Honeywell

White Paper

Critical considerations for monitoring low levels of Hydrogen Sulphide



When it comes to gas detection in today's industrial safety environment, it's not just about what can hurt you right away – it's what can hurt you over a long period of time. That's why experts are becoming increasingly concerned about the long-term health effects of dangerous toxic gases like Hydrogen Sulphide (H_2S).

Legislated exposure levels for H_2S

European Union (EU)
According to the EU Directive 2009/161/EU, which has been in effect since January 2012, all European Union (EU) Member States' national standards are superseded by the Directive's recommendation of a Time Weighted Average (TWA) (known as Long-Term Exposure Level or LTEL under EH40), of just 5ppm and a Short-Term Exposure Level (STEL) of 10ppm.

It is important to remember that no EU Member State can go above these values, but some EU Member States have even lower national limits. Some examples of these include:

Netherlands
The Maximal Allowed Concentration (MAC) is 10ppm (14 mg/m^3) but the Council's Dutch Expert Committee on Occupational Standards (DECOS) recommends a health-based occupational exposure limit (HBROEL) TWA over 8-hours of 2.3 mg/m^3 (~1.6 ppm).

Finland
A 15-minute value of 15ppm is recommended.

Russian territory
Russia's Federal Law No. 52-Φ3 from 30th March 1999 dictates that the Maximum Permissible Concentration (MPC), based on an 8-hour exposure period is 7ppm (10 mg/m^3) but many sites/businesses within the region stipulate even lower thresholds. In addition, the region makes a further condition that in instances of a mixture of H_2S and C1-C3 Hydrocarbon, the MPC is 2ppm.

The Middle East (UL)
The UL standard is used in this region and in 2010 the American Conference of Governmental Industrial Hygienists (ACGIH) conducted a study that led to the lowering of H_2S exposure levels. Their findings highlighted the considerable long-term damage that H_2S can cause, leading to a decrease in TWA levels from 10ppm down to just 1ppm and a reduction in STEL from 15ppm to 5ppm for a 15-minute period.

Understanding thresholds and alarm settings

Most portable gas detectors are equipped with several alarms to detect immediate or longer-term threats to gas exposure, measured in Parts Per Million (ppm).

Time-Weighted Average (TWA)/Long-Term Exposure Level (LTEL)
TWA/LTEL measures the average gas reading over an 8-hour period. As an example, if the European Union (EU) standard dictates that a worker can be exposed to 5ppm over an eight-hour period, and the worker is in an environment containing 5ppm, the TWA alarm will sound after 8-hours. If the same worker is in an environment containing 10ppm of H_2S, the TWA alarm will sound after 4-hours.

Short-Term Exposure Limit (STEL)
STEL measures the average gas reading over a 15-minute period. As an example, if the European Union (EU) standard dictates that a worker can be exposed to 10ppm over a 15-minute period, and the worker is in an environment containing 10ppm, the STEL alarm will sound after 15-minutes. If the same worker is in an environment containing 20ppm of H_2S, the TWA alarm will sound after a 7.5-minute period.

Instantaneous alarm threshold
This alarm is triggered as soon as a gas concentration above a specific setting is detected.

Maximising performance and accurate detection

Electrochemical cells provide an excellent technology for H_2S detection, but they can be susceptible to the effects of abrupt temperature and humidity fluctuations. An extreme change in these environmental conditions can cause sensors to drift (known as temperature/humidity shock), and this can lead to inaccurate gas readings, especially when low concentration readings are required.

Moving from a room temperature to a cold environment
Negative drift can potentially be experienced by some electrochemical sensors under these conditions. This could theoretically lead to a lower H_2S reading, causing an underestimation of actual exposure. H_2S' extreme toxicity makes this a potentially dangerous condition.

White Paper

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Moving from room temperature to a hot environment

Positive drift can be potentially experienced by some electrochemical sensors under these conditions. This can theoretically lead to an overestimation of actual exposure, resulting in "nuisance alarms".

In either case, these effects can have adverse effects on your business. Nuisance alarms can be very costly, halting production and leading to process downtime and potential revenue loss. An underestimation of levels can put workers at risk, compromising a best practice approach to safety.

Mitigating the effects of temperature/ humidity drift

It is possible to limit this potential for either positive or negative drift, by using a process called "blanking". This is the use of an algorithm that helps to negate sensor drift in electrochemical sensors.
BW Technologies by Honeywell employs this principle in GasAlertQuattro, and this, combined with rigorous climatic testing, ensures we are able to offer a high performance solution that virtually removes the occurrence of temperature/humidity drift.

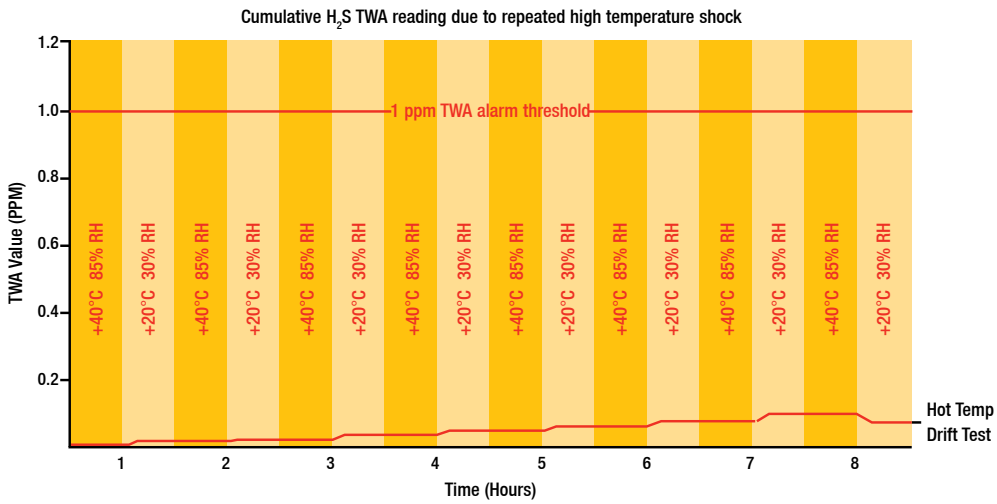
GasAlertQuattro from BW Technologies by Honeywell

