Concerned About Confined Spaces?? Worried about Gas Detection?

More injuries occur in confined spaces due to atmospheric conditions rather than any other issue. Multiple studies have shown this can be up to 90% of reported injuries. For this reason all confined spaces safe working procedures and standards necessarily focus on atmospheric monitoring.

Know The Beast

Atmospheres contain a mixture of gases some good (example Oxygen) and some not so good (example Carbon Monoxide). In our atmosphere normally the good outweigh the bad but in confined spaces this is not always the case.

The 3 Risks

When monitoring an atmosphere where we work, generally three potential hazards are considered:-

- Oxygen Depletion
- Toxic Gases
- Combustible Gases

Each behaves differently and presents different risks:-

- Asphyxiation
- Poisoning
- Explosion/Fire

In a simple world actions can be planned around each observed risk but when these risks occur in combination it is not so simple. In fact many gases have multiple faces and actions can be different based on circumstances.

To illustrate more clearly:

Carbon Dioxide (CO_2) is generally assumed to be part of the general atmosphere (0.03%v/v) and is a gas most people are familiar with. Most would consider Carbon Dioxide primarily an asphyxiate able to displace oxygen. Whilst Carbon Dioxide could displace an atmosphere and behave to exclude oxygen it is also a toxin. Without this knowledge some have used measurement of Oxygen depletion as a measure of safety in respect of Carbon Dioxide. This is dangerous and can lead to fatalities (AS/NZS 60079.2 has more detail).

Essentially the issue here is that an atmosphere is generally consider deficient at levels below 20.8% O_2 and gas detectors are set to alarm at 19 or 19.5% O_2 Level to warn users. Because Oxygen only makes up 20.8% of the atmosphere a 1.3% depletion of Oxygen to reach the alarm set point of 19.5% requires approximately 7% displacement of the atmosphere (ie. 20.8%-19.5%/19.5%. If Carbon Dioxide is responsible for such a displacement, a 7% concentration is potentially fatal and 0.5% toxic yet an O_2 deficiency alarm would not yet have been reached and activated.

Another CO_2 associated risk is Oxygen sensor poisoning seen when standard oxygen sensor technology is used in multiple higher level CO_2 exposures. MSA proprietary Xcell™ sensors do not suffer from this due to the new generation electrolyte system that also has the benefit of being non-consumed and lead free.

Another example

Ethanol (common drinking alcohol) is known to be combustible (we have all seen the cocktail flames at the bar). Most people look at Ethanol as a combustible hazard however Ethanol has a strong toxic profile as a gas.

As a combustible Ethanol requires 3.3% vol (33,000ppm) in air to support an ignition. In contrast Ethanol has a toxic exposure limit of 1000ppm or less than 3% of the defined LEL (Lower Explosive Limit). Bear in mind this is the maximum allowable limit so Ethanol is clearly more toxic than explosive. If a typical combustible gas detector is used (and correctly calibrated for Ethanol) with alarm point at 10% LEL, then the worker is being exposed to a toxic environment long before the first alarm point. This is the wrong tool.

For Ethanol a different solutions is needed and in this case MSA Photoaccoustic™ technology with high accuracy, low limits of detection can reliably monitor at toxicity levels. This same scenario occurs for any hydrocarbons such as fuels accumulating in sewers from leakage.

Knowing the beast is as much about knowing not only what is there and also how work practices are occurring. Gases can be (and are) nearly all multifaceted and exhibit different risk depending on worker PPE and practices.

Test the Monster

Clearly before entry or work, an assessment must be conducted to look at the levels o f gas determine risk. Assuming the potential risk sources (gases) are well established then the next step is accurate assessment.

Warning:- Many accidents occur from sources of gases not considered a risk. Always assess all possibilities and if it is possible to do least a preliminary test.

What is important here? Firstly gas detectors are just that and only detect gas or vapour that is present **where the sampling is occurring!** Seems obvious but is often overlooked. Sampling multiple spots can help but again careful selection must occur particularly with vapours. Vapours are typically often considered in the same way as gases however their progeny-sis hides a risk. A vapour is a gas which typically exists as a liquid or solid at room temperature for example petrol. These typically have a low vapour pressure ie they like to stay as liquids and are heavy so often the gaseous phase in the atmosphere considerably underestimates the presence of the liquid or solid.

