



TECHNICAL INFORMATION SHEET 30

REVISION 1: 2014

WORKING IN REDUCED OXYGEN ATMOSPHERES

Background

The air that we breathe is primarily composed of two gases; nitrogen at 78 % and oxygen at 21 %. Oxygen is absolutely vital to life and breathing a lower concentration of oxygen may have dire consequences.

Oxygen also plays a vital part in combustion mechanisms. Oxygen is not in itself flammable, but increasing the oxygen content in an atmosphere will dramatically reduce the ignition resistance and increase the combustion rate of materials and substances. Conversely, reducing the oxygen content in an atmosphere markedly reduces the combustion rate of materials.

Cellulose, for example, in the form of paper, is extremely hard to ignite at a 15 % oxygen level. An atmosphere controlled to this level therefore becomes very useful, to reduce fire risks, in places such as document stores, library archives, museums etc. This is sometimes usefully exploited in so called 'hypoxic air' fire suppression systems, in which the oxygen content in the atmosphere may be taken down to circa 15 % or even lower. This is usually achieved by either the injection of extra nitrogen into the atmosphere to dilute oxygen or the use of a mechanical device (Pressure Swing Adsorber) to remove oxygen. In addition to fire suppression, hypoxic environments are becoming more common in other areas such as food preservation to deter oxidation and extend shelf-life.

However - at 15 % oxygen level, such an atmosphere can also be a significant threat to human life due to the risk of asphyxiation. Hence, further safeguards need to be put in place. How well a person can cope with these environments is dependant on the health and fitness levels of the individuals exposed, the strenuousness of the task being undertaken and the time spent in such atmospheres.

The BCGA is concerned at the increased use of these 'hypoxic air' fire suppression systems, the safety of people within these areas and by the publication of a BSI 'Publicly Available Standard' (PAS 95: 2011), the existence of which is sometimes taken to infer that such systems must therefore be safe.

Use in reduced oxygen atmospheres

BCGA strongly recommends that installers of such systems, and indeed premise owners with, or who are considering having such systems installed in their buildings, should comply with the following requirements:

- A space containing reduced oxygen atmosphere meets the criteria of a confined space within the meaning of the Confined Spaces Regulations 1997; These require that employers should carry out an adequate risk assessment and put in place appropriate control measures to protect those accessing or working in the area. Additional advice on confined spaces is available on the Health and Safety Executive (HSE) website.

- These spaces should be managed to ensure a safe system of work is in place that restricts access to only authorised visitors and workers. Risk assessments should specifically cover any arrangements for communicating with those who are, because of the nature of the task or the layout of the confined space, working alone.
- Employees should also be made aware of the risks and the safeguards e.g. what alarms sound like, what action to take in the event of an alarm sounding etc. If safety or protective equipment is provided staff should be trained in its proper and safe use.
- An initial detailed health assessment for individuals expected to enter such environments, either as workers or as part of any rescue team, should be carried out and followed by on-going regular monitoring; checks should be carried out by a qualified medical practitioner and include lung function and heart condition.
- Staff expected to work in such environments should be made aware of medical conditions that could make it more hazardous to work in such spaces e.g. existing breathing difficulties from causes like chest infections, chronic obstructive pulmonary disease (COPD) etc. or other issues such as pregnancy.
- Entry into the space should be controlled, and only authorised staff that have had the appropriate medical checks should enter.
- Adequate system maintenance, including quality control checks, should take place to ensure that oxygen levels are maintained accurately at the appropriate level and safety alarms/systems operate as per design. All systems should be fail safe and programmable devices should have an appropriate SIL (Safety Integrity Level) rating.
- Alarms and means of escape are provided and take account of the hazards involved. Alarms should be tested regularly and set to activate at a limit that will still allow safe evacuation.
- That insurers are fully cognisant of the above.

References:

- 1) HSE L101, *Safe work in confined spaces. Approved code of practice.*
- 2) HSE INDG 258, *Confined spaces a brief guide to working safely.*
- 3) BCGA Guidance Note 11, *The management of risk associated with reduced oxygen atmospheres resulting from the use of gases in the workplace.*
- 4) EIGA Safety Information Bulletin 29/12/E, *Oxygen deficiency hazard associated with hypoxic fire suppression systems using nitrogen injection.*
- 5) BSI, PAS 95, *Hypoxic air. Fire suppression systems. Specification.*

For more information:

Health and Safety Executive (HSE)

www.hse.gov.uk

HSE – Confined Spaces

www.hse.gov.uk/confinedspace/

British Standards Institute (BSI)

www.bsigroup.co.uk

British Compressed Gases Association (BCGA)

www.bcgaco.uk

European Industrial Gases Association (EIGA)

www.eiga.eu

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