GUIDANCE NOTE 9

THE APPLICATION OF THE CONFINED SPACES REGULATIONS TO THE DRINKS DISPENSE INDUSTRY

REVISION 2: 2015

British Compressed Gases Association

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PREFACE

The British Compressed Gases Association (BCGA) was established in l971, formed out of the British Acetylene Association, which existed since l901. BCGA members include gas producers, suppliers of gas handling equipment and users operating in the compressed gas field.

The main objectives of the Association are to further technology, to enhance safe practice, and to prioritise environmental protection in the supply and use of industrial, food and medical gases, and we produce a host of publications to this end. BCGA also provides advice and makes representations on behalf of its Members to regulatory bodies, including the UK Government.

Policy is determined by a Council elected from Member Companies, with detailed technical studies being undertaken by a Technical Committee and its specialist Sub-Committees appointed for this purpose.

BCGA makes strenuous efforts to ensure the accuracy and current relevance of its publications, which are intended for use by technically competent persons. However this does not remove the need for technical and managerial judgement in practical situations. Nor do they confer any immunity or exemption from relevant legal requirements, including by-laws.

For the assistance of users, references are given, either in the text or Appendices, to publications such as British, European and International Standards and Codes of Practice, and current legislation that may be applicable but no representation or warranty can be given that these references are complete or current.

BCGA publications are reviewed, and revised if necessary, at five-yearly intervals, or sooner where the need is recognised. Readers are advised to check the Association's website to ensure that the copy in their possession is the current version.

This document has been prepared by BCGA Technical Sub-Committee 6. This document replaces BCGA Guidance Note 9, Revision 1: 2009. It was approved for publication at BCGA Technical Committee 152. This document was first published on 27/08/2015. For comments on this document contact the Association via the website www.bcga.co.uk.

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* Throughout this publication the numbers in brackets refer to references in Section 9. Documents referenced are the edition current at the time of publication, unless otherwise stated.

TERMINOLOGY AND DEFINITIONS

Cellar	A liquid food store, where temperature may be controlled or maintained lower than external atmospheric temperature.
Confined space	Any place, including room, chamber, tank, vat, silo, pit, trench, pipe, sewer, flue, well, or other similar space in which, by virtue of its enclosed nature, there arises a reasonably foreseeable specified risk. It has two defining features: 1. It is a place which is substantially, (though not always entirely) enclosed. 2. There will be a reasonably foreseeable risk of serious injury from hazardous substances or conditions within the space or nearby.
May	Indicates an option available to the user of this Guidance Note.
Shall	Indicates a mandatory requirement for compliance with this Guidance Note and may also indicate a mandatory requirement within UK law.
Should	Indicates a preferred requirement but is not mandatory for compliance with this Guidance Note.

GUIDANCE NOTE 9

THE APPLICATION OF THE CONFINED SPACES REGULATIONS TO THE DRINKS DISPENSE INDUSTRY

1. INTRODUCTION

Gases are used in beverage dispense to operate cellar equipment, to retain the carbon dioxide (CO_2) content in an alcoholic beverage, or to push product out of a container, i.e. a keg. CO_2 is also used to carbonate water for soft drinks dispense. The gases used are generally nitrogen (N_2), CO_2 and various mixtures of N_2 and CO_2. The gases will be used on separate systems, not connected to each other (however, refer to Section 3.4). Compressed air would not normally be used for dispense (as the oxygen content will affect beer quality), but may be present for driving beer pumps etc. whilst other specialist gases may be kept for other specific purposes. Typically gases are stored within or near the cellar.

With the exception of air, the gases used in drinks dispense, if released in a sudden or uncontrolled manner, may produce local oxygen (O_2) deficient atmospheres, which may ultimately result in asphyxia. In addition CO_2 can become toxic in higher concentrations. An enclosed space which poses a risk to health from exposure to a reduced O_2 atmosphere, or which may result in the accumulation of dangerously high levels of CO_2, meets the criteria of a confined space within the meaning of the Confined Spaces Regulations (1). These require that employers carry out an adequate risk assessment and, where necessary, ensure appropriate control measures to protect those accessing or working in the area.

Not all cellars are considered to be a confined space; this will be determined by the risk assessment. Where the risk assessment identifies that a cellar is a confined space then this guidance shall be followed.

The gas companies cannot be considered as the competent body to maintain the assessment in the cellar; only the licensee, owner, tenant, manager or operator can assume the responsibility. However, individual gas suppliers can provide relevant advice on products that they supply which may assist the licensee in adequately assessing risk.

In cases where a bulk liquid storage vessel under the ownership of a gas supplier is located on site, contact should be made directly with the gas supplier for specific advice.

This document only refers to reasonably foreseeable, specified risks associated with common gas and gas dispense systems. The advice given does not apply to any other element of safety in the cellar, including other specified risks referred to in the Confined Spaces Regulations (1).

Further guidance on the safe use of drinks dispense gases is available in BCGA GN 30 (18), *The safe use of gases in the beverage dispense industry*.

This Guidance Note has been prepared by the British Compressed Gases Association (BCGA) in consultation with the British Beer & Pub Association (BBPA) and the Brewing, Food & Beverage Industry Suppliers Association (BFBi) in order to provide guidance to users of gases in the drinks dispense industry.

2. SCOPE

This document covers:

(i) The establishment of a common standard for the application of the Confined Spaces Regulations (1) to drinks dispense applications.

