Appendix 1 Detailed Specific Guidance

The basis for safety is best secured by avoiding the need to enter a confined space, therefore wherever possible work practices/areas/plant etc. should be modified to enable the work to be carried out from outside the confined space.

A1.1 Organising - Communication

Confined Space Register

A Confined Space register shall be maintained for each of the sites, with individual departments maintaining their own register (See appendix for register template to be used). No other templates will be used to record confined spaces. In addition, all departments must develop and maintain a map of each confined space and review this annually.

A Confined Space Register shall contain as a minimum:

- Confined Space Reference (unique and identifiable) See A1.5 – Signage
- Location
- CS Type (NC1, NC2, NC3, NC4 & NCx) See CS Classification
- Is the space entirely or substantially enclosed
- Inherent foreseeable specified risks

A1.2 Organising - Competence

Where it is not reasonably practicable to avoid entering a confined space to undertake work, the employer and/or contractor is responsible for ensuring a safe system of work is used. In designing a safe system of work, they shall give priority to eliminating the source of danger before deciding what precautions are needed for entry.

All personnel involved in the authorization, supervision and entry itself shall be trained based on the level of entry risk (See Appendix 6 Training Requirements)

All entrants will undertake training which includes the following elements:

- Definition of a confined space.
- Specified risks and the definition of.
- Duties under the Regulations, preventing the need for entry.
- Risk Assessment and hazard identification.
- Atmospheric hazards and gases
- Principles and use of gas detectors and understand the alarm settings
- Safe systems of work and permits to work
- Roles, responsibilities and Entry Controller duties
- Pre use Checks, correct donning and adjustment of harness
- Inspection and application of tripods, winches and fall arrest equipment.

- Practical exercises including traversing a Confined Space

In addition, those likely to be involved in any emergency rescue should be trained for that purpose.

Rescue arrangements will be set out in the safe system of work and the risk assessments and defined prior to entry.

Training will include:

- Likely causes of an emergency
- Use of rescue equipment e.g. tripod/winch
- Procedures to be followed when donning and using apparatus
- Checking of correct functioning and testing of emergency equipment
- Identifying defects and dealing with malfunctions and failures of equipment during use
- Works, site or other local emergency procedures including the initiation of an emergency response.
- Emergency first aid and resuscitation procedures
- Use of firefighting equipment
- Liasion with local emergency services in the event of an incident
- Rescue techniques

A1.3 Planning - General Principle

A risk assessment shall be carried out prior to entry (See Safety Code 06 – Risk Management) If the risk assessment identifies risks of serious injury from work in confined spaces, the Confined Space Regulations applies. The regulations contain the following key duties:

- Avoid entry into confined spaces, e.g by completing he task from the outside.
- If entry into a confined space is unavoidable, follow a safe system of work and put in place adequate emergency arrangements prior to work commencing.

Consider the following options as alternatives to enter Confined Space?

- Modify the confined space itself so that entry is not necessary
- Modify items within the confined space so they can be accessed, tested or monitored remotely (e.g. emergency lighting).
- Inspection, sampling and cleaning operations can often be done from outside the space using the appropriate tools and equipment.
- Remote cameras can be used for inspection of vessels, pits etc

If you need to enter a confined space, you will have a safe system of work and the necessary emergency arrangements. Use the results of the risk assessment to help identify the necessary precautions to reduce the risk of injury. These will depend on the nature of the confined space, the associated risk and the type of work involved.

Arrangements must be made that the safe system of work, including the precautions identified are developed and put into practice.

The safe system of work and the risk assessment will need to include all emergency arrangements for raising the alarm and carrying out rescue operations in an emergency. Each identified confined space will have Emergency arrangements they will depend on the nature of the confined space, the risks identified.

A1.4.1 Entry into a Restricted Access Space

A restricted space is an area where due to physical constraints and/or hazardous materials or plant, there is a need to control who enters.

