POOL WATER TREATMENT
ADVISORY GROUP

TECHNICAL NOTE

38 Dechlorinating backwash water prior to discharge

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Whether discharge water consent requires the removal of free chlorine depends on three factors – the free chlorine concentration, the volume of water discharged and how long it stands prior to discharge. The method of dechlorination may depend on base water characteristics and the ease of compliance with the required discharge consent. This technical note deals with these issues.

Discharge
Since 1994, backwash water has (controversially) been classified as a trade effluent. In England and Wales, discharge to sewers requires the consent of the local water service company; and discharge to a water course must be authorised by the regional office of the Environment Agency. In Scotland, the relevant authorities are Scottish Water and the Scottish Environment Protection Agency (SEPA); in N Ireland, the Department of the Environment. These authorities may have specific requirements about the rate and quality of discharges from backwashing, dilution, pool emptying, etc. It is important in any case for pool managers to consult the authorities about their operation and any changes to it. The relevant water authorities must be consulted about discharges of water from backwashing/dilution. Many are now requiring that discharge does not exceed 5 litres per second which means that a backwash attenuation (holding) tank is required.

Backwash water may need dechlorination if it is going to a surface water drain. Water rationing and shortages may affect these judgements. In any case, it may be worthwhile to recycle some of the water drained from the pool into a grey water system for toilets etc. This necessitates precautions to prevent any risk from *Legionella*.

The Water Regulations Advisory Scheme (WRAS) gives advice about Fittings Regulations throughout the UK. Enforcement is by regulations in England & Wales and through bylaws in Scotland and N Ireland.

Monitoring and treating backwash waste water
Dealing with the waste water from the filter backwashing prior to discharge can be achieved in two ways:

- in proportion to the backwash flow rates and directly to drain
- with a retention (or holding) tank, where the waste water is collected and then chemically treated over time. Upon reaching the regulatory discharge parameters, it is discharged. The tank should be large enough to accept a complete backwash cycle and can be located above or below ground.

Both methods have advantages and disadvantages which should be reviewed prior to selection. A primary consideration is the availability of plant room space – for example, the footprint required for a retention tank of 20-30 m^3.

Chemical injection and control may be unavailable or inadequate. In this case, more technology will be required. Waste water flow monitoring can supplement the injection/control system with a flow meter, thus removing the requirement for the retention tank. This should ensure the chlorine is neutralised proportionally to the backwash flow and then directly on to discharge.

It is essential that this treatment process is evaluated technically, as chemical reaction times will need to be calculated to ensure neutralisation prior to discharge, and thus avoiding any penalties or fines from the local governing authority.

There are five chief methods of dechlorination dealt with here – **activated carbon**, **sodium thiosulphate**, **sodium metabisulphite**, **UV** and **recycling**. **Aeration** is described but not recommended.

Activated carbon filtration
Activated carbon is a black, solid substance resembling granular or powdered charcoal. It is highly porous with a very large surface area. Certain contaminants accumulate on the surface of the activated carbon by a process of adsorption. Many organic compounds – e.g. chlorinated and non-chlorinated solvents, benzene, gasoline, pesticides, herbicides and trihalomethanes (THMs) – can be adsorbed by activated carbon.

Activated carbon is also effective for removal of chlorine and is widely used in industrial processes for this. Granular activated carbon (GAC) is honeycombed with minuscule channels that greatly increase the surface area and thereby account for its adsorptive properties. However, the activated carbon filters used in many water treatment devices can themselves become a source of contamination. Over time, the activated carbon granules can become saturated with chemical contaminants, resulting in the release of these compounds into the outlet water, possibly in even higher concentrations than in the source water. In addition, there are usually high-pressure head losses over the GAC bed and there is a regeneration/replacement cost.

The major problem associated with carbon in any form is bacterial contamination. Wet activated carbon, richly infused with trapped organic matter, provides an ideal breeding ground for bacteria. High bacterial levels can result when the carbon is fully saturated and then left to stand (e.g. overnight). As the water temperature inside the carbon bed rises, bacterial breeding escalates. The space requirements for the filter housing, together with the required regular maintenance of the carbon bed, make activated carbon unpopular for the treatment of swimming pool backwash water.