(ii) The preparation of a set of recommendations which could be applied by all involved in the business, and giving accurate and consistent advice on the use of dispense gases in confined spaces (i.e. the cellar or store room) in compliance with the Regulations.

(iii) To state clearly the position of the suppliers of dispense gases with regard to the role of the Competent Person, as defined in the Confined Spaces Regulations (1).

3. KEY PROPERTIES OF GASES USED FOR DRINKS DISPENSE

With the exception of air, all the gases used in the drinks dispense industry, if released in a sudden or uncontrolled manner, may produce local O_2 deficient atmospheres, which may ultimately result in asphyxia. The normal concentration of O_2 in air is approximately 21 %. Any variation from this should be cause for investigation to establish the reasons why. Additionally, in higher concentrations CO_2 can become toxic and there is the potential for CO_2 enrichment in a confined space, refer to Section 3.1. A cellar meets the criteria of being a confined space, if it is enclosed and the risk assessment indicates a risk to health from exposure to a reduced O_2 atmosphere, or from the accumulation of a dangerously high level of CO_2. The Confined Spaces Regulations (1) require that employers carry out an adequate risk assessment and, where necessary, ensure appropriate control measures to protect those accessing or working in the area. Refer to Section 4. The key properties of the common gases are:

3.1 Carbon dioxide

At normal temperature and pressure, CO_2 is classified as a non-toxic non-flammable gas but it does start to affect breathing at concentrations at about 1 % with affects becoming more serious with increasing concentration. CO_2 is a colourless odourless gas with a characteristic taste and pungency at higher concentrations. It does not support life or combustion. It is approximately 1.5 times as heavy as air, with a density, at 1.013 bar absolute, 15 °C, of 1.87 kg/m³. Gas suppliers usually transport and store CO_2 in bulk as a liquefied gas, at a temperature of approximately –17 °C and a pressure of 20.7 bar.

CO_2 cannot exist as a liquid at atmospheric pressure. When the liquid under pressure is released to the atmosphere, a dense white cloud is formed, containing cold gas, solid CO_2 particles and condensed moisture from the air. The solid CO_2, at –78.4 °C, may settle on adjacent surfaces before subliming to produce more cold gas. As the gas is heavier than air, it will generally spread along the ground and accumulate in low lying areas such as pits and trenches. CO_2 will dissolve in water to a limited extent to form a weak acid, but it is generally un-reactive. It is not good practice to allow CO_2 to be de-pressurised in an uncontrolled manner, refer to European Industrial Gases Association (EIGA) Document 164 (14), *Safe handling of liquid carbon dioxide containers that have lost pressure*.

CO_2 is normally present in atmospheric air at a level of approximately 0.040 % (400 ppm). As a normal aspect of human and animal metabolism, it plays an important role in the control of several vital functions, but is toxic in high concentrations.

In-line with the Control of Substances Hazardous to Health (COSHH) Regulations (3), the Health and Safety Executive (HSE) publish Guidance Note EH 40 (6), *Workplace Exposure Limits*, which states a workplace exposure limit for the concentration of CO_2 in air. Currently this is 0.5 % by volume (5000 ppm), calculated as an 8-hour time-weighted average. A short term workplace exposure limit of 1.5 % by volume (15000 ppm), calculated as a 15 minute time weighted average concentration, is also given.

The HSE paper on the *Assessment of the major hazard potential of carbon dioxide (CO_2)* (10) identifies that although, at low levels CO_2 is mildly toxic to humans, above concentrations of about 7 % in air (i.e. > 70 000 ppm), humans are particularly sensitive to further increases. To ensure the safety of those who enter a potentially enriched CO_2 environment the limits imposed by HSE EH 40 (6) are used to calculate an acceptable level of risk. A concentration greater than 1.5 % is deemed to be high risk, refer to Table 4.

The effects of inhaling varying concentrations of CO_2 are given in Table 1, but it should be appreciated that the reactions and the timescales to cause the effects of CO_2 in a specific individual depend on the concentration and duration of exposure as well as individual factors, such as age, health, physiological make-up, physical activity, occupation, and lifestyle.

The effects of CO_2 are independent of the effects of O_2 deficiency. The O_2 content in the atmosphere is therefore not an effective indication of the hazard from CO_2. For example a potentially fatal CO_2 concentration of 14 % can exist with a normal O_2 content.

Where gas detection systems are being considered it is important to note that an independent gas sensor is necessary to monitor for CO_2 enrichment. O_2 depletion monitors **do not** provide protection for monitoring atmospheres where CO_2 may be present. Refer to Section 4.1.

Filter respirators give **NO PROTECTION** in atmospheres containing dangerous concentrations of CO_2.

Further information on the physiological effects of CO_2 is given in EIGA Safety Information Sheet 24 (15), *Carbon Dioxide Physiological Hazards*, and EIGA Document 164 (14).

CO_2 Concentration Volume %	Effects and Symptoms
1	Slight and unnoticeable increase in breathing rate.
2	Breathing becomes deeper, rate increases to 50 % above normal. Prolonged exposure (several hours) may cause headache and feeling of exhaustion.
3	Breathing becomes laboured, rate increases to twice the normal. Hearing ability reduced, headache experienced with increase in blood pressure and pulse rate.
4 - 5	Breathing laboured at four times the normal rate. Symptoms as above, with signs of intoxication after ½ hour exposure and slight choking feeling.
5 - 10	Characteristic pungent odour noticeable. Breathing very laboured, leading to physical exhaustion. Headache, visual disturbance, ringing in the ears, confusion probably leading to loss of consciousness within minutes.
10 - 100	Loss of consciousness more rapid, with risk of death from respiratory failure. Hazard to life increased with concentration, even if no oxygen depletion.