All restricted areas must:

- Be clearly signed to indicate restricted access/authorised access only (where possible)
- Where appropriate, have additional signage to warn people of the hazard present e.g low/high voltage electricity, fragile ceiling etc
- Be kept locked when not occupied and have a system to identify when someone is in the space
- Be defined a NO lone working area. Where this is not possible, there must be a safe system of work (SSOW) in place, which will identify who is in the space and clear emergency procedures will be recognised as part of the SSOW.
- Have a relevant, up to date risk assessment (which will form part of the SSOW) and this will be communicated to all persons that enter the restricted space.

Confined Space Classification for a comprehensive list of confined spaces, please see the Confined Space Register, which will be developed, monitored and updated by each department.

Some places may become a confined space when work is carried out or materials introduced, or during their construction, fabrication or subsequent modification.

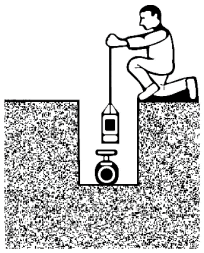
To align training and competency requirements, the classification system of the City and Guilds 6150 assessment scheme shall be used. The City and Guilds classification of low, medium and high-risk classification are explained briefly below. It should be noted that this classification system is based on the entry rather than the structure and assumes entry classification may change depending on the number of entrants, the distance travelled into a structure. The inherent risks, and the introduced/task-based risks.

Low Risk Confined Space Entries

Low risk is a shallow entry with adequate natural or mechanical ventilation, where access is simple and unobstructed and there is no likelihood of flooding. Examples within STFC are meter pits, valve chambers, seismic pits etc. If the operative is only

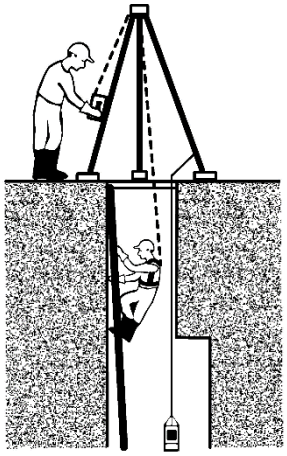
checking areas no deeper than 1200mm with east access openings using a gas detector where standing up on an alarm situation would render them safe.

For low-risk entries, breathing apparatus is not required, due to the risk of hazardous atmosphere is very low or the time taken to get out of the space would be less than the time taken to don an escape set. The use of winch and harness is not compulsory, and no on-site rescue provision is required.



Medium Risk Confined Space Entries

Medium risk is that entry where the operative is required to enter any tank, chamber or room that has restricted airflow but would expect the atmosphere to be safe due to the controls put in place. The use of a gas monitor, escape set, tripod, winch, harness and other associated confined space entry equipment shall be required. Where the entrant in direct unobstructed access with continuous attachment to the fall arrest/retrieval block or similar mechanical rescue device; the risk assessment and method statement should be able to demonstrate additional, on-site rescue provision is not generally required.



Where it is not possible to have an entrant permanently attached to a fall arrest/retrieval block or similar mechanical rescue device; there must be a rescue team available in the event of an emergency.

High Risk Confined Space Entries

High-risk entries are defined as those entries where full working breathing apparatus is required either because there is a known hazardous atmosphere or because the likelihood/risks associated with a hazardous atmosphere, occurring is significant. This may be due to intrinsic hazards within the space (i.e residues) or introduced hazards. Other hazards may include, the presence of heat, physical hazards (is awkward access, size restrictions etc) or other hazards may necessitate classifying the entry as high risk.

A1.5 Signage

Confined Space signs warn people that an area is considered a confined space.

All confined spaces will be visually identifiable by signage. All signage will need to comply with ISO 7010 and meet the Health and Safety (Safety Signs and Signals) Regulations 1996. (See below example)

All confined spaces will have the recommended signs (below) and carry the unique confined space number or ownership given on the confined space register. See A1.1

If it is not possible to place a sign near to or at the entrance to a confined space, a map will be produced by each department identifying where their confined spaces are located. This map will be accessible to all interested parties upon request.

Additional signage will include “Confined Space Emergency Exit Do not obstruct” to highlight areas that interlude along a defined confined space route or location.