Remember a gas detector only indicates the state of the atmosphere where tested not anywhere else.

If a combustible liquid is present in a confined space it will be likely near the lowest level and very poorly represented in the upper regions of the tested atmosphere. In fact the vapour pressure can be so low that testing any more than a few mm from the surface may not detect the presence of a combustible vapour. Think how hard it is to light Kerosene with a naked flame ie. How close you need to get and consider a standard combustible sensor mimics the same process internally.'

If the operation is to do hot work and the sparks could reach to floor then failure to properly assess the confined space can easily lead to an ignition with terrible consequence. Choice of technology here can assist but not completely alleviate. Photo Ionisation Detectors such as MSA Sirius will detect many vapours at a low concentration (eg ppm levels) to warn further investigation is needed. If fuels are involved be cautious with standard gas detectors.

Extensive testing s needed before entry.

Monitor the Monster

All standards covering confined space activity require on-going atmospheric monitoring. Many fail to do so. It is sobering to consider gas detectors provide **NO PROTECTION** to users unlike normal PPE.

They are warning devices only that require users to take some action. If not working, not present, incorrectly located or ignored the consequences can be fatal. On-going monitoring is essential as atmospheres can and do change.

Many factors can result in a change in the atmosphere in a confined space. For example the work undertaken could introduce new hazards such as acetylene for hot work which if leaking can quickly make the site explosive. New hazards can arise from the activity undertaken. For example, hot work can generate Carbon Monoxide (a toxic gas) or other toxic fumes. Removing sludge can release trapped gases.

In all cases when the atmosphere changes in a confided spaced **SPEED IS KING**. Many gas detectors can be slow to respond to atmospheric changes. This is because nearly all **standard confined space gas detectors** rely on electrochemistry and or technology at least 30 years old. Response time of upwards of 60 seconds is not uncommon with a few below and even these can take at least 30 secs.

In confined spaces this is critical as by definition a confided space is typically difficult to enter or escape. A back-up plan needs to account for the delay or difficulty of escape and must critically consider the time taken for the detector to respond. If the change is rapid and catastrophic, it is possible that workers could be at real risk before a detector responds. The faster the response of the detector the greater the chance of taking remedial action to prevent serious consequences.

Recent developments unique to MSA X-cell sensors have reduced the typical response time to less than 15 seconds. This breakthrough greatly improves the potential for positive outcomes when the atmosphere changes rapidly in a confided space.

Choose Carefully

A gas detector is often the only way to know of impending atmospheric risk in a confined space. Many gases of concern either don't smell (eg Carbon Monoxide, Methane) or rapidly destroy the body's ability to detect at dangerous levels (eg Hydrogen Sulphide). A gas detector like the Altair 4X™ is potentially a life saver provided user's respond appropriately.

Choose and use the detector well. As potentially the only source of warning in often inhospitable workplaces, the consequences of a gas detector failure can be a very serious issue. Reliability is crucial and that comes down to a few factors:-

- Effective availability, make sure it turns on and stays on!!
- Response time, make sure it's fast!! (or plan for a slow response)
- Accuracy, make sure it actually reads the gas of concern and does so accurately. Blowing on the unit to see an oxygen response tells you nothing about the combustible or toxic sensors which are often more critical. In fact it doesn't even show if the sensor is accurate and in a confined space inaccuracy can be fatal.

There are some general rules for looking at detectors.

Choosing a Gas Detector – The Seven Rules

In today's regulated safety environment the need for reliable, effective gas detection has never been so important. New players have seen the opportunity to generate cash by jumping on the confined spaces band wagon and making detectors leaving consumers with a bewildering array of choice. So how do you choose?

Robustness

Strangely this is not the first thing that comes to most people's minds when looking at gas detectors yet is critical to reliability. If a detector is not working then everything else is irrelevant.

When choosing a **detector** you should think of it as a **tool of trade**. If the product performs like your everyday tools you will face less downtime, lost productivity and cost. The detector must be shockproof, waterproof and robust even out of any carry case. Ask you supplier to allow you to drop the unit on concrete a few times or knock it firmly on a hard surface when trialling. Drop it in water if water is an issue. Make sure this done with the unit turned on and tested with gas before and after.