Table 1: The effects of inhaling CO_2

3.2 Nitrogen

N_2 is classified as a non-toxic, non-flammable gas which is chemically non-reactive. It is odourless and does not support life. It is slightly lighter than air, depending upon temperature.

A leak of N_2 into a confined space will increase the levels of N_2 and can cause an O_2 deficient atmosphere. If so, this may ultimately cause asphyxia. Asphyxia due to O_2 deficiency is often rapid with no prior warning to the victim. The effects of inhaling reduced concentrations of O_2 are given in Table 2.

O_2 depletion monitors should be considered where a significant risk of depleted O_2 levels is present. Refer to Section 4.1.

O_2 Concentration Volume %	Effects and Symptoms
19.5	Minimum required level of O_2 (as recommended by HSE).
< 18	Potentially dangerous. Reduced intellectual and physical performance.
< 10	Risk of unconsciousness followed by brain damage or death due to asphyxia is greatly increased.
< 6	Immediate loss of consciousness occurs.
0	Inhalation of only 2 breaths of an inert gas (which contains no oxygen, such as N_2) causes immediate loss of consciousness and death within 2 minutes.

Table 2: The effects of inhaling reduced concentrations of O_2

3.3 Air

Air is classified as a non-toxic, non-flammable gas, but it does support combustion. It is odourless and colourless. Air does support life.

3.4 Mixed gases

The gas suppliers provide cylinders with combinations of CO_2 and N_2 pre-mixed together. There are also specialist systems where the gases may be mixed together in a cellar, for example, where N_2 is sourced via an Air Separation Unit. These gases shall be treated as if they exhibit the properties of all the component gases, unless their hazard classification demonstrates otherwise. Refer to Section 3.1 and 3.2.

4. THE CONFINED SPACE REGULATIONS

An enclosed space containing a reduced O_2 atmosphere and/or an accumulation of high levels of CO_2, meets the criteria of a confined space within the meaning of the Confined Spaces Regulations (1); these regulations require that employers carry out an adequate risk assessment and, if this indicates a risk to health and safety, put in place appropriate control measures to protect those accessing or working in the relevant area, i.e. create a safe system of work and ensure appropriate emergency arrangements are in place. Where a cellar is designated as a confined space, then only authorised personnel, who have received adequate training and who apply appropriate safe systems of work shall be allowed access, refer to Section 7. Appropriate signage shall be displayed, for examples refer to Figure 1. For further information refer to HSE L101 (5), *Safe work in confined spaces. Approved code of practice*, and HSE INDG 258 (9), *Safe work in confined spaces.*

Drinks dispense gases may produce local oxygen-deficient atmospheres, and/or an atmosphere enriched with CO_2, refer to Section 3. The normal concentration of O_2 in air is approximately 21 %. Licensees, and their staff, would not be expected to work in an environment where the O_2

concentration is below the norm. Where it is necessary for people to work in a reduced O_2 environment additional safeguards should be considered. Personnel should not work in, or enter, spaces where the oxygen level is less than 19.5 %, noting that even this level may be dangerous for some individuals, e.g. those with medical conditions affecting their breathing or lung function. Atmospheres containing less than 18 % oxygen are potentially dangerous and entry into such areas shall be prohibited unless appropriate safety controls are adopted. Refer to Section 3.

BCGA provide additional guidance on working in reduced oxygen atmospheres and the effect on combustion mechanisms within BCGA TIS 30 (19), *Working in reduced oxygen atmospheres*.

In all areas where gases are stored, handled and used, or into which a gas may reasonably be expected to leak, then adequate control (for example, ventilation) is necessary. Gas assisted pumps, especially where they are operated by N_2, CO_2 or mixtures of these gases, shall be vented such that they discharge in a safe place in the open air, i.e. outside the building. In confined spaces appropriate ventilation systems, gas detection systems and signage warning of the dangers of asphyxiation are required, refer to Figure 1. BCGA Guidance Note 11 (16), *Reduced oxygen atmospheres. The management of risk associated with reduced oxygen atmospheres resulting from the use of gases in the workplace*, provides comprehensive advice on managing reduced oxygen atmospheres in the workplace. BBPA provide additional guidance on CO_2 in cellars in their technical guidance leaflet, *Carbon dioxide in cellars* (20).

Smoking shall not be allowed in confined spaces.

Appropriate signage shall be displayed. Examples are shown in Figure 1.

The BFBi publish a poster highlighting the hazards of a gas leak and the risk of an asphyxiating atmosphere. It is available via the BFBi website, refer to Section 9.

No smoking | No unauthorised access | Potential asphyxiating atmosphere | Gas cylinder store

Figure 1: Examples of signs

It is recommended that the cellar access door is secured in the open position, where it is safe to do so, whenever personnel are required to work in the cellar. This will assist with ventilation and ensure the exit is clear. However, consideration should be given to the efficiency of mechanical ventilation systems and natural air-flow routes. You may need to ensure safeguards are in place to warn others of the risks e.g. of tripping or falls.