A2.0 – Hazards

The hazards that the Confined Space Regulations address arise through the combination of the combined nature of the place of work and the possible presence of one or more specified risk, such as substances or conditions which, taken together, could increase the risks to the health and safety of people.

Remember: A hazard can be introduced to a substantially enclosed space that otherwise would be safe.

The most likely hazards are as follows (this list is not exhaustive)

Flammable substances and oxygen enrichment

A risk of fire or/and explosion can arise from the presence of flammable substances.

A risk of fire and explosion from an excess oxygen atmosphere.

A risk of explosion from the ignition of airborne flammable contaminants (dust cloud).

A fire or explosion can also be caused by leaks from adjoining plant/processes, or from pipes that run within an area.

A risk from fire or explosion may remain from previous processing/cleaning or from previous storage, or from sludge or other deposits that may be disturbed during cleaning.

Toxic gas, fume or vapor

Fumes may remain from previous processing or because of previous storage, or arise from sludge or other deposits disturbed, e.g. during cleaning.

Fumes may also enter the space from adjoining plant.

Fumes and vapor can also be produced from the work inside the confined space, eg. welding, flame cutting, use of solvents etc.

Oxygen deficiency

Oxygen deficiency may result from, for example:

(a) purging of the confined space with an inert gas

(b) naturally occurring biological processes which may consume oxygen

(c) vessel completely closed for some time, rust formation consumes oxygen

(d) the risk of increased levels of carbon dioxide from exertion (heavy breathing) or presence of compounds such as lime chippings

(e) buring operations and work such as welding and grinding which consumes oxygen

(f) displacement of air during pipe freezing, for example, with liquid nitrogen

(g) a gradual depletion of oxygen and entrants breathe in confined spaces.

The ingress or presence of liquids

Liquids can flow into the confined space and lead to drowning and other serious injury depending on the nature of the liquids such as corrosivity or toxicity. Within STFC Liquid Nitrogen is used widely and this material is capable of displacing sufficient oxygen to create an oxygen deficient environment in a small or insufficiently ventilated space, leading to the risk of asphyxiation.

Solid materials, which can flow

Free flowing solids can submerge a person, preventing breathing. Materials which create this hazard include sand, and any other substances in granular or powder form.

Presence of excessive heat

This can lead to a dangerous rise in core body temperature and can be made worse by personal protective equipment being worn. A slower heat build-up in the body can cause heat stress, and if action is not taken to cool, the body there is a risk of heat stroke and unconsciousness. This can occur where work in hot conditions is undertaken in a confined space or where, for example, boilers/furnaces have not been allowed sufficient time to cool before people are allowed to enter and undertake work, or where equipment or where equipment had been steam cleaned to remove hydrocarbons.

Excessive heat may also be seasonal, risk assessments will take this into account. The following mitigation measures will be considered.

Preventing and managing heat stress will include:

(a) Postpone work to a more suitable (cooler) time e.g from Summer to Winter.

(b) Conducting heat stress assessments in the confined space. Wet globe measurements can assist in this process.

(c) Training workers to identify and report heat stress symptoms

(d) Installing air-conditioning and ventilation systems to keep the air circulating and dissipate heat, this could be as simple as opening a controlled door an hour or so before entry (providing the required signage is in place and the necessary people have been informed)

(e) Personal Protective Equipment (PPE) may include protective cooling apparel.

A review of the PPE to be worn should be considering the effect of heat, e.g chemical suits may lead to a reduced entry time before rest breaks and forced ventilation increase.

A3.0 Implementation

Management of an Entry into a Confined Space

The following items shall be taken into consideration when carrying out a confined space entry.

Supervision

When STFC are using a 3rd party to manage a confined space entry, the contract-supervising officer (CSO) will ask contractors to provide details of competency. These details will be confirmed by the permit issuer who has overall supervisory responsibility. SC15 – Appendix 3 form can be used.

Communication

A communication system will be needed between those inside the confined space and those on the outside, (visual, verbal, walkie talkies etc) and a system to raise the alarm in an emergency.

