Confined Spaces

Guidance Note 5

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Confined Spaces

Introduction

This Guidance Note gives practical information about working in confined spaces.

Sample templates have been included in Appendices 1, 2 & 3. If you wish to use these templates to construct your own documents, you must ensure that all references to **Alcumus SafeContractor Accreditation** have been removed and the final documents are clearly incorporated into your existing safety management system.

Working in a confined space is a hazardous operation. A number of people are killed or seriously injured in confined spaces each year. Such incidents repeatedly involve more than one fatality because untrained people attempt to rescue their workmates without proper equipment and training.

What is a Confined Space?

A confined space is an enclosed space where there is a risk of death or serious injury from hazardous substances or dangerous conditions (e.g. lack of oxygen).

A confined space has one or more of the following characteristics:

- Limited access or egress
- The space contains known or potentially hazardous substances and / or atmospheres
- The space is not intended for continuous working
- Conditions of engulfment or entrapment may exist or develop.

Some confined spaces are obvious such as storage tanks, silos, enclosed drains and sewers. However, others may be less obvious, such as vats, ductwork, unventilated / poorly ventilated rooms and open-topped chambers.

Principle Hazards of a Confined Space

Dangers can arise in confined spaces due to the following:

- Lack of oxygen
  - Low oxygen levels may occur through – engulfment; rust formation; chemical reaction between soil and oxygen; groundwater reacting with chalk and limestone to produce carbon dioxide and displacing normal air; or decomposition of organic matter.

- Fire and/or explosions

- Toxic substances
  - Poisonous gas, fume or vapour may accumulate in the space from surrounding ground, may enter from connection pipes, or may build up in connected vessels etc.

- Physical hazards are amplified
  - Examples include noise, extreme temperatures, burn hazards, engulfment hazards, mechanical hazards, slips/trips or falls, electrocution and moving machinery.

- Residues left in tank/vessel
  - These may give off gas, fume or vapour.

- Dust
  - This may be present in high concentrations e.g. flour silos.

Legal Duties

Employers are legally required to carry out a risk assessment under the Management of Health and Safety at Work Regulations 1999. For work in confined spaces this means identifying the hazards present, assessing the risks and determining what precautions to take. The assessment will normally include consideration of:

- The task
- The working environment
- Working materials and tools
- The suitability of those carrying out the tasks
- Arrangements for emergency rescue.

If your risk assessment identifies serious risk of injury from working in confined spaces, the Confined Spaces Regulations 1997 apply. The key requirements of the regulations are:

- Avoid entering the confined space e.g. by doing the work from the outside
- If entry is unavoidable, adopt a safe system of work
- Develop and implement suitable emergency procedures prior to commencing work.

Avoiding Entry to a Confined Space

You must consider whether the work can be done in another way so that entry or work in a confined space can be avoided. Good planning and adopting a different approach can reduce the need for confined space working.

Safe Systems of Work

You must have a safe system of work in place for work in a confined space. The safe system of work, and any precautions identified must be developed and put into practice. Everyone involved must be properly instructed to ensure they know what to do and how to do it safely.

The results of your risk assessment will help to identify the necessary precautions to reduce the risk of injury.

Risk Assessment

A suitable and sufficient risk assessment must be carried out by a competent person prior to work in a confined space. The risk assessment should question the following:

- Is entry into the space essential?
- Can the job be undertaken from outside the confined space?
- What hazardous substances may be encountered?
- What hazards may be encountered?
- What control measures could be adopted?

Where possible, keep hazards out of a confined space. For example, petrol or diesel engines should never be used inside the space, substances which emit solvent vapours should not be used, and burning processes should be undertaken outside of the space and the articles then lowered into place.

The work should be carried out from outside a confined space where possible. For example, cameras may be used to inspect inside confined spaces, or cleaning or sampling may be undertaken using tools from outside the space.

* *See Appendix 2.*

Permits-to-Work

A permit-to-work system is a formal written system and is an extension of the safe system of work. A permit is used where there is a reasonably foreseeable risk of serious injury in entering or working in the confined space. The use of a permit system does not, by itself, make the job safe. It supports the safe system, providing a ready means of recording findings and authorisations required to proceed with entry.