Where there is a requirement for personnel to be lone workers then this activity shall be subject to a specific risk assessment with appropriate control measures put in place to establish a healthy and safe working environment for lone workers. Appropriate arrangements will be necessary to provide assistance and to manage the rescue of persons in the event of an emergency. Lone working may require additional instruction, training, supervision, personal protective equipment, gas detection (such as personal gas monitors) etc. HSE INDG 73 (7), *Working alone. Health and safety guidance on the risks of lone working*, provides additional guidance.

In the event of an incident, licensees should have local emergency procedures in place to recover personnel from a confined space. This would include notifying the emergency services, where practical increasing ventilation and preventing further access to the space. Attempts to rescue persons from confined spaces or from areas where reduced oxygen or enriched carbon dioxide atmospheres may be present should only be made by persons trained in the use of air supplied breathing apparatus and confined space entry procedures, refer to Section 7 and Section 8.

The gas supply companies can offer advice on key aspects of the Confined Spaces Regulations (1) in respect of dispense gases. However the responsibility for compliance with the Confined Spaces Regulations (1) belongs to the dispense gas user (for example, the owner or operator) who is required to develop a safe system of work for all personnel who have access to the confined space, including non-employees such as suppliers. The gas supply companies will provide safety information, such as Safety Data Sheets, for their products, to enable the gas user to identify potential hazards and therefore to appropriately manage his premises.

4.1 Gas detection

Before detector / monitoring equipment is considered the site shall be assessed to establish the level of risk involved, refer to Section 5. If the risk assessment indicates that monitoring of gases may be appropriate, the type of gas being used and the locations from where the gas may originate and accumulate (taking into consideration the properties of the gas) will determine the appropriate location(s) for the detector / monitor. Where necessary, appropriate gas detection or monitoring equipment that incorporates warning alarms should be used to test the workplace atmosphere before entry and during occupancy. Fixed equipment is preferable to personal equipment. Gas detector / monitor displays and warning signs shall be sited so that they are clearly visible to personnel before entering the affected area. Each entry point shall have a gas detector / monitor and warning signs. Detection equipment shall be subject to a formal planned maintenance schedule that includes functional testing, calibration of detectors, alarm and interlock checks, and the routine replacement of components.

Where the risk assessment indicates a requirement for gas detection, it shall be determined if this is to detect O_2, CO_2, or both. As necessary, an independent gas detector is required to monitor CO_2 and an independent gas detector is required to monitor O_2. Where there is a potential risk for the accumulation of CO_2, then this shall be monitored using a CO_2 detector, not an O_2 detector.

If, in the absence of permanently fixed gas detectors, the person entering the cellar / confined space is totally reliant on a portable (personal) gas detector for protection, that person should have been trained in the use of that gas detector, and it should be used in accordance with the manufacturer's operating instructions. In particular, the instrument

should be powered up and allowed to settle prior to entry, typically for between 30 and 60 seconds. The user should also be made aware if the instrument has a significant response time when exposed to a sudden change in CO_2 concentration.

NOTE: Providers of gas detection / monitoring equipment can provide advice on suitable equipment and the appropriate location of the detector / monitor.

5. ASSESSMENT OF RISK

As part of managing the health and safety of your business and employees it is necessary to control the risks in your workplace. An appropriate risk assessment shall be carried out. All areas where gas is stored, piped and used shall be considered in the safety assessment. However, the most frequent source of leakage is from the dispense equipment, rather than the cylinders or storage vessels.

The British Soft Drinks Association (BSDA) provide advice to users in their leaflet, *Safe use of dispense equipment in retail and other non-licensed premises. Advice to users* (21).

The BBPA provide advice in their technical guidance document on *Carbon dioxide in cellars* (20).

The HSE provide guidance on risk assessment in HSE INDG 163 (8), *Risk assessment. A brief guide to controlling risks in the workplace*.

All assessments shall be recorded and the records maintained and updated as necessary. Enforcement authorities may request to see these records.

The assessment calculation shall be based on a full cylinder of gas being released into the confined space following an incident; more than one cylinder developing a leak at the same time is a highly unlikely event (however, refer to Section 5.1, NOTE 2). No allowance is made in the calculation for air changes, either natural or via a forced ventilation system. Modifications to the confined space that affect the free air volume shall be allowed for by re-assessing the situation.

Factors which affect the overall assessment include:

- Whether the confined space is below ground or airtight above ground.
- Any forced air circulation system.
- If the confined space opens directly to an area occupied by people.

5.1 Procedure for the calculation of risk

Identify all areas where gas is stored, piped or used. Conduct an assessment for each area.

NOTE: If piping is continuous, without any mechanical joints and with no risk of mechanical damage, it may generally be discounted in the assessment.

BCGA Guidance Note 11 (16) can be used to calculate the potential depletion of oxygen in a confined space.

The following calculation can be used to calculate the value of the concentration of CO_2 in air, which could result from the escape of the cylinder contents into a confined space. The chart given in Appendix 1 can be used to assist with this calculation.

Appendix 3 gives a quick flowchart guide to the process of risk reduction.

$$\textit{Concentration of } CO_2 \textit{ in air} = \left(\frac{V_{gas}}{V_{air}} \right) \times 100$$

Where:

V_{gas} = Largest volume of CO_2 contained in a single cylinder (m^3)

Establish the largest volume of CO_2 contained in a single cylinder. Identify all the gas cylinders within the confined space under assessment and, using the appropriate gas company data (refer to Appendix 2), determine which single cylinder has the largest volume of CO_2, (refer to Notes below).