The type of communication and method of raising an alarm must be risk based and identified on the risk assessment and detailed on the method statement and rescue plan.

Whichever communication method is chosen is should be tested. There are some parts of STFC sites which suffer from poor signal or interference, so testing communications is vital.

Fire/Explosion Risk

If confined space entry work is required in a hazardous area or hot work is required, the relevant permit must be completed before commencing work.

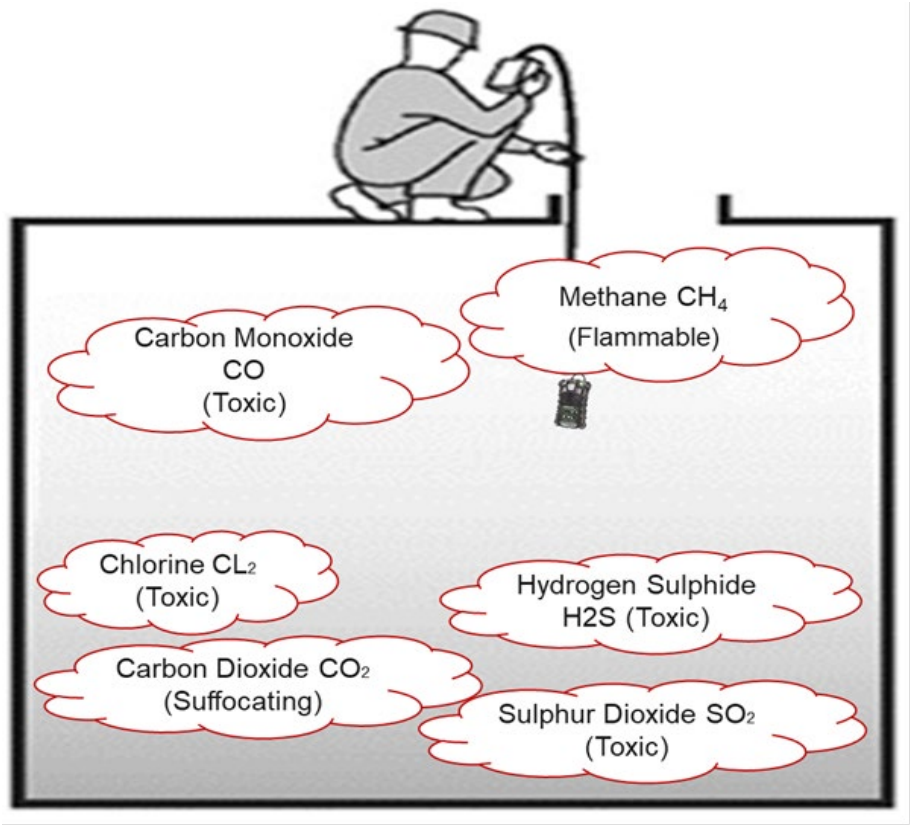
See SC20 (Controlling explosive and flammable gases and dusts) and SC32 (Fire and emergency management)

Note: Precautions may be needed to prevent static electricity hazards

Testing/Monitoring the atmosphere

The atmosphere within a confined space may need testing for hazardous gas. Continuous monitoring of the atmosphere must also be carried out to check that there is no change in the atmosphere while the work is being carried out, particularly where there is a known possibility of adverse changes in the atmosphere during the work.

Atmospheric testing for minimum oxygen content and monitoring for flammable gases may be needed. There may be more than one gas present, and the space will need to be tested at various levels as some gases are heavier than others. Typically, hydrocarbon vapours are heavier than air and logically they will tend to remain at the bottom of the space. However, with disturbance of the atmosphere, the vapour could be anywhere with pockets forming in corners. It is therefore necessary to take readings all over the space to give a comprehensive coverage and reasoned assessment that the space is safe for entry.



Testing of peak values for a duration of 10 minutes prior to entry is required.

