CONFINED SPACE PROCEDURE

Classification - Public

Contents

Contents

1. Overview

1.1 Purpose

The purpose of this document is to detail the process for planning and managing confined space activities by Mace.

Local, regional legal requirements, industry guidance and codes of practice i.e. UK Confined Spaces Regulations 1997 Approved Code of Practice, may also apply.

1.2 Scope

The requirements of this procedure applies to all Construction projects where Mace have responsibility for managing confined space activities.

Where a specialist contractor or a Client has a lower standard than this document, or where a Client specifies a higher standard that cannot be achieved then the Mace Health, Safety and Wellbeing team should be contacted for further advice.

1.3 Roles, responsibilities and competency

Personnel working in confined spaces are to be suitably confined space trained and have the knowledge and experience appropriate to the work undertaken. They should be fit and healthy to work in the confined space.

Additional confined space rescue training is required for persons undertaking a role in a confined space rescue team and they shall be sufficiently resourced to respond to an emergency at an appropriate time at the point of entry.

Roles and responsibilities, and associated training/competency are detailed in Table 1 on the next page.

1. Overview cont.

Role	Responsibility	Training/Competency
Mace Project Lead/ Contract Lead	• Overall responsibility for planning the confined space works and implementing correct control measures in-line with this procedure. • Reviewing and accepting contractors Safe System of Work (SSoW) for working in confined space. • Hold sufficient knowledge of the asset or space to enter, and an appreciation of the risks and hazards that are present.	Confined Space Entry & Management Level by a recognised provider e.g. CITB, RoSPA or City and Guilds.
Confined Space Coordinator	• Planning the confined space works and implementing correct control measures in-line with this procedure. • Reviewing and accepting contractors SSoW for working in confined space. • Hold sufficient knowledge of the asset or space to enter, and an appreciation of the risks and hazards that are present.	Confined Space Entry & Management Level by a recognised provider e.g. CITB, RoSPA or City and Guilds. Confined Space Coordinator training requirement in Mace Training Matrix.
Contractor Supervisor	• Implementing correct control measures in-line with their SSoW. • Confirm that work is being conducted by competent persons. • Remain present whilst work is being carried out and monitor activities.	Confined Space Entry & Management Level by a recognised provider e.g. CITB, RoSPA or City and Guilds.
Top Person	• Manage all communications from the top to the bottom of the space as well as notifying emergency services and site management. • Confirm communication methods, i.e. radios/phones are working before commencing works • Regularly checking the gas monitors and recording the readings. • Restricting access for authorised persons only. • Keep an active tally/equivalent access control system to confirm who is working within confined spaces. • Monitor rescue team's air pack prior to entry. • Remain present whilst work is being carried out and monitor activities.	Recognised Confined Space Entry training and rescue techniques with escape sets e.g. CITB, RoSPA or City and Guilds.
Confined Space Operative	• Pre-use check of all associated personal confined space equipment prior to entry. • Continuously check personal gas monitor is operational. • Evacuate confined space if any alarm activates. • Check that medical vaccinations are up to date as advised by a medical professional.	Recognised Confined Space Entry with escape sets e.g. CITB, RoSPA or City and Guilds. **Note:** The level will be based on risk i.e. Low, Med or High.
Rescue Team	• Check all rescue equipment at the start of each shift. • Confirm breathing apparatus air cylinders are full at the start of each shift. • Regularly undertake familiarisation exercises for all safety related confined space equipment.	Recognised Confined Space Entry training and rescue techniques with escape sets e.g. CITB, RoSPA or City and Guilds.

Table 1: Confined space roles, responsibilities and competency

2. Confined space process

Confined space activities must be planned and managed as per the process in Fig 1 below.