V_{air} = Free air volume (m^3)

Calculate the free air space in the confined space under assessment. For a regularly-shaped space measure the height, width and length, then multiply together to determine the volume of the space (m^3). From this volume deduct the volumes of any objects within the confined space, such as kegs, barrels, coolers etc. for examples refer to Table 3. These objects reduce the volume of free air in the confined space. Allowance shall be made for maximum stocks during peak trading periods since these extra stocks further reduce the free air volume in the confined space.

NOTES:

1. The largest carbon dioxide volume could be in a mixed gas cylinder.

2. If more than one cylinder is connected and opened to the same ring main then the total of the cylinder volumes so connected shall be calculated and used in the assessment.

3. If more than one gas supply system is used within the same confined space the supply with the largest value of V_{gas} shall be used. This assumes that regular leak checks are conducted on the systems, at least after every cylinder change.

4. Appendix 2 give the volumes for cylinders from some of the major gas suppliers. If another supplier is involved, contact them for data for your cylinders.

Object	Volume
11 gallon keg	0.05 m^3
22 gallon keg	0.10 m^3
36 gallon barrel	0.16 m^3
10 litre bag in boxes	0.015 m^3 (64 boxes = 1 m^3)
Cellar cooler	0.2 m^3
Remote line cooler	0.175 m^3
Full crates (for beer bottles)	0.008 m^3 (120 crates = 1 m^3)
Full cardboard box wraps or cases	0.025 m^3 (40 = 1m^3)

Table 3: Estimated volume of typical objects located in a cellar

Using the calculated value categorise the risk as tolerable, medium or high according to Table 4.

Risk type	Description
Tolerable risk	Carbon dioxide concentration in the air less than 0.5%.
Medium risk	Carbon dioxide concentration in the air between 0.5% and 1.5%.
High risk	Carbon dioxide concentration in the air above 1.5%.

Table 4: Risk categories

The result obtained provides a useful general guide to the risk that is likely to be encountered, however there are other potential hazards that may need to be taken into consideration, these include:

- Gases from natural or external sources that may be present in the local atmosphere, for example, CO_2, radon (Rn), methane (CH_4), etc.

- How well the different gases mix together. For example, CO_2 is a dense gas that will accumulate at low levels, therefore there is generally likely to be a greater concentration of CO_2 closer to the floor.

- The efficiency of the ventilation system employed, or the natural air pathways. Mechanical ventilation systems can be more effective than natural ventilation.

- Displacement of air during pipe freezing, for example, where liquid nitrogen is in use.

- A gradual depletion of oxygen as workers breathe in confined spaces and where ventilation systems or the provision of replacement air is inadequate.

- Gases and liquids may leak or may have leaked into the confined space from adjacent plant, installations, processes or landfill sites, especially where the confined space is below ground level.

- Air quality can differ if the space contains remote or low-lying compartments. Take into consideration the possible effects of the dimensions and layout of the confined space.

- Equipment, such as gas driven pumps, which vent into the confined space.

NOTE: Such equipment, especially when operated by N_2, CO_2 or mixtures of these gases, should have been installed such that they discharge, via a vent system, to a safe place in the open air, i.e. outside the building.

- Specific tasks which may take place in the confined space and which may affect air circulation, fresh air renewal or oxygen consumption, including the use of cleaning agents and solvents.

Take appropriate action to mitigate the risk, refer to Section 6.

6. ACTIONS RESULTING FROM ASSESSMENT

WARNING: In the event of a gas leak do not enter the confined space until it is safe to do so.

6.1 Tolerable risk

- Record assessment. Plan risk reduction where practicable, with actions and dates. Update plan with actions completed.

- Train all personnel in safety procedures, and good housekeeping.

- Create a schedule for regular gas leak checks, with special emphasis on cylinder and keg changes. Always leak check after disturbing a gas connection.

NOTE: Carry out a leak test using an approved leak detection fluid. For information on leak detection fluids refer to EIGA Document 78 (12), *Leak detection fluids cylinder packages*.

- Review and monitor gas cylinder stocks. Maintain stocks consistent with business need, and ensure effective stock rotation. Do not overstock.

- Follow equipment maintenance schedules and keep records of work carried out.

- Ensure that all gas equipment conforms to appropriate industry documents, for example, BCGA GN 30 (18), BBPA, BFBi, BSDA, etc.

- Display appropriate warning signs at entrance to and inside confined spaces.

- Review any assessment at appropriate intervals, or when there is any change.

6.2 Medium risk

As per acceptable risk, plus:

- Consider ventilation, mechanical in the case of subterranean spaces (specialist advice required), or by the use of additional low level air bricks for ground level or elevated spaces.

- Consider the installation of a carbon dioxide and/or an oxygen gas monitor (dependent on which gases are held on the premises), with an appropriate maintenance contract.

- Develop emergency procedures for the confined space.

- Consider siting some or all of the cylinders externally to facilitate free venting and isolation of the supply in case of a leak.

- Consider reducing the size and/or number of cylinders being used.

6.3 High risk

As per medium risk, plus:

- Mandatory installation of mechanical ventilation (specialist advice required), or, if already installed, ensure operational effectiveness.

- Recommended installation of a carbon dioxide and/or an oxygen gas monitor (dependent on which gases are held on the premises), with an appropriate maintenance contract.

7. COMPETENCE AND TRAINING

All personnel who are required to access a confined space shall be competent to do so. Personnel shall receive suitable information and instruction regarding the hazards associated with cylinders and their gases, and / or any other gases piped into the confined space, as well as other hazards which may be encountered, from their employer.