Testing should be carried out by persons who are competent in the task and capable of interpreting the results. Recording of the results and monitoring of the process is documented on the STFC Permit to work and also the STFC Entry card, with frequency of testing clearly identified based on the risk assessment or as dictated by permit issuer. This is usually carried out at a 3min period.

The initial testing shall be carried out without entering the confine space, if by the nature of the space such as compartmentalization this is not feasible the entry shall be deemed high risk and specialist advice shall be sort.

Testing Stratified Atmospheres
When monitoring for entries involves a descent into atmospheres that may be stratified, the atmospheric atmosphere envelope is to be tested at approximately 1.5 meters in the direction of travel and to each side.

If a sampling probe is used the entry rate of descent is to be slowed to accommodate the sampling speed and detectors response rate.

Gas Purging
Where there is presence of flammable vapours, these will need to be purged by an inert gas to remove any flammable vapor. The purged gas will then need to be vented away from personnel. Care needs to be taken on where the gas is vented to and not to expose others to any harmful or flammable vapours. The atmosphere will need checking for oxygen content and elimination of flammable vapours.

Ventilation
Forced or extract ventilation may be needed to provide sufficient fresh air to replace the oxygen that is being used up by people working in the space, and to dilute and remove gas, fume or vapor produced by the work.

Lock out Tag Out

Lock out/Tag out (LOTO) is a control measure usually conducted in advance of planned maintenance or repair activity of a Confined Space.

The need for LOTO will have been identified through the risk assessment and in advance of a confined space entry. LOTO type will depend on the hazard identified and recorded within the permit to work.

Isolation from gases or solids

The recommended form of isolation for confined space entry is physical disconnection and blanking and should be carried out in all but the most exceptional circumstances. If this is not possible then additional control measures must be put in place to minimise the risks, such as using isolating spades or permanent atmospheric monitoring equipment

Isolation of mechanical equipment

The power should be disconnected, separated from the equipment and a check made to ensure isolation has been effective. Lock all other equipment, which by virtue of its potential energy can move, with a suitable chock or other blocking equipment

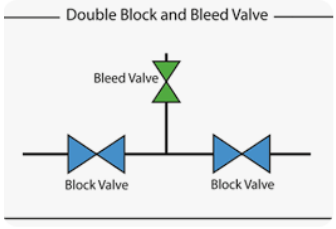
<u>Suggested types of mechanical isolation:</u>

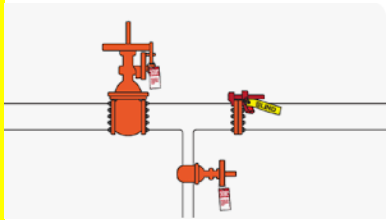
Breaking and blanking – Disconnect at the closest join to the vessel. Blank off open ends except those on the vessel. If possible, misalign pipework.

Only suitable for steam, water and some innocuous substance, as a failure will result in spillage outside the confined space.

All valves must be locked and labelled. The bleed must be proven to be clear. Automatic valves must NOT be used for isolation. Actuators should be removed where using automatic valves cannot be avoided.

Examples below of Double block and bleed and breaking and blanking systems.





Isolation of electrical equipment

Disconnect power from any electrical shock situation. Equipment must be isolated using lockable tags (see LOTO under SC34)

Any motors present in the area must be isolated by either choking or wedging moving parts, and wherever possible remove or disable remote controls from equipment.

Spading

Spading must only be used where breaking and blanking is technically difficult.

This is the isolation of a section of pipeline at a flanged joint without making significant pipeline alterations. This is normally if the isolation is temporary, but a positive isolation that cannot be achieved with a valve can be obtained.

You must ensure that you Spade at the closest joint to the vessel. This reduces the dead space in the pipelines where gases etc. can remain.

If any Spades are already in existence, they must not be relied upon without checking them first, this check must also include corrosion checks. You must also check that the Spade can withstand the maximum supply, expansion pressure and temperature behind it.

Example of a spade

Personal protective Equipment

All personnel protective equipment shall be specified during the risk assessment process for the work to be undertaken and shall be task specific based on the identified hazards.

