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62 – Gas monitoring in the plantroom

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This technical note deals with the use of electronic gas monitoring systems in the plantroom.

Gassing incidents in general are dealt with in PWTAG Technical Note TN33. That note covers causes, fail-safe system design and emergency procedures.

Why have a gas monitoring system?

Gas monitoring systems have two uses: to detect leaks and give advance warning of toxic gas incidents; and to cover safety if the site uses chlorine gas or chlorine dioxide on the incoming water, or ozone as a secondary disinfectant.

A gas monitoring system allows a plant room or other risk area to be continually monitored for toxic gas. An exterior alarm or light – or combination of both – warns people from entering an affected area.

Choosing a gas monitoring system

Care must be taken when choosing a gas monitor as many are not specific to chlorine or ozone alone and this is why they seem to be much cheaper. The monitor chosen should be specifically appropriate to the gas it is to monitor, and should operate within the range of concern. Most gas monitors can have a number of multipoint sensors, enabling several areas to be monitored at the same time. Remote monitoring capability is essential, with local alarm sounders.

The gas leak detection system should:

- raise an audible alarm in a continuously staffed area or control centre
- activate audible alarms in the affected area
- operate any automatic isolation valves
- control the mechanical ventilation, if fitted.

Installation and use

Consideration should be given to the areas of risk. Risk assessments should be made of the areas that could be affected by toxic gas and the sensors and alarm beacons located to protect these areas. Best practice is to place sensors in the areas of highest risk. This may be a chemical storeroom or the area from where chemicals are dosed. Pool plant maintenance firms or manufacturers can provide advice on this.

Gas sensors may be placed in storage and plant areas. The manufacturer or supplier of the system should advise on the best location for the sensors; typically mounted between 0.3- 0.5m above floor level. Since the gases of concern (eg chlorine, chlorine dioxide and ozone) are all heavier than air,



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sensors should be installed around 0.35m above floor level and away from direct heat sources and from areas with fluctuating temperatures. Care should be taken to ensure that they are protected from possible damage, and that staff are aware of their location.

Monitoring Audible alarms need to have a distinct tone so that personnel are familiar with it. In addition, warning lights of the amber flashing or traffic light type may be fitted outside each chlorine area.

Chlorine Detection systems should provide a continuous monitoring function when chlorine is in storage or in use. Chlorine gas sensors should be tested regularly in accordance with the manufacturer's instructions to demonstrate that the detector and its associated circuits are functioning correctly. A record of such tests is recommended. The detection system should operate the alarm circuits in the event of power loss, sensor failure, or low condition of the standby batteries. Battery back-up systems are available for power outages, and should be incorporated in the installation to protect the alarm relay system..

Low-level alarm The detector system should activate the low-level alarm at a chlorine concentration of 1-5ppm. Lower settings are liable to activate the system every time the tank is filled, unless a duration requirement is also imposed. For example, some companies set the low level alarm at 0.5 ppm, but require the sensor to register this concentration for at least 30 seconds. For indoor installations, the low alarm level should activate the ventilation fan, open the intake louvres, and activate local audio alarms and any remote telemetry alarm.

High-level alarm Multi-stage detector systems are sometimes used to give an indication of the severity of the malfunction to personnel outside a chlorine room. It is suggested that the high-level alarm operates at about three times the level of the first-stage alarm, – ie 3-15ppm, depending on the duration that the sensor needs to register this level. However, some companies set the high-level alarm at 2ppm with a 30-second duration requirement.

On activation of a high-level alarm, the ventilation system should be shut off, the auto-shut down system activated (where fitted) and the high-level alarm sounded. The tone of the alarm at low and high levels should be different and operators trained to recognise the difference and how to respond in each case. Local alarms may be supplemented by telemetry links to control rooms, where appropriate.



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Maintenance

Like all safety equipment, gas monitors need planned maintenance. The manufacturer should provide for specific details. Typically:

- every six months sensors and the electronic device should be checked by trained technicians from pool maintenance companies or the manufacturer
 - every two years the sensor should be replaced or or serviced as per manufacturers' instructions.
- Records of all service and sensor calibration should be kept.

Access to an incident

It is important to note that in the event of a toxic gas release no members of staff should visit the affected area – with or without PPE. PPE can be used for minor leaks, if it is stored and maintained correctly. The challenge to the risk assessor is determining if the leak is minor or major.

In the case of chlorine gas this has a major implication for whether the exposure is irritating or fatal as here (HSG 40 Safe handling of chlorine from drums and cylinders and EH40/2005 Workplace Exposure limits):

- 0.5-1ppm Clear sensory irritation
- 1-15ppm Irritation of the mucous membranes in the eyes and nose, and especially the throat and lungs. Irritation becomes intolerable at concentrations of around 4ppm
- >50ppm Dangerous, even with exposures of 5-10 minutes; may cause inflammation of the lungs with an accumulation of fluid
- >1000ppm May be fatal after a few breaths. Death results from lung damage.

The UK short-term exposure limit for chlorine is 0.5ppm for up to 15 minutes, 0.3ppm for chlorine dioxide and 0.2ppm for ozone.

The first call for assistance should be to the emergency services for incident control and rescue, and then in the case of chlorine gas to Chlor-Aid through the chemical supplier, who will offer advice on how to deal with the release.

It is important to maintain a record of the incident and keep a back up of the monitoring data, in the event of any legal claim against the operator.