It is the duty of the employer to ensure their persons are adequately trained and to establish competency. It is recommended that a training programme is carried out under a formalised system where an acceptable level of competency is achieved. Records shall be kept of the training provided and the competence level achieved. The training programme shall make provision for periodic re-training.

Recommendations for the training of personnel are described in EIGA Document 23 (11), *Safety training of employees*. BCGA GN 23 (17), *Identifying gas safety training requirements in the workplace*, provides information on the general topics which should be covered when considering gases safety training. Specific training requirements relating to the storage and use of drinks dispense gases are covered in BCGA GN 30 (18).

Specifically for confined spaces, persons likely to be involved in any emergency rescue shall be trained for that purpose, refer to HSE L101 (5).

8. PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment (PPE) shall be provided as required by the Personal Protective Equipment at Work Regulations (2). PPE may only be considered as a control to achieve an acceptable level of residual risk after other levels of control have been applied. A risk assessment shall determine the requirement for the use of hazard controls, including PPE. Where PPE is required a PPE Assessment shall be carried out. Due regard shall be given to the requirements of the COSHH Regulations (3), any relevant equipment publications, manufacturers information and the product Safety Data Sheet. The PPE shall be selected for a particular task and location shall be appropriate and be chosen to effectively reduce the overall risk. Thus there are different PPE requirements for differing products, different tasks and possibly different personnel.

HSE L25 (4), *Personal Protective Equipment at Work*, provides guidance on the Personal Protective Equipment at Work Regulations (2). EIGA Document 136 (13), *Selection of personal protective equipment*, provides guidance for selecting and using PPE at work.

Specifically for confined spaces there may be a need to provide breathing apparatus to enable safe entry into a confined space to conduct an emergency rescue. Refer to Section 4 (for licensees' local emergency procedures) and Section 7.

9. REFERENCES

	Document Number	Title
1.	SI 1997: No 1713	The Confined Spaces Regulations 1997
2.	SI 2002: No 1144	Personal Protective Equipment at Work Regulations 2002.
3.	SI 2002: No 2677	Control of Substances Hazardous to Health Regulations 2002 (COSHH).
4.	HSE L25	Personal Protective Equipment at Work.
5.	HSE L101	Safe work in confined spaces. Approved code of practice.
6.	HSE Guidance Note EH 40	Workplace exposure limits.

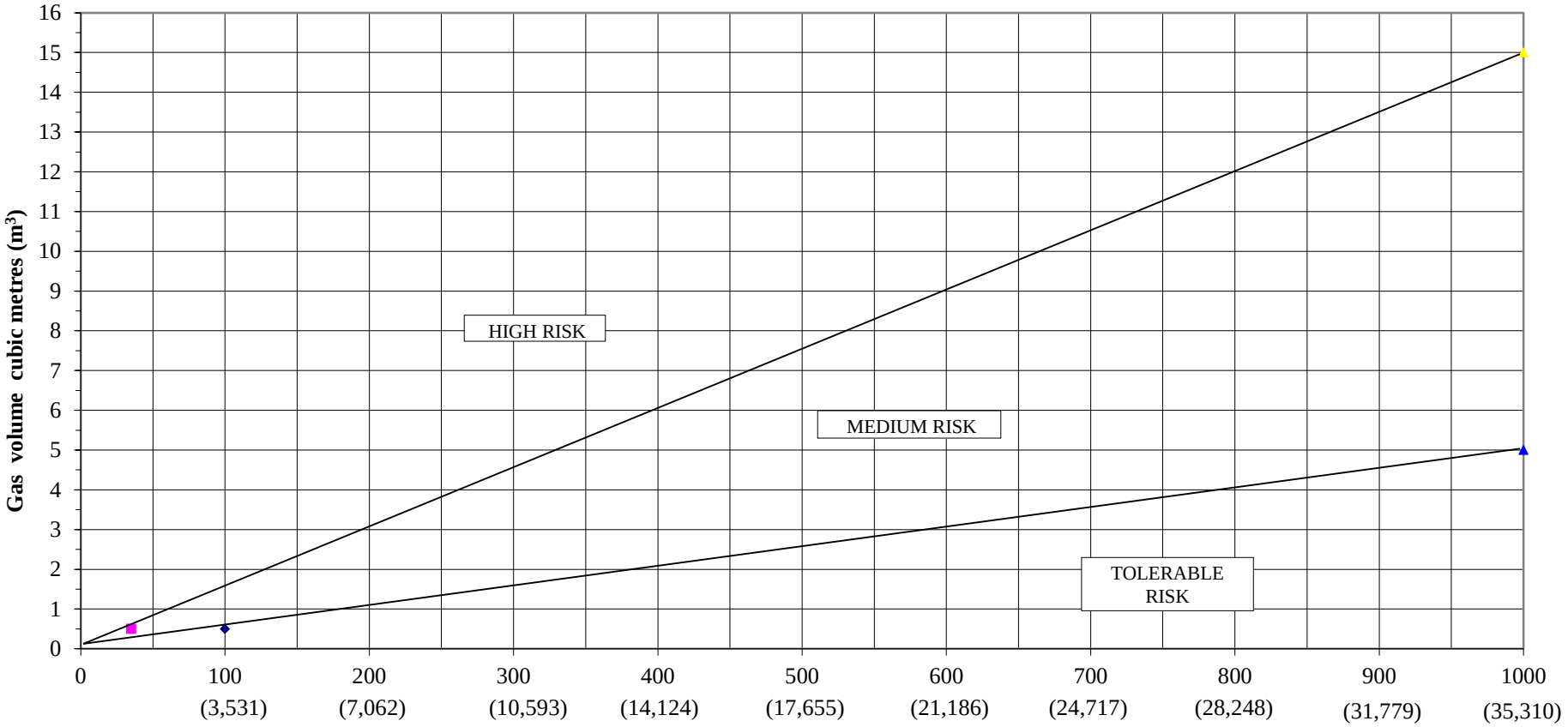
	Document Number	Title
7.	HSE INDG 73	Working alone. Health and safety guidance on the risks of lone working.
8.	HSE INDG 163	Risk assessment. A brief guide to controlling risks in the workplace.
9.	HSE INDG 258	Safe work in confined spaces.
10.	HSE	Assessment of the major hazard potential of carbon dioxide (CO_2). A paper by Dr. Peter Harper.
11.	EIGA IGC Document 23	Safety training of employees.
12.	EIGA IGC Document 78	Leak detection fluids cylinder packages.
13.	EIGA IGC Document 136	Selection of personal protective equipment.
14.	EIGA IGC Document 164	Safe handling of liquid carbon dioxide containers that have lost pressure.
15.	EIGA Safety Information Sheet 24	Carbon dioxide physiological hazards.
16.	BCGA Guidance Note 11	Reduced oxygen atmospheres. The management of risk associated with reduced oxygen atmospheres resulting from the use of gases in the workplace.
17.	BCGA Guidance Note 23	Identifying gas safety training requirements in the workplace.
18.	BCGA Guidance Note 30	The safe use of gases in the beverage dispense industry.
19.	BCGA Tecnical Information Sheet 30	Working in reduced oxygen atmospheres.
20.	BBPA Technial Guidance Leaflet	Carbon dioxide in cellars.
21.	BSDA Leaflet	Safe use of dispense equipment in retail and other non-licensed premises. Advice to users.