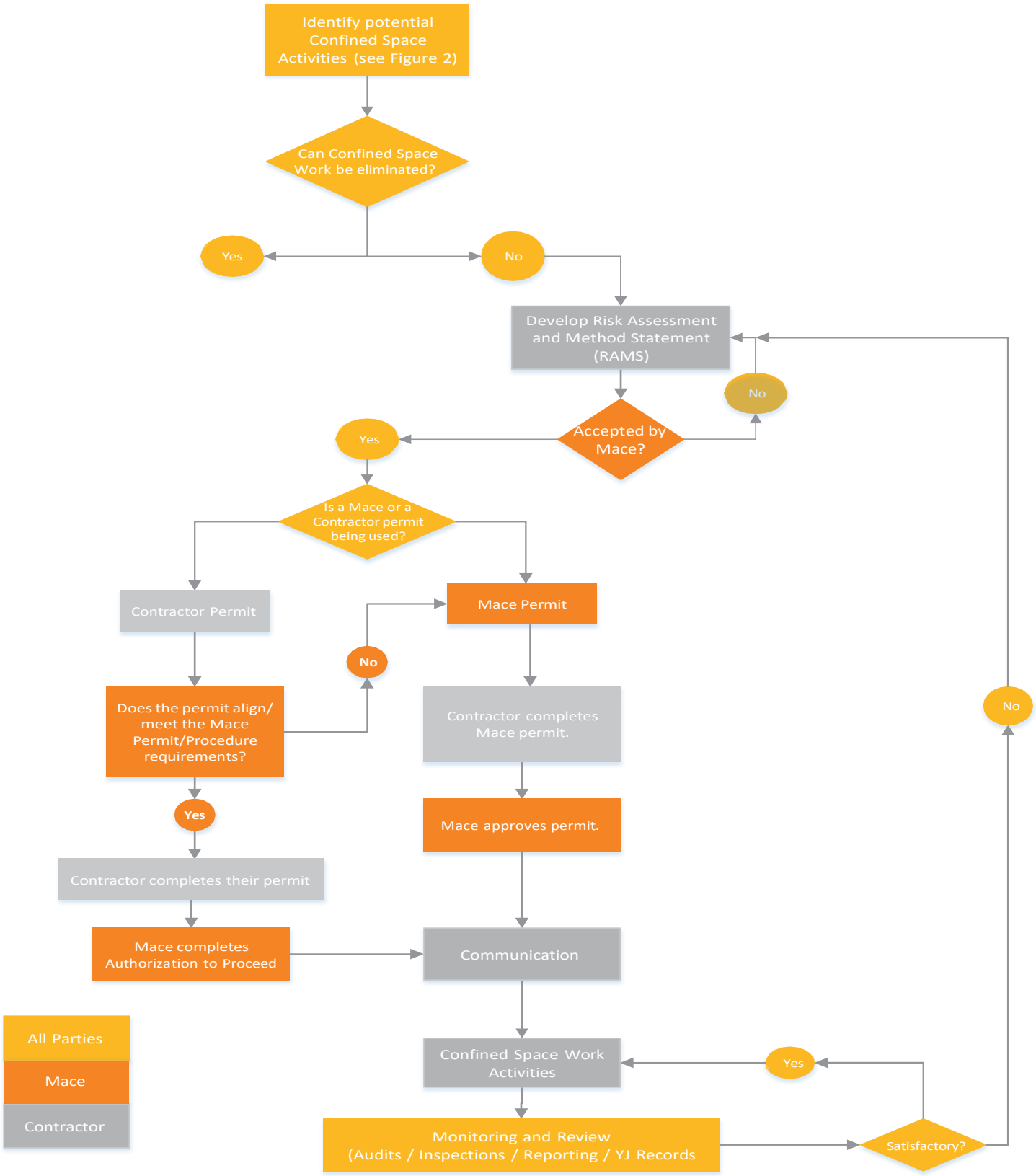

Figure 1: Confined space process

2. Confined space process cont.

Where possible the need to work in confined spaces should be prevented. Where this is not possible then work needs to be planned to minimise the need for a person to work in a confined space.

2.1 Confined space definition

A confined space must satisfy both of the following features[1]:

- It must be a space which is substantially (though not always entirely) enclosed.
- One or more of the specified risks (see below) must be present or reasonably foreseeable.

A Specified Risk, means a risk of:

a) serious injury to any person at work arising from a fire or explosion

b) without prejudice to paragraph (a)

- the loss of consciousness of any person at work arising from an increase in body temperature.

- the loss of consciousness or asphyxiation of any person at work arising from gas, fume, vapour or the lack of oxygen.

c) the drowning of any person at work arising from an increase in the level of liquid.

d) the asphyxiation of any person at work arising from a free flowing solid.

A confined space means any place, including any chamber, tank, vat, silo, pit, trench, pipe, sewer, flue, well or other similar space that presents a foreseeable specified risk by virtue of its enclosed nature. It does not mean that only equipment such as large industrial tanks or sewers are confined spaces. For example, the use of petrol driven equipment inside an enclosure can result in a build-up of carbon monoxide from generated exhaust fumes within the enclosure, resulting in oxygen depletion of the atmosphere. This work area would therefore be classified as a confined space.

2.2 Identifying confined space activities and confined space classification

Confined space activities need to be classified based on risk. Fig 2 is a guide for determining the confined space classification. Specific controls for each specification are provided in Table 2.

The Safe System of Work (risk assessment, method statement, permit, equipment, monitoring etc.) needs to include the common and additional controls, dependant on risk.