A permit-to-work system may not be required where:

- The risks assessed are low and can be easily controlled
- The system of work is very simple; and

- Where you can be sure that other work activities being carried out cannot affect safe working in the confined space.

The decision not to adopt a permit-to-work system must only be taken by a competent person, taking into account the advice of specialists and the results of the risk assessment.

The permit-to-work should include the following information:

- Site location
- Reason for entry, with a brief description of the job
- Signature of the authorising person, prior to work commencing
- Space classification, e.g. is the space a classified space
- Steps have been taken to isolate any hazardous energy sources
- Types of hazardous processes being undertaken
- Communication systems in operation
- Rescue procedures and equipment
- PPE required
- Environmental conditions
- Date of entry and authorised duration; and
- Signatures of the confined space workers.

On satisfactory completion of the job, the authorising person should cancel the permit.

Re-issue of the permit

If the work has not been completed before the permit expires, a re-issue of the permit is required. The responsible person must visit the location and ensure that conditions have not substantially altered since the certificate was initially issued. If the conditions have altered the situation must be reassessed and, as necessary, further controls should be specified.

End of operations

On completion of work in the confined space, the permit must be signed-off and returned to the permit issuer, stating that the work area is safe for normal operations and that all workers are clear from the space.

The process operator should check the essential services and if agreed, the permit should be cancelled.

Operation review and revision

Following each operation, the procedures will be reviewed and revised, as necessary.
Periodically, persons in charge should review the permit-to-work system to ensure that permits are being correctly completed, and that the required controls are being adopted.

* *See Appendix 3*.

Procedure Prior to Entering a Confined Space

If entry into a confined space is essential, a safe system of work must be adopted. The findings of the risk assessment should be used to identify the control measures.

Before any work in confined spaces starts, the following steps should be completed:

- Appoint a supervisor to take responsibility for the whole operation
- Ensure all workers are competent, are medically fit and have received adequate training
- Withdraw any plant from service
- Turn off all gas, power, steam or water supplies into the confined space
  Isolate the permit space, and put up signs indicating that work is being undertaken within the confined space
- Empty, flush, clean or otherwise purge the confined space of any flammable or toxic substances, so far as is reasonably practicable
- Monitor the quality of the air within the confined space and evaluate the hazards. It is important that the correct monitoring and analytical procedures are used
- Ventilate all contaminated confined spaces for at least 15 minutes before entry, and ensure suitable and sufficient ventilation equipment is available and tested by a competent person
- Ensure suitable and sufficient PPE is available and tested by a competent person
- Check the size of the access/egress points to ensure they are large enough to allow easy passage by workers wearing PPE
- Supply suitable and sufficient work equipment, for example extra-low voltage equipment and non-sparking tools
- Supply suitable and sufficient lighting equipment
- Ensure there is an adequate communication system
- If necessary, ensure a work permit is obtained, completed, signed and dated by a competent person.

Provision of Ventilation

Natural ventilation may be sufficient in certain circumstances, but most spaces will require mechanical ventilation e.g. where portable gas cylinders and diesel fueled equipment are used inside the space.

To ensure ventilation is adequate:

- The number and size of openings should maximise dilution of contaminants
- Where airborne contaminants exist, fresh air should be introduced using a positive-pressure system
- Care should be taken to ensure that pockets of toxic or flammable gases are not formed as they are emitted from the confined space

- Equipment should be earthed to prevent discharge of static electricity
- Oxygen should not be used for ventilation, (for example to 'sweeten' the air), as it may increase the risk of igniting flammable gas, or may result in spontaneous combustion of certain substances.

Atmospheric Monitoring

Before anyone enters the confined space, the atmosphere should be tested for various gases, such as:

- Oxygen levels should not be less than 19.5% (oxygen deficient), or greater than 23.5% (oxygen enriched)
- Flammable gases and vapours should not be greater than 10% of the lower explosive limit
- Hydrogen sulphide should not be greater than 10ppm
- Carbon monoxide should not be greater than 50ppm
- Other toxic gases or vapours should not exceed their Workplace Exposure Limits.