Further information can be obtained from:

UK Legislation	www.legislation.gov.uk
Health and Safety Executive (HSE)	www.hse.gov.uk

European Industrial Gases Association (EIGA)	www.eiga.eu
British Compressed Gases Association (BCGA)	www.bcga.co.uk
The British Beer & Pub Association (BBPA)	www.beerandpub.com
Brewing, Food and Beverage Industry Suppliers Association (BFBi)	www.bfbi.org.uk
The British Soft Drinks Association (BSDA)	www.britishsoftdrinks.com

CARBON DIOXIDE - ROOM VOLUME ASSESSMENT CHART



Room volume cubic meters (m^3) (Figures in brackets are in cubic feet)

GAS COMPANIES – GAS CONTAINER PROPRIETARY INFORMATION

Table A2-1: BOC SURESERVE - Gas cylinder reference chart

	Cylinder Type (Refer to label)	Max filled pressure (bar(g))	Cylinder size (cm)		Approx. cylinder weight (kg)	Carbon Dioxide (m^3)	Nitrogen (m^3)
			Diameter	Height			
Suregas	E	50	14	50	7	1.7	
Suregas	B	50	14	83	14	3.4	
Suregas	B	50	14	94	14	3.4	
Suregas	SB	50	16.6	62.8	14	3.4	
Suregas	SB	50	17.6	69	14	3.4	
Suregas	R	50	20.3	87	30	7.4	
Suregas	K	50	23	149.5	65	18.2	
	LC200 HP	23	50.8	158.8	132	107	
Suremix 30	V	220	14	94	16	0.74	1.74
	S	220	20.3	87	30	1.35	3.16
	N	220	23	149.5	65	3.52	8.22
Suremix 50	V	200	14	94	16	1.35	1.35
	S	200	20.3	87	30	2.55	2.55
	N	200	23	149.5	65	6.45	6.45
Suremix 60	V	180	14	94	16	1.68	1.12
	S	180	20.3	87	30	3.06	2.04
	N	180	23	149.5	65	7.86	5.25

NOTE: Nominal fill weights, pressures and volumes are stated at 15 °C and 1013 mbar.

Table A2-2: AIR LIQUIDE - Gas cylinder reference chart

Cylinder Size	Max. Filled Pressure (bar(g))	Carbon Dioxide (m^3)	Nitrogen (m^3)
3.15 kg	50	1.68	Nil
6.35 kg	50	3.39	Nil
12.7 kg	50	6.78	Nil
22.6 kg	50	12.07	Nil
30/70 mixed gas 10 litres	200	0.68	1.59
50/50 mixed gas 10 litres	200	1.39	1.39
60/40 mixed gas 10 litres	180	1.76	1.17
30/70 mixed gas 47/50 litres	200	3.40	7.95
Air Separator Nitrogen Receiver	10	Nil	1.0

NOTE: Nominal fill weights, pressures and volumes are stated at 15 °C and 1013 mbar.