[1] Confined Space Regulations 1997 (UK)

2. Confined space process cont.

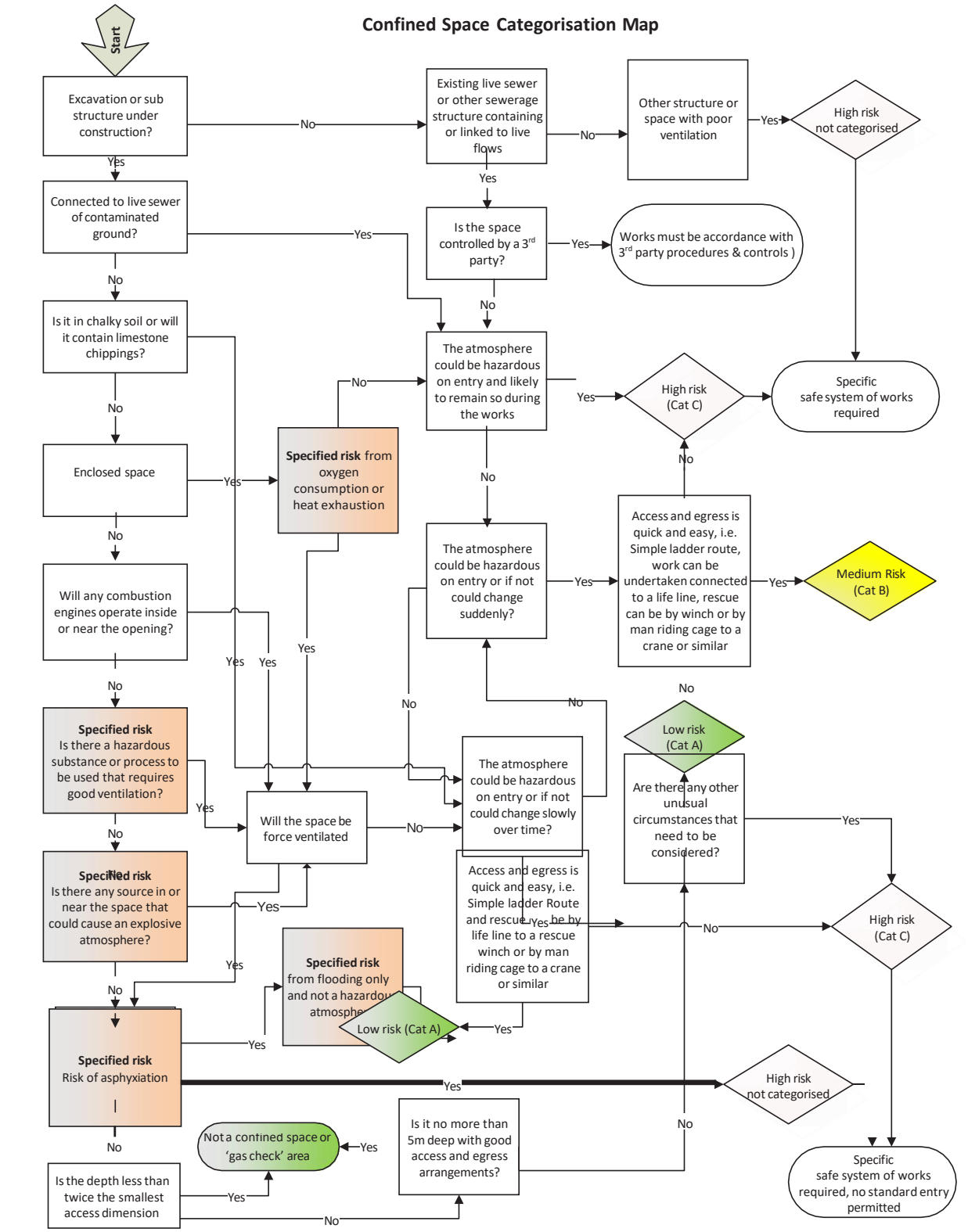

Figure 2: Confined space classification flowchart

2. Confined space process cont.

Once an assessment has been made, the category of the confined space shall be recorded and the appropriate controls implemented as specified in Table 2. See Appendix A for more guidance on Common Controls. For spaces where defined control measures are not practical, these should be reviewed and accepted by the Confined Space Topic Specialist. Deviation from defined control measures must be supported by a risk assessment and approved by the Managing Director/BUD and the HSW business unit lead.