Warranty

Always check the warranty offered and what is covered. Always check what the warranty covers and what excludes warranty eg. Drop or immersion. It is not so much what the warranty statement is but what it does not cover. For instance, accidentally dropping an instrument may invalidate warranty. It can also reduce the waterproofness of the instrument. Extended warranties based on old technology sensors which typically have lives of 3 years or less will often require "regular" service and quite significant cost. Time for warranted service requirements may also reduce instrument availability.

The new technology MSA X-cell sensors in the Altair X™ series have significantly increased like over existing technology. This is revolutionary in gas detection giving customers lower cost of ownership, greater reliability and potentially no reason to have units out of service. For the first time in the history of standard industry confined space gas detectors, the sensors will potentially outlive the instrument.

Accuracy

A gas detector should provide a warning to potentially save your life. It must be accurate every time. Watch for false alarms. We all know about "crying wolf" and the same applies to detectors. It's really worth knowing how accurate and repeatable the detector is. Test the detector regularly with known gas and calibrate if needed. This is indicated in all international standards but also is the only way to verify ALL sensor read gas. Zero reading does not tell you the sensor is detecting gas. There is a cost for gas but it is a lot less than a life and probably less per week than most people spend at the pub. Remember when the chips are down if the detector does not respond then the outcome could bed dire.

MSA Altair™ series detectors have a check mark to confirm they have been tested and met MSA standards of functionality. Simply to activate when gas is applied and passes a confidence tick is issued to the screen. It's your tick from MSA that the detector response is assured.

Speed

Speed does matter! Many detectors respond quite slowly in higher ranges and can take up to a minute or more to respond. You can walk a long way in a minute. Recently safety notices were issued by several authorities warning of the risk of slow response. The slow response people experienced resulted in near injury as falling oxygen levels went undetected. Just because products meet a standard doesn't mean there are not differences. Make sure you detector meets your standard. It's your life. The slower the response the less time you have to take action or the further you need to go to reach safety. MSA Altair 4X™ takes less than 15 seconds to reach 90% of reading. That is up to 4 times faster than average and 8 times faster than the slowest alternatives. Always check the written specifications.

Alarms

All gas detectors have basic alarms, normally at least visual and audible. You should at least also have a vibration alarm. You will likely be using these in noisy environments with other tools. A vibration alarm will greatly improve the chances you won't miss an alarm.

New Concepts

Think beyond the boundaries!

Confined spaces can be dangerous places and accidents can occur where a person can be overwhelmed. Apart from the obvious gas issues (where a good reliable gas detector should be in alarm) workers could suffer a physical injury rendering them unconscious. Fire departments are well aware of this risk and carry special extra alarms which activate based on lack of movement.

MSA further developed their well established technology in this area and have included special alarms in Altair 4X™. The "MOTIONALERT™" alarm initiates when the Altair 4X™ detector remains still for 30+ seconds. Typically called a Mandown alarm, these are standard issue for Fire Fighters as s separate device or incorporated in SCBA. MOTIONALERT™ aims to detect and activate when the wearer is not moving and potentially unconscious. This may be the most critical alarm, activating when you are in real trouble. Since it relates to movement it covers many potential issues and is much more than just a gas alarm.

Raising the Alarm!

Many confined spaces require workers to wear respirators for protection. How do you raise an alarm at will if you cannot shout? Raising the innovation bar MSA has now incorporated a panic alarm which allows operators to set off a signal alarm independent of gas alarm status. This innovation will allow workers to communicate a serious issue without the need to remove vital respiratory protection.

Functionality

A gas detector is your tool to assist you to do your job safely. Like any good tool it should be simple and easy to use. That includes accessing all standard functions used daily. Having to push multiple buttons or sequences to access everyday functions is not helpful. Using a gas detector should not require a degree in operation when really it should be a safety adjunct to a safety distraction.

Ease of use must be backed with interactive visual detector simulators. If you need to train someone or change something you don't want to rely on the supplier or expensive training. Fully interactive training software with real video interaction has been available for MSA products for some time. These can be networked or provided as free CD's so users of MSA detectors are always able to practice or review when it suits them.

Innovation

Look for innovation in design. That assures you the company is think, not just copying. MSA recently introduced a "glow in the dark" case on Altair 4X™. This a world first and assists you keep track of the instrument in the dark of a confined space. Look for innovation as a sign of leadership.