



TECHNICAL INFORMATION SHEET 30

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 fatal 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 local 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 (for example, a Pressure Swing Adsorber) to remove oxygen. In addition to fire suppression, hypoxic environments are becoming more common in other areas, such as in food preparation, for preservation to help 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 (from hypoxia), therefore the use of hypoxic atmospheres shall be risk assessed and safeguards may need to be put in place. How well a person can cope with these environments is dependent on the health and fitness levels of the individuals exposed, the strenuousness of the task being undertaken and the time spent in such atmospheres. For further information refer to BCGA GN 11, *The management of risk when using gases in enclosed workplaces*.

The BCGA is concerned at the increased use of 'hypoxic air' fire suppression systems and the safety of people within these areas. BSI Publicly Available Specification (PAS) 95 and the Health and Safety Executive (HSE) Research Report RR1137 provide guidance but this should not be taken to infer that such systems are therefore 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 a reduced oxygen atmosphere meets the criteria of a confined space within the meaning of the *Confined Spaces Regulations 1997*; These Regulations require that employers shall 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 HSE website.

- These spaces shall be managed, ensuring a safe system of work is in place that restricts access to only authorised persons. 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.
- Persons managing and / or accessing the space shall be made aware of the risks and the safeguards, for example, what alarms sound like, what action to take in the event of an alarm sounding, etc. If safety or personal protective equipment is provided then each person shall be trained in its proper and safe use.
- Entry into the space shall be controlled, and only authorised persons that have had the appropriate medical checks and instruction should enter.

An initial occupational health assessment for persons who may foreseeably enter such environments, in any capacity, including rescue teams, should be carried out. To be followed by on-going monitoring; checks should be carried out by a qualified medical practitioner to include any risk from existing medical conditions, lung function and heart condition.

There are medical conditions that make it more hazardous to work in hypoxic atmospheres. Care is required prior to authorising certain persons to enter hypoxic atmospheres. Particular care is required in respect of:

- those with chest infections, chronic obstructive pulmonary disease (COPD), bronchitis, etc.;
 - those with cardiovascular complications;
 - expectant mothers;
 - smokers and users of E-cigarettes;
 - vulnerable persons, such as the young, elderly or those who are disabled, particularly where they have reduced mobility.
- Appropriate atmospheric monitoring equipment shall be installed. Alarms should be tested regularly, being set to activate at a limit that will still allow safe evacuation. Refer to BCGA GN 11.
 - Adequate system maintenance, including quality control checks and periodic calibration of equipment, should take place to ensure that oxygen levels are maintained accurately at the appropriate level and that safety alarms / systems operate as per design. All systems should be fail safe and should have an appropriate safety integrity level (SIL) rating.
 - A specific risk assessment shall be carried out to determine appropriate emergency arrangements which shall be developed and maintained. This may include evacuation procedures, emergency oxygen supplies, emergency ventilation, etc.
 - That insurers are fully cognisant of the above.

References

- 1) SI 1997 No. 1713. The Confined Spaces Regulations 1997.
- 2) HSE L101, *Safe work in confined spaces. Approved code of practice.*
- 3) HSE RR1137, *A health risk assessment of working in hypoxic atmospheres.*
- 4) BCGA Guidance Note 11, *The management of risk when using gases in enclosed workplaces.*
- 5) BSI, PAS 95, *Hypoxic air. Fire suppression systems. Specification.*

For more information

UK Legislation

www.legislation.gov.uk

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.bcga.co.uk

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