		Common Controls							
Confined Space Classification	**Description**	**Atmospheric monitoring**	**Confined space permit**	**Emergency escape set**	**Mechanical Rescue (tripod, winch, davit)**	**Two means of access and escape**	**Trained rescue team and equipment**	**Tally System**	**Non Standard entry, specific RAMs approved by topic specialist**
Gas Check Area	A gas check area is an area not necessarily categorised as a confined space but used as a precaution against a very low risk of a hazardous atmosphere in a space no deeper than two metres. • A risk assessment should be completed for the activity and define the classification for the space. This classification only requires that a gas monitor is used to check the space on entry and be present in the space with the individuals during work, and that sufficient means of access and egress are in place. • There is no need for a Confined Space Entry Permit or escape breathing apparatus. • The safe system of work should include arrangements for rescuing a casualty in the event of a first aid incident.	X							
Confined Space Category (a) Low Risk	These spaces are where investigative planning, and testing has proven that the area is safe under normal operating conditions and where easy access and egress points are in place with good natural ventilation. • A safe system of work shall be developed and appropriate resource to retrieve occupants in the event of an incident. • A permit to enter may not necessarily be required to control entry however this should be risk assessed and specified in the safe system of work. • If anything changes that may lead to a hazardous atmosphere for example the introduction of a hazardous chemical then all personnel must leave the space and the area re-assessed with additional control measures implemented as per the new classification until normal conditions return.	X	X	X	X				
Category (b) Medium Risk	These are locations where the flow level and atmosphere normally remain safe but where precautions are necessary as conditions may change. • A safe system of work is required to state what the appropriate control measures are to ensure safe entry and the area remains safe during the work activities. • Each person shall carry a gas monitor. • Work method requires that a gas monitor is used to check the space prior to entry and is present in the space throughout the works. • Where personnel could be out of sight, a tally system should be adopted to monitor who is in the space at the point of entry.	X	X	X	X	X			

Table 2: Confined Space classifications and common controls

2. Confined space process cont.

Confined Space Classification	Description	Common Controls							
		Atmospheric monitoring	Confined space permit	Emergency escape set	Mechanical Rescue (tripod, winch, davit)	Two means of access and escape	Trained rescue team and equipment	Tally System	Non Standard entry, specific RAMs approved by topic specialist
Category (c) High Risk	These are locations where isolation of any potentially dangerous materials or equipment is essential to make the space safe to enter. There is still a risk of a hazardous or flammable atmosphere and the confined space permit must state that it is safe to enter with or without breathing apparatus and ventilation dependant on the controls specified as per a site specific risk assessment. • Atmosphere Gas testing must be carried out on every occasion before entry and continuously monitored. • The confined space permit must include relevant controls stipulated in the risk assessment and define the safeguards to be in place, which must be clearly understood by all relevant personnel for entry in each category (C) confined space on the project. • All locations must be examined to identify the specific precautions necessary. The safety procedures shall be written down for each location and a confined space permit produced each time the space is opened. • Each person shall carry a gas monitor. • All Category (C) Confined Space locations on the project are to be uniquely identified, a notice fixed at each entry and exit point and a register of locations. The register must be kept by the Mace Manager.	X	X	X	X	X	X	X	
High risk not categorised	Confined space situations where general control measures are not sufficient and therefore require additional planning and control measures specified and implemented appropriate to the risk. The Confined Space Topic Specialist or Health, Safety and Wellbeing Manager should be part of the planning process and review and accept the control measures and methodology.								X

Table 2: Confined Space classifications and common controls

2. Confined space process cont.

2.3 Safe system of work (SSoW)

2.3.1 Risk assessment

All confined space activities must have a risk assessment. The risk assessment must include:

- Classification of confined space (See Fig 2).
- All hazards and risks, including surrounding environment and works occurring in and around the confined space. This is especially important working in a confined space affected by adverse weather such as flooding.
- Any hazardous substances or materials, existing or introduced through the work activity.
- Emergency response and rescue.
- Resources required to plan, manage and undertake works.
- PPE requirements.
- Control measures required for the method statement.
- Confined space entry and exit procedure including permit to work and prevention of non-authorised personnel.
- Specific personnel and their suitability to enter. Note: All individuals working in a confined space must be certified fit to work by a medical practitioner.

2.3.2 Method statement

The method statement must detail all aspects of the confined space entry, rescue, relevant drawings, work undertaken and any associated assets/ infrastructure that affects the confined space e.g. a sewer network.

- The content shall be in accordance with the Mace risk processes.
- Review and acceptance of the RAMS must be by a competent Mace manager (see Table 1 above) with experience of confined space work and by a secondary sign off preferably a member of the Health, Safety and Wellbeing team.
- For confined space activities in areas classified as ‘high risk not categorised’ (See Table 2 above), then this is considered non-standard entry and should be reviewed by the Mace confined space topic specialist.

Consideration must also be given to the hazards in Table 3 for all confined space activities.

Additional guidance is provided in Appendices B - D.

2.3.3 RAMS communication

All personnel that enter the confined space must be fully briefed on the confined space activities underway. This will include (but not limited to) all or a combination of below

- Four Steps to Safety.
- Daily/Night Activity Briefings (DABs/NABs).
- Tool box talks.
- Pre start meetings.
- Start of shift meetings.

