POOL WATER TREATMENT
ADVISORY GROUP

TECHNICAL NOTE

33 Gassing Accidents

July 2016

Gassing Accidents
Incidents involving bathers being affected, even hospitalised, as a result of exposure to chlorine gas release in pool buildings are not infrequent. Invariably this is the result of the mixing of incompatible chemicals, usually with the release of chlorine gas. Such incidents may simply be the result of a manual mixing of incompatible chemicals, usually in the store or plant room.

The precipitating factor may turn out to have been something as trivial as a bit of grit in a valve. But what is often missing, and which could have averted the incident , is a system or design that minimises the risk of chemical mixing and stops continued chemical dosing when things go wrong. Otherwise the hypochlorite/acid mix can generate a gaseous chlorine vapour which can migrate from its source into public areas including the pool hall.

If the pool operator is unsure whether the system they are responsible for is designed correctly and also incorporates the necessary fail safe facilities, they should audit their systems. In all cases operators should have an appropriate Emergency Action Plan (see below) including measures in place to evacuate the pool after a failure in circulation, before the system is restarted.

Disinfectant is safer dosed before the filters and pH adjusting chemical after, to keep them apart. If this is not possible – where UV is deployed, for example – the injection points should be at least 10 pipe diameters apart.

Chemical dosing units should be topped up separately. Colour coding of chemical containers to the dosing units should be considered – for example, hypochlorite delivered in a black container is added to a black dosing unit; acid delivered in a white container is added to a white dosing unit. Each dosing unit should clearly labelled.

Power failure/isolation
If power is cut (or the plant fails totally for some other reason) there are two ways that chlorine gas can be released.

1 If the filtration system and the chemical injection points are above pool water level, the water in the system above the pool water level drains back to the pool and in the process draws air or liquid into the system. As a result, both acid and chlorine solutions are drawn into the pipework; they sit in the pipework until the plant re-starts and then mix. Chlorine gas is formed and enters the pool hall via the pool inlets.

2 When the power is returned, the circulation pumps – because they usually incorporate starting equipment – do not start up. However, this does not always apply to the chemical pumps; if both chlorine and acid pumps re-start, acid and chlorine may mix in the pipework system, with the same result as above. But this can be checked by turning off the circulation pump and seeing if the chemical dosing pumps continue to run. If so, an interlock is not present and needs to be fitted.

Fail safe
A pool's dosing system should fail safe if a fault develops: the system shuts down and an alarm sounds. Any disruption to the pool circulation should interrupt chemical treatment to prevent chemical build up in the system. There are a number of ways of achieving this.

If the dosing plant is water operated (eg circulation feeders) the water should come from the pool system and it too should fail safe with the circulation failure. Equally, dosing pumps regulated by a water flow meter signal offer a simple fail-safe system.

Otherwise there must be at least an electrically operated interlock between the chemical control system and the starting equipment for the circulation pump so that dosing stops on motor failure.

This is best supplemented by pressure or flow sensors (which themselves fail safe) closing the system down when the main water system loses pressure or flow. This will overcome problems of loss of main circulation pump prime, even when the motor runs. Flow switches should be checked regularly for functionality, as they are generally unreliable. A good design will incorporate strainers fitted on the sample line supply.

Anti-syphon valves in the chemical dosing pumps will ensure that chemicals will not be drawn through the pump in the event of a vacuum in the pipework system.

An additional sample point may be installed to feed, say, a residual chlorine monitor, purely as an alarm if the chlorine residual gets too high – to indicate overdosing through circulation pump failure, for example.

Public impact
Well managed public and private swimming pools should have an Emergency Action Plan (EAP). The plan should be enacted by the operators in the event of a chlorine release. Due to the toxic nature of chlorine, the fire and ambulance services should be called if the public are involved. Pool operators should bear in mind the possible complicating factors of hysteria and panic, which can be associated with physically non-threatening incidents.

TECHNICAL NOTE

A full swimming pool evacuation from both the pool and building is often the standard response to these incidents. But the evacuation of wet, poorly clad swimmers into the external environment may have other health consequences, such as hypothermia. Children can be particularly susceptible to the cold, so evacuation to a safe part of the building (such as sports hall) may be better.

Chlorine is a highly toxic gas, heavier than air, and so it may affect swimmers before staff. It is very different from the sort of 'chlorine smell' sometimes associated with a pool whose water is imperfectly managed. At low concentrations chlorine is an eye irritant and causes a burning session in the throat leading to coughing. Children may be more sensitive to the inhalation effects of chlorine, as are those who already have respiratory conditions, such as asthma or emphysema.

A one-off exposure (sufficient to cause mild lung or eye irritation) is unlikely to result in long-term health effects. Those exposed to the gas generally make a complete recovery, although a small proportion may acquire a condition known as reactive airways dysfunction syndrome (RADS) in which the lungs become more sensitive to chemical irritants.

More substantial exposure may cause chest tightness, coughing, breathing difficulties, severe headache, chest pain and tachycardia. Any exposure to high concentrations of chlorine may be potentially fatal; it should be noted that such symptoms may be delayed for up to 48 hours. Exposed individuals with no symptoms at point of exposure should seek medical advice if they develop respiratory symptoms within 48 hours.