Table A2-3: AIR PRODUCTS - Gas cylinder reference chart

Cylinder Type	Product Name	Max. Filled Pressure (bar(g))	Carbon Dioxide (m^3)	Nitrogen (m^3)
L or K	Topgas CO_2	50	18.14	Nil
MD 30	Topgas CO_2	50	11.5	Nil
PT 10	Topgas CO_2	50	3.8	Nil
L or K	Topgas 30	200	3.23	7.54
MD 30	Topgas 30	200	2.05	4.78
PT 10	Topgas 30	200	0.68	1.59
L or K	Topgas 50	160	5.39	5.39
MD 30	Topgas 50	160	3.43	3.43
PT 10	Topgas 50	160	1.14	1.14
L or K	Topgas 60	160	7.62	5.08
MD 30	Topgas 60	160	4.84	3.23
PT 10	Topgas 60	160	1.61	1.07

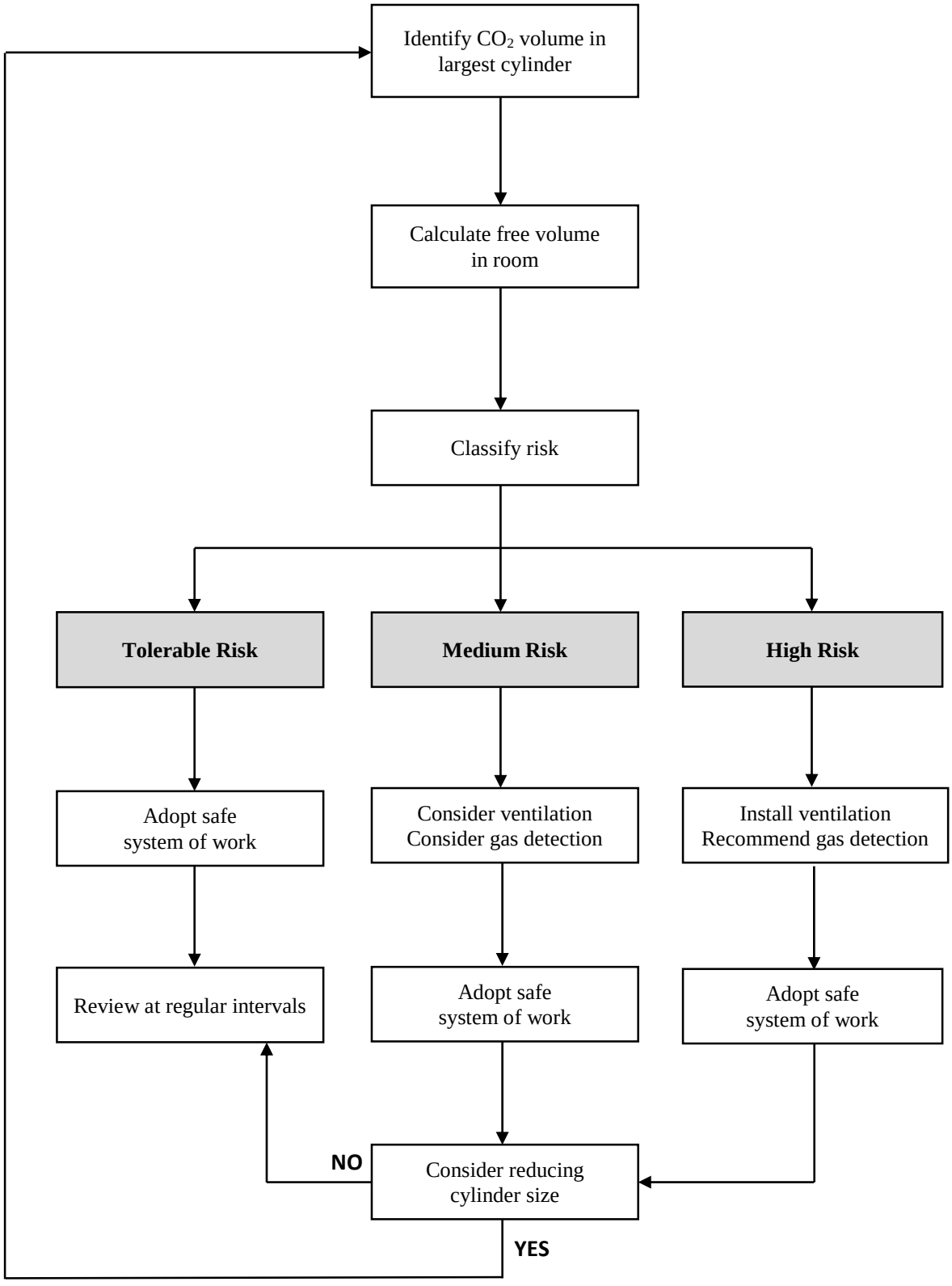
NOTE: Nominal fill weights, pressures and volumes are stated at 15 °C and 1013 mbar.

Table A2-4: AIR PRODUCTS CRYOEASE SERVICES - Gas cylinder reference chart

Cylinder Designation	Carbon Dioxide (m^3)	Nitrogen (m^3)
240 litre liquid nitrogen tank	-	157
Prism 30:70 receiver	0.12	0.27
Prism 50:50 receiver	0.19	0.19
10 litre 30:70 mixed gas	0.69	1.6
10 litre 50:50 mixed gas	1.35	1.35
10 litre 60:40 mixed gas	1.68	1.12
3.1 kg CO_2	1.67	-
6.35 kg CO_2	3.42	-
15.0 kg CO_2	8.07	-
50.6 kg CO_2	27.22	-
CarboStore 180 CO_2 tank	113.2	-
CarboStore 270 CO_2 tank	150	-

NOTE: Nominal fill weights, pressures and volumes are stated at 15 °C and 1013 mbar.

LICENSEE'S GUIDE TO CELLAR GAS RISK REDUCTION



British Compressed Gases Association

www.bcga.co.uk