2. Confined space process cont.

Hazard	Considerations
Flammable substances and oxygen enrichment	• Fire or an explosion arising from the presence of flammable substances. • Fire and explosion from an excess of oxygen in the atmosphere, for example, caused by a leak from an oxygen cylinder forming part of welding equipment. • Explosion from the ignition of airborne flammable contaminants. • Fire or explosion caused by leaks from adjoining utility services, plant etc.
Toxic gas, fume or vapour	• Gas and fume can build up in sewers, manholes, contaminated ground. • Fume and vapour can be produced by work inside the confined space, for example, welding, flame cutting etc. Additionally the use of adhesives or solvents introduced into a space can create a hazardous environment.
Oxygen deficiency	Oxygen deficiency is where the atmosphere reduces below an acceptable level required to sustain normal breathable air leading to a shortage of oxygen within the blood, for example: • Purging of the confined space with an inert gas to remove flammable or toxic gas, fume, vapour or aerosols. • Naturally occurring biological processes consuming oxygen which can occur in sewers, and storm water drains etc. • Leaving a vessel completely closed for some time (particularly one constructed of steel) since the process of rust formation on the inside surface consumes oxygen. • The risk of increased levels of carbon dioxide from limestone chippings or excavating in chalk. • Burning operations and work such as welding and grinding which consume oxygen. • A gradual depletion of oxygen as workers breathe in confined spaces and where provision of replacement air is inadequate.
Ingress or presence of liquids/ solids	• Liquids can flow into the confined space and lead to drowning and other serious injury depending on the nature of the liquids such as their corrosiveness or toxicity. • Influx of solids may also result in drowning.
Presence of excessive heat	• This can lead to a dangerous rise in core body temperature, a heat build-up in the body can cause heat stress, and if action is not taken to cool the body there is also a risk of heat stroke and unconsciousness. • This can occur where work in hot conditions is being undertaken in a confined space or where, for example, boilers have not been allowed sufficient time to cool before people are allowed to enter to undertake maintenance work, or where equipment has been steam cleaned to remove hydrocarbons.

Table 3: Confined space hazards and considerations

2. Confined space process cont.

2.4 Confined space permit to work

- Requirements for a confined space permit to work will be detailed in the Risk Assessment and Method Statements (RAMS) and must consider the Confined Space Classification in this document. See figure 1 to determine whether a Contractor or Mace Permit will be used.
- If a contractor permit is to be used, Mace will issue an Authorisation to Proceed.
- The confined space permit must be available at all times at the access point; and entry log in place.
- The permit must be cancelled at the end of the shift and all copies returned to the permit issuer. A new permit is issued before the start of the next shift.
- Further details on permits and authorisation to proceed can be found in the Mace Permit and Authorisation to Proceed.

NOTE: The nature of permit-to-work will vary in their scope depending on the job, and the risks. A permit-to-work system is unlikely to be needed where, for example:

- The assessed risks are low and can be controlled easily;
- The system of work is very simple; and
- You know that other work activities being carried out cannot affect safe working in the confined space.

If an assessed risk is subsequently eliminated entirely, and there is no foreseeable chance of it recurring, you can consider giving unrestricted entry provided the above conditions apply.

2.5 Communication

Key risks, controls and status of works should be discussed at Mace and Contractor meetings, e.g. prestart meetings, weekly coordination meetings, monthly 8 week look ahead, NABs/DABs and supervisor/black hat meeting as appropriate.

2.6 Reporting

All incidents and near misses must be reported in line with the Mace Incident Reporting and Investigation Procedure.

3. Testing, Examination, Monitoring and Review

3.1 Testing and examination

Any equipment provided must be inspected prior to use and at regular intervals not exceeding seven days. Additional thorough examination must also be undertaken.

Equipment	Inspection	Test Frequency
Breathing apparatus	Pre-use, recorded weekly inspection.	6 months
Resuscitator	Pre-use, recorded weekly inspection.	6 months
Gas detector(s)	Pre use, some models require calibration in clean air before use in the space. Recorded weekly inspection.	3 months
Ventilation equipment	Pre-use, recorded weekly inspection and monitor while in use.	12 months
Harness	Pre-use, recorded weekly inspection.	6 months
Tripod, davit	Pre-use, recorded weekly inspection.	6 months
Rescue cage	Pre-use, recorded weekly inspection.	6 months

Table 4: Equipment testing and inspection

3.2 Monitoring and review

Works must be monitored and reviewed in line with the Table 5 below. All audits/inspections are to be logged onto YellowJacket.