Sodium thiosulphate
Backwash water can be collected into a retention tank for dechlorinating. It is then recycled by a submersible pump and treated. Fifteen grams of sodium thiosulphate will remove 3mg/l of chlorine from 1m^3 of pool water.

The recycling system and the chlorine content of the backwash water need to be measured and controlled. Backwash water tends to have high level of turbidity; therefore, the oxidation-reduction potential (ORP) system is ideal for this application. When NO chlorine is indicated on the ORP measuring system, the recycling system can be switched to dump, by activating the three-way valve. This will automatically rotate and empty the storage tank to the sewage system. When the tank is empty the three-way valve will automatically return to recycling position.

Sodium metabisulphite
Sodium metabisulphite is an alternative to sodium thiosulphate. It is an inorganic, odourless white powder that will sink in water and dissolve slowly over time or more rapidly with agitation. It is also available as an aqueous solution.

Its primary use in swimming pools is in the reduction of free chlorine concentration following overdosing, and before discharge to waste following the back washing process of the pool filtration.

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Subject to the level of chlorine to be neutralised, along with any other possible contaminants or regulatory standards, the rate of injection is 1.8g of dry sodium metabisulphite per cubic metre of water volume to attain a reduction in free chlorine residual of 1mg/l.

Depending on the plant room design, injection of sodium metabisulphate is usually managed via a proportional controller and sensor system that can control the addition of the sodium metabisulphite until the desired set point is reached via a metering device. In most swimming pools, this set point value can be verified with DPD tests or through the established chlorine monitoring system for the pool water volume.

But with backwash water, there is usually a dedicated controlling, sensing and dosing system indicating that the backwash water has been neutralised and now ready for discharge.

UV photolysis
At high UV doses (at least 20 times the dose used in pool water treatment), ultraviolet light is very effective at removing free chlorine from water. Both hypochlorous acid and the hypochlorite ion absorb UV strongly in the wavelength band 250-350 nm. There are other benefits of using UV for this purpose.

- The water receives a high UV disinfection dose
- There is a degree of organic chlorine destruction
- It eliminates labour and the safety hazard of mixing chemicals
- It eliminates the risk of introducing microorganisms into the environment and there is an overall improvement in water quality.

However, the effectiveness of UV is highly dependent on the clarity of the water to UV light and it is vital that the transmittance of the water at a wavelength of 254nm is measured. Unlike pool water, which generally has a known range of UV transmittance, this property of backwash water will be highly variable. The inlet concentration of chlorine also determines the required UV dose. As a result, system selection is of such complexity that it should be left to specialists within the UV industry. Water quality may be such that UV treatment is not a practical solution, taking into account its high power consumption.

Recycling water
As an alternative to dechlorination, recycling waste water may be considered. There are units on the market which use a combined process of pre-treatment, ultra-filtration and oxidation to treat the waste water. It can be re-used as either water for backwashing the filters or put back into the pool balance tank as make-up water.

The backwash water recycling units work with four treatment stages – sedimentation, pre-filtration, ultra-filtration (UF) and disinfection. Ultra-filtration is the central treatment stage, using two UF modules. According to DIN 19645, water to be reused in the pool must show a reduction of the virus concentration of 107 (seven log stages). The final disinfection/oxidation stage can be controlled by the filtrate ORP measurement. Based on membrane pressure measurements, the filtration time is optimised. Units should operate automatically with little input from the site staff, although some preventative maintenance will be required. When evaluating systems, the pool operator should consider the impact on total dissolved solids (TDS) and understand that some proportion of fresh water will be required. There should be a cost benefit analysis including water savings and the energy cost reduction from the re-use of water warmer than the mains supply.

Aeration
Aeration is effective in the removal of chloramines from chlorinated pool water, but the loss of free chlorine is minimal and aeration alone is not considered a realistic method for dechlorination of backwash water.