If the atmosphere contains hazardous levels of contaminants, or is oxygen deficient, the following steps are recommended:

- Identify the source of the contamination and remove it
- Ventilate contaminated spaces by drawing out air and replacing it with non-polluted air, until several air changes have been achieved
- Ventilate the space and re-test the air until you can prove that the atmosphere is safe.

Safety data sheets should be kept to hand so that they are readily available to the emergency services in the event of an incident.

Access / Egress

It is recommended that the minimum size of an opening to allow access with full rescue apparatus be 575mm diameter or minor axis. Existing plant may have smaller access points, but they should not be less than 457mm diameter round, or 457mm long and 410mm wide if oval or rectangular.

Sewers of dimensions smaller than 900mm high x 600mm wide should not be entered, and where shafts contain a ladder or step irons, 900mm clear space should be provided between the ladder/steps and back of the shaft.

Emergency Arrangements

Before anyone goes in to the confined space, suitable rescue (and resuscitation) arrangements must be in place.

It is essential that the method of rescue proposed does not put the rescuers health and safety at risk.

Emergency arrangements must include;

- Raising the alarm
  – Measures must be in place to ensure that those working within the confined space can communicate their distress to those outside so that emergency procedures can be implemented. For example, a tug of the rope, radio communication or activating a lone worker alarm.
- Rescue and resuscitation equipment
  – Appropriate rescue/resuscitation equipment must be provided and properly maintained. This equipment will often include lifelines and lifting equipment (to raise unconscious personnel).
- Safeguarding the rescuers
  – Multiple fatalities have occurred when rescuers have been overcome by the same conditions that have affected those that they are trying to rescue. Ensure that rescuers are themselves protected from the cause of the emergency.
- Emergency services
  – Ensure that arrangements are in place to contact the emergency services in the case of any accident. When the confined space work is of a prolonged nature and the risks justify it, notify and consult with the emergency services in advance.
- First aid
  – Ensure that appropriate first aid equipment is provided and used until professional help arrives.
- Rescuers
  – Personnel chosen to carry out rescue operations need to be trained for that purpose. The training will need to include: - likely causes of the emergency; use of rescue equipment; check procedures before donning/using apparatus; checking that emergency equipment is functioning; identification of defects; shutting down adjacent plant prior to rescue; resuscitation/emergency first aid; use of firefighting equipment; liaison with emergency services and rescue techniques.

Employee Training

Every worker who enters a confined space, their supervisors and attendants must be given suitable and sufficient training.

Specific training should be devised for supervisors, entrants, attendants, and rescuers. Although the training will vary with each task, in general, everyone should be trained on:

- Recognising a confined space.
- The need for a permit-to-work system, and why it should be followed.
- Emergency procedures, in particular access and escape.
- Use, care and maintenance of PPE and RPE, and use of any other safety equipment such as atmospheric monitoring equipment.
- First aid procedures.
- Lock-out and isolation procedures.
- Rescue procedures.
- Fire protection.
- The need for good personal hygiene.
- Communication.
- Hazard recognition.
- Recognising potential adverse health effects.

Both theoretical knowledge and practical experience are vital. Drills should ensure that the workers know how to respond if an alarm sounds, and how to use breathing apparatus correctly.

Further Guidance

- HSE website: http://www.hse.gov.uk/confinedspace/index.htm

- Safe work in confined spaces: Confined Space regulations 1997 Approved Code of Practice and Guidance
  L101
  ISBN: 9780717662333
  Available at: http://www.hse.gov.uk/pubns/books/l101.htm

- Safe work in confined spaces
  INDG258
  Available at: http://www.hse.gov.uk/pubns/indg258.pdf

- Managing confined spaces on farms
  Agriculture Information Sheet 26
  Available at: www.hse.gov.uk/pubns/ais26.pdf

- Respiratory protective equipment at work: A practical guide
  HSG53
  ISBN: 9780717629046
  Available at: http://www.hse.gov.uk/pubns/books/hsg53.htm