Activity	Overview	Responsibility	Frequency
Exposure trigger times	Daily checks of trigger times of tools.	Contractors	Daily
Site Management Tours, OEI Tours, Leadership tours	Regular site tours and inspections checking the work environment and practices.	Mace, Contractors	Weekly/Monthly
Confined Space Audit	Compliance against requirements of the Mace Confined Space Procedure.	Mace	Depending on risk i.e. before commencing Confined Space activities, periodically throughout the works not to exceed 3 months.
Site Management Tour, OEI Tours, Leadership Tours	Regular site tours and inspections checking the work environment and practices.	Mace, Contractors	Weekly/Monthly

Table 5: Monitoring and review

Appendix A - Common Controls Guidance

Common controls noted in Table 2 are further detailed below. These need to be implemented as appropriate. Additional control measures, depending on risk can be found in Appendix B-D.

Atmospheric monitoring

Below are different atmospheric testing management systems. These should be selected based on the location and risk of the confined space activities.

A - Checking the atmosphere within a confined space

- The area within a confined space will need to be checked for hazardous gas, fume or vapour and to check the concentration of oxygen is suitable for normal breathing prior to entry using a certified and calibrated gas detector.
- The atmosphere check must be a defined process which details a staged check at various depths of the space. This is to take into consideration a varying density of potential gas that may be present at varying depths from top to bottom.
- Once this check has been completed the space must be continuously monitored until persons in the confined space have exited.
- For subsequent re-entries into the confined space, a full atmosphere check must be undertaken of the area prior to entry.
- It is recommended that a gas detector is placed directly at the bottom of the space on a rope so that the Top Person can take regular readings throughout the shift. Persons that traverse into the confined space, for example, in a tunnel or heading, shall carry a gas monitor with them at all times to continuously monitor the working area and alert personnel if conditions change.
- If a gas monitor ceases to work it must be replaced immediately. All persons must exit the space unless each person has a working gas monitor and the static monitor at the bottom of the point of entry is fully functional.
- Alert all others present in the space if anyone experiences dizziness, light-headedness or any respiratory difficulty. The space shall be evacuated immediately.
- If any gas monitor's alarm activates in the space, all personnel must leave the confined space immediately, alert a senior member of staff without delay and prevent entry into the confined space and report the incident to the Mace Health, Safety and Wellbeing Manager.

Fig 3(a) Drager personal gas monitor

Fig 3(b) Crowcon personal gas monitor

Fig 3(c) Trolex fixed gas monitor

Appendix A - Common Controls Guidance

B)Forced air ventilation

For confined spaces that require mechanical ventilation to provide sufficient fresh air to replace the oxygen that is being used up by people working in the space, and/ or to dilute and remove gas, fume or vapour produced by the work. This can be done by using an exhaust or ventilation fan system. Fresh air should be drawn from a point where it is not contaminated either by used
air or other pollutants. Never introduce additional oxygen into a confined space to 'sweeten' the air as this can lead to oxygen enrichment and could greatly increase the combustibility of other materials. Oxygen above the normal concentration in air may also have a toxic effect if inhaled. The type of ventilation equipment should be selected based on the number of air changes required per hour. The equipment supplier should provide advice on the correct equipment for the size and nature of the space.

Fig 4 (a) Forced air ventilation system

Fig 4 (b) Forced air ventilation system

Depending on the gas monitoring readings, forced air ventilation may be required on a short or long term basis. Monitoring of ventilation is required to confirm they are operating when
working in a confined space. Use and selection of ventilation fans must be risk based and included in the SSOW.

Gas purging

Good ventilation and a supply of breathable air are essential in a confined space; inhaling an atmosphere that contains no oxygen can cause loss of consciousness in a matter of seconds. When the atmosphere inhaled contains some oxygen the loss of oxygen from the bloodstream takes place more slowly. Nevertheless the individual will feel very fatigued and will find it difficult to help themselves. Prolonged exposure to such an atmosphere can result in loss of consciousness.

Where the risk assessment has identified the presence or possible presence of flammable or toxic gases or vapours, or that the natural air change in the area may be slow resulting in stagnated air there may be a need to purge the area. This can be done with air or an inert gas. You can only use inert gas for purging flammable gas or vapour because any purging with air could produce a flammable mixture within the confined space. Where purging has been carried out the atmosphere will need to be tested to check that purging has been effective, and that it is safe to breathe before allowing people to enter. Gas purging is a specific activity that should be risk assessed and precautions identified that ensures the effectiveness of the activity and to protect those outside the confined space from flammable and toxic gas hazards. This should be documented in the safe system of work.

Emergency escape set (self rescue)

Below are examples of different escape sets which can be used during confined space works. This should be selected based on the location and risk of the confined space activities.

A) Emergency escape breathing apparatus

Used as a standard part of Personnel Protective Equipment for confined space work where a risk of a non- safe atmosphere is foreseeable. This equipment is simple to put on and features automatic operation. A small air cylinder provides air to a positive-pressure full-face mask. Some can also be used in conjunction with external air suppliers such as in muster areas etc.

