maintaining the statutory distancing between bathers. There is detailed guidance on this from DCMS and Swim England. Pool managers will need to consider issues like:

- general swimming – not just lanes
- unprogrammed activities – eg children's fun/activity sessions
- separate times/sessions for vulnerable groups – eg over 70s
- people with disabilities
- aquatic exercise classes
- club swimming
- teaching
- aquatic activity in settings like hydrotherapy pools
- hotel and holiday settings
- baby swimming
- access for the disabled.

8. Bather hygiene – showers etc

Everyone using a pool building should wash or otherwise disinfect their hands as they enter and as they leave. Pool managers should enable and encourage this.

Pre-swim showering is a vital contribution to ensuring the free chlorine in the pool water is available for disinfecting the Covid-19 virus (rather than being used to oxidise organic material coming off bathers). Bathers should be actively encouraged to shower with soap

and water while maintaining the statutory physical distancing. Operators should provide soap dispensers to encourage this.

In some circumstances, pool managers may consider encouraging showering at home before a swim, but this is clearly less than ideal. If showers are unused then they should be flushed weekly for 15 minutes.

Bathers should be reminded to use the toilet and then wash their hands (following the physical distancing rules) before swimming, and children given that opportunity at frequent intervals during their swim.

9. Ventilation

An outdoor pool with appropriate disinfection and pH, and bathers correctly distancing, should provide a relatively safe environment.

Reducing recirculation and increasing the proportion of outside air reduces contamination generally, including disinfection byproducts and any airborne viruses.

It is recommended that any pool hall ventilation system which normally runs with recirculation should where possible maximise the input of outside fresh air. There is further guidance on the CIBSE website (<https://www.cibse.org/coronavirus-covid-19>) and in Swim England's *Return to Pools Guidance* (<https://www.swimming.org/swimengland/pool-return-guidance-documents/>).

10. Cleaning

There will be an increased requirement for cleaning pool surrounds and changing rooms. How the pool operator accomplishes this depends on the design of the changing areas, as all have unique characteristics to be considered and programmed accordingly. A full and deep clean of all areas should be done before opening.

PWTAG Technical note 44 (*Disinfecting coronavirus*) has details on disinfection methodology. And there is further guidance on gov.uk: *COVID-1:cleaning of non-healthcare settings* (<https://www.gov.uk/government/publications/covid-19-decontamination-in-non-healthcare-settings>)

The use of shared objects such as slides, climbing structures, play equipment, noodles and floats should be risk assessed taking into account distancing, cleaning requirements and the potential for aerosol production. Only those items essential to providing the service should be deployed. Managers may recommend that users bring their own equipment, which should be thoroughly cleaned and disinfected before use and not shared with people outside their family group. Any shared equipment should be cleaned and disinfected each time it is used.

Swimming aids should be disinfected daily, by soaking for one hour in 100mg/l chlorine solution (details in technical note 44) and then rinsing before use.

For the health and safety of both staff and bathers, any containers used for cleaning purposes should be labelled: eg either as used equipment that has not yet been cleaned and disinfected; or as cleaned and disinfected equipment. Disinfectants should be stored safely and securely.

11. Cryptosporidium

Although it is known that the Covid-19 virus can be shed in faeces, it is a respiratory virus and transmission via the respiratory tract is the main concern. Nevertheless, accidental faecal releases should be monitored and dealt with, mainly to reduce the risk of spreading the chlorine-resistant organisms *Cryptosporidium* and *Giardia*. This is fully covered in PWTAG Technical note 2, *Faecal contamination*.

There should be a written procedure, as part of a pool's Emergency Action Plan, stating what to do in the event of a faecal incident. Staff should be trained in these procedures, and the training recorded.

12. Appendix

Covid-19 is an enveloped virus that is likely to be more sensitive to chlorination than, for example, non-enveloped viruses such as adenovirus (*World Health Organization, 2020* <https://www.who.int/publications/i/item/water-sanitation-hygiene-and-waste-management-for-the-covid-19-virus-interim-guidance>). Currently, there are no chlorine Ct values for SARS-CoV-2, but a reported Ct value (4-log reduction) for adenovirus is 0.75mg.min/l at pH 7 (*Thurston-Enriquez et al, 2003* <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC165174/>). It has therefore been assumed that Covid-19 will at least have a 4-log reduction with chlorination with a Ct value of 0.75mg.min/l at pH 7. If Covid-19 is to be inactivated within 30 seconds in swimming pool water then the free chlorine concentration should be at least 1.5 mg/l at pH 7 and where possible up to 3mg/l to reduce the inactivation time to around 15 seconds.