All personnel protective equipment proposed shall be checked before start of the task to ensure it is fit for the purpose intended and is in good working order.

Access and Egress

The size of openings to confined spaces needs to be adequate.

If the opening into the confined space is below 575mm diameter minimum dimensions, then other precautions must be taken. See below.

Different criteria apply when the critical entry dimensions extend over a significant length or height, as in the case of sewers, pipes, culverts, small tunnels, and shafts. It is recommended that people should not normally enter sewers of dimensions smaller than 0.9m high by 0.6m wide.

Any other specialist methods of access used such as the use of ladders, tripod, winches etc. must be fit for purpose, in date and have the necessary paperwork.

Lighting

Ensure adequate and suitable lighting for the task and environmental conditions. Consider the possibility of a flammable atmosphere may be present and therefore all lighting equipment taken into the confined space must be Ex rated and have the correct zone rating – See SC20 for further details

Limited working time

There may be a need to limit the time that individuals are allowed to work iun a confined space. This may be appropriate where, for example, respiratory protective equipment is used, or under extreme conditions of temperature and humidity.

Suitability for work in a confined space

All personnel who will be working in and involved with the confined space entry shall be adequately trained and briefed. If the risk assessment requires a permit to work, then all personnel will have attended a confined space course (see training appendix).

Where the risk assessment highlights exceptional constraints from the physical layout, the competent person may need to check that individuals are of suitable build, and that they have no issues with claustrophobia etc.
All persons (employee or contractor) must have a valid confined space entry medical. Employees entering confined spaces will receive the medical clearance via the STFC Occupational Health department. See SC24 for further details.

Contractors must ensure that they have the required medical clearance and evidence of this must be verified by the permit issuer.

Emergency/Rescue

Regulation 5 of the confined space regulation states that:

“No person at work shall enter or carry out work in confined space unless there have been prepared in respect of that confined space suitable and sufficient arrangements for the rescue of a persons in the event of an emergency, whether or not arising out of a specified risk”

All Confined Space entries shall have a rescue plan, which will not be reliant on the emergency services.

A rescue plan, rescue team and equipment will be defined in the risk assessment and method statement for the work to be carried out and shall be agreed and briefed out to all parties concerned as part of the entry.

Types of rescue can be separated into four groups:

Self-Rescue: As an example, where an entrant is carrying a portable gas detector, the detector will alarm when the atmosphere is tending towards a hazardous state. This will give the entrant sufficient time to don an escape breathing apparatus set and in accordance with the prepared arrangements evacuate safely from the confined space.

Non-Entry Rescue: Where an entrant is working in a position where they can be hauled or pulled out of the confined space in an emergency, e.g. they can be rescued without the need for the rescuer to enter the confined space. For instance, where an operative is working directly below the access hatch. Where a non-entry rescue is not possible, (i.e. because there is more than one person in the space and there is a risk that recovery lines may become entangled, then it is suggested that the on-site recuse team should be on stand-by at the entry point.

Entry Rescue: When the need for an on-site rescue has been identified in the risk assessment, the team shall be made up of suitably trained and competent personnel, with full working breathing apparatus or escape set (this will depend on the level of risk of confined space) and all necessary rescue equipment, this will normally require third party assistance and resource. Where rescue teams are utilised, consideration should be given to always safeguarding the rescuers.

Public Emergency Services: In some circumstances, e.g., where there are prolonged operations in confined spaces and the risks justify it, there may be an advantage to prior notification to the emergency services (e.g. local fire and ambulance services) before the work is undertaken. If such notification is thought necessary, the emergency services should be consulted, and confirmation obtained about the information they will require. In all cases, arrangements must be in place for the rapid notification of the emergency services should an accident occur. On arrival, the emergency services should be given all known information about the conditions and the risks of entering and/or leaving the confined space before entering it to attempt a rescue. The information may also include the confined space entry checklist, readings taken, risk assessment and method statement.

Reliance on the emergency services alone will not be sufficient to comply with this regulation. STFC must put in place adequate emergency arrangements BEFORE the work starts.