Fig 5 (a) Emergency escape breathing apparatus

B) Emergency escape re-breather

Commonly referred to as the "Turtle" due to the protective outer shell. This equipment convert's expelled air to breathable air through a chemical process within the self-contained unit. This is most suited to environments where the time from the workplace to the exit exceeds the capabilities of the Emergency Escape Breathing Apparatus. Some manufacturers offer a 30 and a 60 minute unit.

Fig 5 (b) MSA Sav0x self-rescuer

Appendix A - Common Controls Guidance

Mechanical rescue (tripod, winch, davit etc)

Below are examples of different mechanical means which may be required for rescue. This should be selected based on the location and risk of the confined space activities.

A) Tripod and winch

A tripod and winch is used to retrieve a casualty from a confined space. This should not be used to get equipment or materials in or out the space unless specifically designed to do so by the manufacturer.

Fig 6 Tripod and winch

B) Davit arm

A davit arm can be used as an alternative to a tripod where the space is greater than a tripod will span. There is a variety of systems to suit different requirements, such as:

- Free standing weighted.
- Fixed to a cast socket.
- Attachment for sheet piles.

Fig 5 (a) Davit arm for sheet piles

Fig 7 Davit arm free standing

C) Rescue harness

A rescue harness must be provided and worn at all times in the confined space where egress is by means of a tripod or davit arm. The point to attach any lifelines to harnesses must run back to outside the confined space and be suitably tested and certificated to support a person.

Fig 8 rescue harness

D) Rescue riding cage

Suitable for confined spaces with a large access area and crane can be used as a primary or secondary
means of access and egress. If used as a means of retrieving a casualty a dedicated riding cage should be readily available.

Fig 9 rescue cage

Appendix A - Common Controls Guidance

Access and egress (two means of escape)

Two means of access and egress should be provided wherever possible and as a minimum where identified based on Confined Space Classification (See Table 2 above) or as defined in risk assessment.

- Primary Access and Egress – for general access and egress.
- Secondary Access and Egress - independent and sufficient to retrieve a casualty, for example a ladder for access and tripod winch that can be attached to a casualty wearing a rescue harness or a stretcher.

Access must be of sufficient size to allow workers to enter and leave wearing all the necessary equipment including where applicable breathing apparatus. Any means of recovering a worker must also be taken into account.

Trained rescue team and equipment

Rescue equipment and teams should be selected based on the location and risk of the confined space activities and quantified in the safe system of work documentation.

A) Emergency arrangements

Planning for work in confined spaces requires detailed arrangements to effectively retrieve personnel in the event of an emergency. These need to be included in the SSOW and may reference out to the overall emergency response plan for the project. The following needs to be included:

- Means of raising the alarm.
- Communications.
- Accurate information regarding the confined space environment.
- Number of people that may require rescuing appropriate to rescue team members.
- Rescue and resuscitation equipment.
- Rescue team's capability.
- First aid equipment and resource.
- First aid provision.
- Access and liaison with emergency services, as appropriate.
- Emergency drills - conducted regularly to test effectiveness of emergency arrangements.

Note: The emergency services cannot be solely relied upon to rescue. The site emergency procedures must be robust enough to get personnel out under the site management control.

B) Rescue team

A rescue team must comprise of a minimum of three trained people, two people to enter the confined space to retrieve a casualty and one top person to control access and egress.

Additional rescue team members may be required. This will depend on the number of people expected to work in the confined space and means to maintain effective communication.

Tally system

A tally board system is used to record who is in the confined space. The method applied should be appropriate to the confined space activities considering location and number of individuals involved. Examples of tally systems are:

- A numbered tag assigned to an individual with a board with hooks to place the tag under headings in and out.
- A board with individual's names, or ID badges and spaces to write cylinder pressures and working time when using breathing apparatus, time the individuals entered the space and time out.

If the confined space has multiple access and egress points there should be a tally board at each access point and a top person at each in direct communication with the other top person's at each location.

Fig 10 (a) detailed tally board with space for emergency arrangements and contacts

Fig 10)b) tally board used to hold ID badges for individuals entering the confined space

Appendix B - Breathing Apparatus

For confined spaces where a safe breathable atmosphere cannot be achieved, or a safe atmosphere has the potential to change then breathing apparatus can be used. The equipment should be selected based on the work activity, duration of the works, size and nature of the area.

Continuous air provided by breathing air compressors

This type of equipment is used for long duration works, air is provided by a breathing air compressor that can provide air to multiple users. Air lines extended long enough to get to the
point of work are connected to the user and controlled via the Top Person.

Due to the specialist nature of work with this type of equipment, the safe system of work should be reviewed by a Mace Confined Space Topic Specialist or Health, Safety & Wellbeing Manager in addition to the Construction Team.

