

Drowning detection systems for public swimming pools

General

The term 'drowning detection system' (DDS) is used to describe various electronic systems that are designed to assist with the surveillance of swimmers within the water of a swimming pool. Approximately 30 systems have been installed in public swimming pools in the UK to date.

There are 3 general types:

CCTV cameras	that give a lifeguard additional underwater views
CCTV cameras with computer monitoring and automatic alarms	that detect 'static' solid objects of appropriate size (i.e. swimmers in potential difficulty)
Wristband tags with computer monitoring and automatic alarms	that detect wristbands that are outside set depth, movement and time parameters (i.e. swimmers in potential difficulty)

See page 3 for further details.

The concept is somewhat controversial, and there is debate within the industry on the extent that such systems should complement traditional lifeguarding arrangements. The advantages of an additional safety system for a pool are set against other factors such as:

- Concerns over inconsistent levels of reliability of systems and situations where glare, swimming aids or high occupancy / activity rates can cause false alarms
- Impact of the additional cost on financial viability
- Risk that such systems can create a false sense of security for lifeguards
- Risk that numerous false alarms can cause lifeguards to ignore a genuine emergency situation
- Limited level of in-use knowledge and experience in UK pools.

These systems all require various items of equipment to be built integrally with the pool structure and it is recommended that for all new and refurbishment projects, their inclusion is considered at an early stage in the briefing and design processes. However, some systems can be retro-fitted in existing pools.

The issues outlined should be taken fully into account during the development of the operator's 'Pool Safety Operating Procedure' ¹ whilst considering the priority of maintaining high levels of lifeguard vigilance and effectiveness.

Available legislation and advice

There is no legislation for drowning detection systems, with only limited published guidance available. There is a one line reference in the HSG 179 'Managing Health and Safety in Swimming Pools', the standard UK reference for swimming pool safety and management, which states that '*cameras and computer aided surveillance systems may be used to assist supervision*'.

The European standard for swimming pool safety BSEN 15288-1 and 2 : 2008 mentions '*special installation / detection technologies*' as requiring consideration at the design stage and a factor to be considered in a risk assessment on supervision requirements. The ISRM ² website has limited information on trials, research and articles about such systems but with some examples accompanied by a disclaimer by the organisation.

¹ See HSG 179 'Managing Health and Safety in Swimming Pools'.

² Institute of Sport and Recreation Management.

Key issues

Swimming pools may have potential blind spots due to their size and shape and these should be carefully assessed, analysed and appropriately mitigated during the design process.

The pool operator has a responsibility to undertake a full risk assessment of all relevant factors, including potential blind spots, before operating the pool. The HSG 179 guidance stresses the importance of lifeguards having good visibility beneath the water and states that a minimum number of lifeguards should be on duty for programmed and un-programmed swimming sessions. For example, in the case of a 50 m pool, recommendations are for a minimum of 4 lifeguards in normal conditions and 6 lifeguards in busy conditions.

The document also states that glare and specular reflection³ should be avoided and points to particular visibility problems for pools that are more than 16 m wide. Even when glare is not an issue, it is likely to be difficult for a lifeguard on one side of the pool to see objects beneath the water on the far side. There can also be visibility issues on the near side of the pool unless the lifeguard is positioned close to the pool edge. This is mentioned in a number of Health and Safety Executive (HSE) reports of prosecutions after fatalities in swimming pools and where fines have been imposed under the Health and Safety at Work Act (HASAWA) 1974.

Important detailed design considerations are:

- The specialist suppliers of DDS systems should be consulted on the suitability of their equipment for a particular swimming pool project
- Underwater cameras that project from the pool sidewalls will not be compatible with moving floors and bulkheads. In this situation, overhead cameras can be added into the system which can be effective in pools up to 2.6 m in depth
- Cameras can be fitted with different lenses to increase coverage and avoid 'blind spots'
- Where underwater cameras are built into the pool tank wall, the depth and size of the camera and housing can be co-ordinated to achieve an aesthetically pleasing appearance to the pool light fittings.



Typical underwater cameras



Examples of lifeguard chairs with integrated CCTV monitor



Typical ceiling mounted camera



Typical underwater cameras



Examples of lifeguard chairs with integrated CCTV monitor



Wristband to monitor swimmers

³ A veiling effect caused by light reflecting from the surface - See Sport England's Design Guidance Note 'Swimming Pools'.

	CCTV Viewing	CCTV + Monitoring + Alarms	Wristband tags + Monitoring + Alarms *
CCTV Viewing	A passive aid to the lifeguard that gives an underwater view via CCTV cameras. However it does not incorporate a detection system. Glare can be a potential problem with viewing monitors in bright environments. However, it is possible to incorporate shrouds around monitors.	A computer aided detection system, that is not primarily a CCTV system and does not require a lifeguard dedicated to watch the TV monitor. The system monitors the swimming pool water and when it detects a person in potential difficulty (i.e. a static solid object of appropriate size and shape), it alerts the lifeguard via an LED monitor. The LED monitor visually flashes and produces an audible alarm. The lifeguard will be given a location on the LED screen and can also see the 'casualty' on the supervision workstation monitor. The computer continually monitors the pool assessing any potential problem.	Individual wristbands, about the size of a small wrist watch, that are worn by users of the pool. If a bather (with wristband) approaches the preset parameters of the system, an alert via radio and / or ultrasonic is generated. Initially a small audio sound and flashing LED light will remind the bather to return to a safer location. If the bather does not respond appropriately, the system activates alarms on the receivers worn by the lifeguards.
Real time underwater images on a viewing monitor	● (Viewing monitor adjacent to the lifeguard chair)	● (Viewing monitor adjacent to the lifeguard chair)	
Underwater CCTV cameras	●	●	
Overhead CCTV cameras	● (Required if a moving floor is installed)	● (Required if a moving floor is installed)	
Computer monitoring for static solid objects		●	
Computer monitoring for set parameters (depth / movement / time of wristband tag)			●
Automatic alarm		●	●
Audio and video recording facility	●	●	
Installation cost (for a typical 25m pool)	> £35k	> £100k	> £15k
Operating costs (for a typical 25m pool)	> £2k	> £2k	> £2k
UK examples	15	10	1

* System mainly targeted at the Hotel sector for pools without constant lifeguard supervision

Overview of alternative types of system