Appendix 1

Checklist for Confined Spaces

Have all confined spaces been identified?	□ Yes	□ No
Is compliance with the *Confined Spaces Regulations 1997* required?	□ Yes	□ No
Has a risk assessment been undertaken?	□ Yes	□ No
Is it vital to enter the confined space?	□ Yes	□ No
Have all hazards been identified in the confined space?	□ Yes	□ No
Has the confined space been isolated from sources of danger e.g. electrical supply, supply pipes, dust and gases?	□ Yes	□ No
Is the confined space empty of hazardous materials and / or moving parts?	□ Yes	□ No
Is the confined space clean and free from explosive or toxic residues / sludges?	□ Yes	□ No
Is there adequate ventilation? (natural or mechanical)	□ Yes	□ No
Are measures in place for atmospheric monitoring?	□ Yes	□ No
Is personal protective equipment (PPE) required?	□ Yes	□ No
Is suitable and sufficient PPE available and well maintained?	□ Yes	□ No
Have employees been trained on why and how to use PPE correctly?	□ Yes	□ No
Is there safe access and egress into the confined space?	□ Yes	□ No
Is there a safe system for bringing apparatus into, or removing it from, the confined space?	□ Yes	□ No
Is someone on site at all times to watch over the work and act as a 'sentry' or 'buddy'?	□ Yes	□ No
Has a formal permit-to-work been issued?	□ Yes	□ No
Has a safe system of work been provided including 'locking off' / restricting access to the area?	□ Yes	□ No
Is a plan in place to deal with emergencies associated with the work in the confined space?	□ Yes	□ No
Are rescue and revival procedures in place and rehearsed?	□ Yes	□ No

Appendix 2

Confined Space Risk Assessment

Where an answer is not relevant enter N/A, where further action is needed as a result of an answer please detail in the further action box and ensure all relevant personnel are informed.

Work Area/Location:	
Work Activity:	

THE SPACE		
	Yes	**No**
Could the previous use of the confined space result in:		
• A deficiency of oxygen or an existing safe atmosphere that could become deficient?		
• The presence or generation of toxic or flammable gases, vapours or fumes?		
• The release of poisonous vapours as a result of the disturbance of sludge or deposits?		
• An oxygen-rich atmosphere being present?		
Has the space been cleaned of all materials and residues, and purged of all previous contents?		
Will any work in the vicinity have an effect on the confined space?		
Is the entrance/exit size big enough for workers to pass when wearing all necessary equipment?		
Is the temperature acceptable for working in?		

THE HAZARDS		
Contact with Moving Parts.	**Yes**	**No**
Have all mechanical, hydraulic, pneumatic or other parts been disabled?		
Have electrics been isolated by locking off isolating switches or removing fuses?		
Has the person entering the space been given the fuses and/or keys?		
Have checks or tests been carried out to ensure that isolation is effective?		
Ingress of Material.	**Yes**	**No**
Have all material entry points been closed off, e.g. by "spading" pipes and "locking/tagging" valves?		
Have checks or tests been carried out to ensure that isolation is effective?		
Could there be ingress from any other source?		
Atmosphere.	**Yes**	**No**
Has the oxygen level been verified as being between 19% and 21.5% oxygen?		
Is ongoing oxygen level monitoring required?		
Could there be pockets of poor air quality?		
Could an oxygen-rich atmosphere develop?		
Is mechanical ventilation needed?		

Atmosphere (Continued).	Yes	No
Is breathing apparatus required?		
Are all petrol-fuelled or diesel-fueled engines excluded?		
Is the correct PPE or RPE available, and is it CE marked and well maintained?		
Have exposures been confirmed as being below Occupational Exposure Limits?		
Fire.	**Yes**	**No**
Is equipment intrinsically safe?		
Are extinguishers to hand?		
Is earthing required to prevent static build-up?		
Personnel.	**Yes**	**No**
Are those entering the confined space medically fit		
Are they adequately trained?		
Does any PPE or RPE fit well?		
Have contractors' permits, procedures and training been verified?		

Rescue		
	Yes	**No**
Is there an emergency rescue procedure?		
Are safety lifelines and harnesses required?		
Is a winch/hoist necessary?		
Is a full-time attendant required?		
Are attendants trained in emergency procedures?		
Do rescue teams or attendants have adequate RPE/PPE?		
Are rescue teams trained in rescue techniques, first aid and CPR.		
Are there adequate means of communications between those inside and outside the confined space?		
Can the attendant summon emergency help quickly?		