Self-contained breathing apparatus

This equipment is used primarily for rescue, a cylinder is worn by the user and air fed directly through 2 regulators to a positive pressure face piece. The sizes of the cylinders can vary and can also be connected to static cylinders and air lines for longer duration use.
The standard cylinder is 9 litre and can often be referred to as a “30 minute set” This is factually incorrect and should not assume that a user can last 30 minutes on a single cylinder, it could in fact be much less. The time will depend on a number of factors:

- How the air is consumed – when a user undertakes physical activity the air that is consumed will be significantly higher.
- In an emergency situation a user may breathe faster and take larger breaths of air.
- The cylinder contents – may not necessarily be completely full on entry, especially if multiple tripod in to the area have taken place.

It is important when allowing access to the confined space that users are trained to use the equipment, regularly drill wearing and using the equipment, especially undertaking physical activity to replicate removing a casualty and understand the usual air consumption in these conditions with each user.

When access is granted in to the confined space by the user, the Top Person must calculate the cylinder contents and estimated time the user has, this should be recorded at the position of entry, see Table 1.

Fig 11 (a) Self contained breathing apparatus (SCBA)

Appendix B - Breathing Apparatus

Close circuit breathing apparatus

Close circuit breathing apparatus is a positive pressure self-contained re-breather unit that takes expelled air and converts to breathable air. This type of equipment can provide the user up to four hours of breathable air and used primarily for rescuing in confined spaces where time from point of entry to the point of rescue and back to the point of entry exceeds the capability of conventional self-contained breathing apparatus. For spaces that require this equipment the safe system of work should be reviewed and accepted by the Confined Space Topic Specialist or Health, Safety & Wellbeing Team in addition to the project Construction Team.

* This table is only to be used as a guide, times will vary depending on the individual's fitness and ability to perform under pressure. Individuals that are physically fit and regularly undertake physical activity using breathing apparatus conserve more air.

The duration of the cylinder can be calculated with this formula:

Volume (in litres) * pressure (in bars)/40
- 10 in minutes (the 10 is subtracted to provide a safety margin), so a 9 litre cylinder, of 200bar, is 9 x 200 / 40 - 10 = 35 minutes working duration.

It is important for the safety of the rescuer that the top person confirms with the rescuer the cylinder contents and duration working with breathing apparatus.

Fig 11 (b) closed circuit breathing apparatus

Breathing apparatus working time										
Cylinder size litres	9	9	9	9	9	9	9	9	9	9
Cylinder pressure	200	190	180	170	160	150	140	130	120	110
Minutes (guide)	35	32	30	28	26	23	21	19	17	14

Fig 11 (C**)** Breathing apparatus working time guidance. **Note:** May vary depending on the user or equipment types or environment it is being used in.

Appendix C - Lock Out Tag Out

- Lock out/Tag out (LOTO) of machines, equipment and service connections that interface with confined space operations must occur before access into a confined space is authorised.

  This is to isolate them from a potentially hazardous environment e.g. steam, water, electrical, mechanical, hydraulic, or gas.

- All equipment shall be locked out where appropriate. Where such control is not possible, equipment may be tagged out-of-service. In all instances, equipment shall be made inoperable to protect against possible operation where such operation may cause personal injury or damage.

- Where LOTO is not possible, then equipment should be made inoperable and tagged out-of-service.

- Personnel must not attempt to operate any switch, valve, or source of energy which is locked out or tagged out.

Appendix D - Intrinsically safe lighting

Intrinsically safe lighting and tools are designed to prevent the release of an ignition source and is required when working in a high risk environment where a risk of a flammable atmosphere is foreseeable.

The type of lighting selected should consider where it is being used and if required for short term or permanent lighting systems.

Each light will be manufactured to operate in specific conditions, as such the lighting should be selected in accordance with the hazardous classifications zone (considering frequency and duration of the occurrence of the explosive atmosphere) in Table 6 below.

Figure 12 (a) Intrinsically safe torch

Figure 13 (b) Intrinsically safe head torch

Classification of Hazardous Places	Overview
Zone 0	A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapour or mist is present continuously or for long periods or frequently.
Zone 1	A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapour or mist is likely to occur in normal operation occasionally.
Zone 2	A place in which an explosive atmosphere consisting of a mixture with air of dangerous substances in the form of gas, vapour or mist is not likely to occur in normal operation but, if it does occur, will persist for a short period only.
Zone 20	A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is present continuously, or for long periods or frequently.
Zone 21	A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur in normal operation occasionally.
Zone 22	A place in which an explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation but, if it does occur, will persist for a short period only.

Table 6: Classification of hazardous places

Note: Intrinsically safe lighting will typically have a sealed power source. They will be unable to produce sparks and would not provide a source of ignition.

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