GasAlertQuattro: Delivering high performance detection with maximised stability

It is fair to say that technology is only as good as the quality of its testing and this is why we undertake extensive testing of our devices to ensure we can deliver benchmark performance that is provable and dependable.

GasAlertQuattro is a multi-gas portable detector designed to offer simultaneous monitoring of up to four gas hazards, including H_2S. To verify that GasAlertQuattro can consistently perform in sudden, dramatic changes in temperature and humidity - while maintaining peak reliability - we conducted extensive testing under worst-case temperature fluctuations in replicated real-life work situations. For example, we considered a scenario of a worker visiting sites in a work van or truck; the interior of the vehicle is likely to be climate controlled, but the sites being visited could be considerably hotter or cooler by comparison.

To replicate this scenario, we conducted a series of tests inside a temperature chamber. One group of tests subjected the detector to room temperature for an hour, followed by an hour at -20°C (-4°F) and then back to room temperature for a third hour. Another series tested the opposite conditions: an hour at room temperature, followed by an hour at 40°C (104°F), followed by an hour back to room temperature. We also conducted further tests that subjected the detector to a series of alternating temperatures of very hot or very cold, cycling every half hour, over an 8-hour period.



After repeated cycles of high temperature shock, measurable drift in the GasAlertQuattro did not exceed 0.1ppm

White Paper

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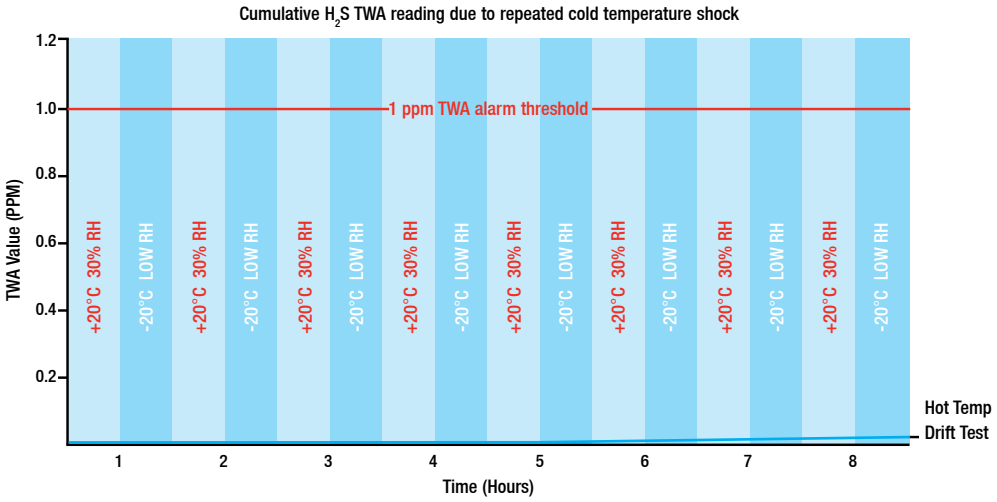
After repeated cycles of cold temperature shock, measurable drift in the GasAlertQuattro was negligible.



Our extensive testing proved that GasAlertQuattro can produce reliable readings of H_2S at low levels consistently; even when experiencing temperature fluctuations, without producing a nuisance STEL or TWA alarm. This has been achieved by our leading-edge sensor technology combined with our intelligent "blanking" algorithm, compensating for the natural drift that can be inherent in the design of electrochemical cells.

The full results of these tests are available upon request.

Tips for monitoring low-level H_2S

While portable gas detectors are designed to work automatically, we recommend taking the following steps to maintain accuracy and reliability:

- Calibrate the device every 180 days as a minimum - BW Technologies by Honeywell's approved distributors can provide cost-effective calibration services
- Always "bump test" before each device use to ensure all the sensors are performing properly. In fact, a bump test is the only way to be sure that your device will respond to the presence of gas
- When you enter an environment with an extreme temperature or humidity, perform a fresh-air "auto zero" adjustment, which will help mitigate sensor drift

GasAlertQuattro – value and performance at a glance

This 4-gas portable is a highly adaptable, easy-to-use solution that meets the monitoring needs of diverse applications and industries:

- Monitors H_2S, Carbon Monoxide (CO), Oxygen (O_2) and flammable gases (%LEL)
- Alarm set-points for all sensors are user adjustable and are displayed during instrument start-up
- Large, bright LCD screen with real-time gas readings and intuitive icons
- Compact, lightweight and ergonomic design; easy for the user to wear
- Works straight from the box and can be ordered with bespoke configuration to meet specific needs
- Full function self-test of sensor(s), battery status, circuit integrity and audible/visual alarms on start-up and continuous testing on sensor(s) for enhanced safety
- Bright wide-angled visual alarm bars and vibration alarm that demands attention; even in high noise locations

Thank you for reading this data sheet.

For pricing or for further information, please contact us at our UK Office, using the details below.

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