Permit to Work		
	Yes	**No**
Does the permit for the work cover:		
• Identification of the location and exact work to be carried out.		
• Activities NOT allowed.		
• Inspection of the space (from the outside).		
• Isolation of any mechanical, hydraulic, pneumatic or other moving parts by disconnection, locking off or chaining.		
• Isolation of electrics by locking off isolating switches or removing fuses.		
• Closing off and locking off all material entry points at the appropriate valve points.		

• Checks and tests to ensure isolations are effective.		
• Selection of suitable equipment, that is safe. *(Where a space could contain an explosive atmosphere, only 'ATEX-compliant' equipment* should be used).*		
• Earthing measures.		
• Cleaning/purging of all hazardous materials.		

Permit to Work (Continued)		
	Yes	**No**
• Verification of oxygen level before entering.		
• Supervision.		
• Emergency rescue procedures.		
• Communications.		
• Hand back procedures. ***Hand back should not take place until:*** - ***Everybody has left the confined space.*** - ***All equipment has been removed.*** - ***All lockouts, tags, spades etc have been removed and pipes replaced.*** - ***The permit has been signed and closed.***		
• Competency of operatives for confined space work.		

Other Relevant Information:			
Further Action:			
Signed: **(Person completing the assessment)**		**Date:**	

* 'ATEX-compliant' equipment must comply with the Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres Regulations 1996 and must be appropriate for the hazardous area in which it is to be used.

Appendix 3

Confined Spaces Permit-to-Work

Permit No:	**Issuing Dept:**			
Location of work:				
Is entry into the confined space essential? **YES / NO (**delete as appropriate*)** ***If NO, proceed with the confined spaces risk assessment.**				
Description of task:				
Hazards identified:				
Control Measures and Precautions Necessary **CHECKLIST**	**Yes**	**No**	**N/A**	**Person Responsible**
Is there safe access/egress for operatives and have all necessary equipment and services been provided?				
Is there adequate space to carry out work safely and is the space free from clutter and debris?				
Are operatives adequately trained and suitable for tasks and trained in use of any PPE that has to be worn?				
Is competent supervision on hand throughout job?				
Have the incoming services been isolated? – gas*/electricity*/steam*/water*/fuel*/other* (**delete as appropriate*)				
Have installed equipment been isolated? Mechanically*/electrically*/both* (**delete as appropriate*)				
Have equipment and pipes/tanks been drained and vented?				
Have potential ingress of fumes or other substances (e.g. excess rainwater if outside) been evaluated and control measures arranged?				
Have residues, sludges or other potential causes of fume been removed?				
Has atmospheric testing for oxygen*/toxic fumes*/flammables*has been carried out? (**delete as appropriate*)				
Are there proven means and trained people prepared for evacuating a casualty from this confined space?				

Have suitable means of communication been set up for those in the confined space to person/s on watch or outside at all times?				
Have suitable tools and equipment been selected, and have intrinsically safe electrical appliances been provided if a potential flammable atmosphere exists?				
Has adequate ventilation by natural air flow*/mechanical means* (**delete as appropriate*) been arranged ?				
Has adequate lighting has been arranged?				

Any other precautions applicable to the job including any special instructions for before and during entry? – Provide details
Personal protective equipment and safety equipment required? – Provide details
Acceptance by workers that they have read and understood the permit (signatures & names)

Authorisation by responsible person
I verify the above location has been examined, the precautions have been taken and that permission is authorised for this work. I also accept responsibility for the work to be carried out. Name of Person Supervising the Work: Signature of Person Supervising the Work:

Time permit starts:	Date:
Time permit expires:	Date:

Sign off that work is completed*/suspended* (delete as appropriate*)**
I confirm that the work has been completed*/partially completed*(**delete as appropriate*), checked by myself and the area left in a safe and tidy condition. This permit is now cancelled. Name of Person Supervising the Work: Signature of Person Supervising the Work:

Date and Time: