

March 2017

Working Safely in Confined Spaces

Occupational Health and Safety Service
HSD062M



UNIVERSITY OF
CAMBRIDGE

Working Safely in Confined Spaces

How the Confined Spaces Regulations 1997 (updated 2014) applies to work around the University

Policy statement and guidance for work in confined spaces

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1. Introduction

Every year in the UK a number of people are killed or seriously injured in confined spaces. This happens in a variety of circumstances, many of which could occur in the University. This Guidance when read in conjunction with other guidance e.g. the University's Health & Safety Risk Assessment Handbook, Institution and Department procedures will help in managing and controlling the risks of working in confined spaces.

2. Policy Statement

The University declares in its published statement of Health and Safety Policy (see Safety Office website, publication HSD016M) that it is committed to the highest standards of excellence in teaching and research and accepts its responsibilities for the health, safety and welfare of all staff, students, visitors and others who may be affected by the activities of the University, including that of contractors.

3. The Law

The Management of Health and Safety at Work Regulations 1999 require the University to carry out suitable and sufficient assessment of the risks of all work activities for the purpose of deciding the necessary safety precautions and controls. For work in confined spaces this means identifying the hazards present, assessing the risks and determining what measures are necessary for safety (e.g. the precautions and controls).

Where the risk assessment has identified the risk of serious injury from work in confined spaces The Confined Spaces Regulations 1997 apply. Also see the associated Approved Code of Practice L101 (2014). What you need to do is further described in this guidance.

4. Definition of a confined space within University context

Under the Regulations (Confined Spaces Regulations 1997 – amended 2009) a confined space means *“any place, including any 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”*. Under these Regulations a 'confined space' **must have both** of the following defining features

- (i) It is a place which is substantially (though not always entirely) enclosed
- (ii) There is a reasonably foreseeable risk of serious injury from hazardous substances or conditions within the space or nearby

In the University this might include

- crawl ways
- manholes
- excavations
- sumps
- building voids
- cellars
- enclosures, including silos, cold rooms and dark rooms.
- freight containers
- interior of plant and machines
- roof spaces
- tanks

Remember that the application of these Regulations in any of these places depends on the presence of a reasonably foreseeable risk of serious injury.

5. The Hazards

The hazards can arise through the combined nature of the place of work and the possible presence of substances or conditions which taken together could increase the risk to the health and safety of the people working in the area.

5.1 Flammable substances and oxygen enrichment

A risk of fire or an explosion can arise from the presence of flammable substances or from an excess of oxygen in the atmosphere. A fire or explosion can also be caused by leaks from adjoining plant or processes that have not been isolated. Remember that while some flammable gases will naturally rise in air, most solvent vapours will fall and every flammable gas or solvent vapour has a different Lower Flammable Limit (%) in air. A flammable atmosphere may thus build up initially in either the bottom or top of a confined space. Increased oxygen levels make fire much more likely and more intense.

5.2 Toxic gas, fume or vapour

These can build up in sewers, manholes, or leak from behind vessel linings, rubber, lead brick etc, and when sludge or other deposits are disturbed. Fume and vapour can also be produced by the work carried out in the confined space e.g. welding, brazing, grinding, painting or using adhesives and/or solvents. Plant failure can cause problems e.g. refrigerant gas if the refrigeration plant fails or a dewar of cryogenic gas fails etc. A toxic atmosphere may build up initially in either the bottom or top of a confined space depending upon the relative density of the gas, fume or vapour.

5.3 Oxygen deficiency

This can result from many types of work and processes

- (a) purging of a confined space with an inert gas (nitrogen, argon etc.) to remove flammable or toxic gas, vapour or fume without air being reintroduced (as appropriate).
- (b) naturally occurring biological processes removing or displacing the oxygen
- (c) rusting
- (d) welding or grinding operations
- (e) gradual depletion of oxygen as workers breathe in a confined space!

5.4 Excessive heat

This can lead to a dangerous rise in core body temperature which may be made worse as a result of wearing personal protective equipment. This could lead to heat stress and the risk of heat stroke and unconsciousness.

5.5 Other hazards

- (a) These can include liquids and solids that could flow e.g. animal food & grain silos
- (b) Silos of biomass fuels can also accumulate toxic gas by partial decomposition.
- (c) Some enclosed spaces on the University estate may have the legacy of the past contaminants such as asbestos, mercury and radiation.
- (d) Although Cambridge is generally a low radon area, it may need to be considered if people are working in an underground area for a prolonged time.
- (e) Other hazards that are not specific to confined spaces include electricity, mechanical equipment, noise, dust, collapse of excavations etc. etc.

6. Risk Assessment

The priority when carrying out the risk assessment is to identify the measures needed so that work in confined spaces can be avoided if at all reasonably practical and possible. If in the light of the risks identified, it cannot be considered reasonably practicable to carry out the work without entering the confined space, then it is necessary to determine what measures need to be taken to secure a safe system for working within the confined space. This will help to identify the necessary precautions and control measures.

When a number of confined spaces are broadly the same in the terms of the conditions and activities and the risks identified and the control measures to deal with them are the same it may be possible to devise a generic risk assessment to cover them all. **However** the risk assessment must unambiguously identify the confined areas covered by name and location. A significant change in any of the areas would invalidate the assessment.

NOTE: THE PERSON CARRYING OUT THE RISK ASSESSMENT SHOULD HAVE A COMPLETE UNDERSTANDING OF THE WORK INCLUDING THE TASKS TO BE UNDERTAKEN, THEIR ASSOCIATED HAZARDS AND RISKS, AND IMPORTANTLY THE PRECAUTIONS AND CONTROL MEASURES THAT MUST BE IMPLEMENTED.

6.1 Factors that need to be included in the risk assessment

- (a) Previous contents of the space – information about the substances held, stored or used in the space
- (b) Contamination or legacy of past – including asbestos, mercury and radiation
- (c) Physical dimensions
- (d) The work being undertaken eg cleaning, maintenance etc
- (e) Oxygen deficiency
- (f) Equipment and substances being used (Appendix 1 – Example risk assessment)
- (g) The ease of access for assistance and egress for escape from a confined space

7. Preventing the need of entry

The University has a duty to prevent staff and contractors from working in or entering into confined spaces where it is reasonably practicable to undertake the work without entering the space.

Some examples include

- (a) Testing the atmosphere or sampling the contents from outside using probes
- (b) Cleaning the confined space using water jetting, long handled tools or in-situ cleaning systems
- (c) It may be possible to view inside a confined space through a porthole or grill. Lighting and CCTV may be useful, but consideration should be given to the possibility of a flammable atmosphere in the space; in which case ATEX rated equipment would be required (ATEX rated equipment should not cause ignition).
- (d) The Construction (Design and Management) Regulations 2015 (CDM) places a responsibility on designers to ensure that any design includes adequate regard to the need to avoid foreseeable risks to health and safety – this includes any necessary maintenance and decommissioning.

8. Safe Working in Confined Spaces

Precautions that are required in a safe system of work will vary and depend on the nature of the confined space, the location, the building, the type of work being carried out, the equipment and substances being used eg asbestos removal in a basement in the Old Cavendish Buildings must consider possible contamination by mercury and radiation. The main elements when drawing up a safe system of work may include:

- (a) Supervision
- (b) Training and skills for confined space working
- (c) Communications
- (d) Testing and monitoring the atmosphere
- (e) Inert gas purging and the re-establishment of breathable air if required
- (f) Removal of any residues
- (g) Isolation from gases or liquids
- (h) Isolation from mechanical or electrical equipment
- (i) Selection and use of suitable equipment
- (j) Selection and use of Personal Protective Equipment (PEE).
- (k) Portable gas cylinders and generators
- (l) Access and egress
- (m) Lighting
- (n) Static electricity
- (o) Emergency and rescue
- (p) **Lone working should NOT be allowed in confined space AND a trained buddy or guard should always be available outside the space but in communication with those carrying out the work.** It is **NOT** appropriate for two or more people to work in a confined space without a trained buddy or guard available outside the space. It is very important to note that it is **NOT** the role of the buddy or guard to attempt a rescue in the event of an incident, their role is to raise the alarm.

9. Use of a permit-to-work system

A permit-to-work system is a formal written scheme and is usually required where there is a reasonably foreseeable risk of serious injury in entering or working in a confined space. It is an extension of a safe system of work and NOT a replacement for it. A permit-to-work system may be appropriate:

- (a) to ensure that everyone working in the confined space are aware of the hazards involved and the work to be carried out
- (b) to ensure that the safe system of work is in place. This needs to be done before anyone starts work or are allowed into the confined space
- (c) where there is a need to co-ordinate and co-operate with other work activities that may affect the work in a confined space

- (d) to ensure effective communications between all parties concerned eg Department, Estate Management and contractors
- (e) where there are known contaminants eg the Old Cavendish Buildings and a legacy of mercury contamination

The permit to work needs to be authorised by someone who has a complete understanding of the work including the tasks to be undertaken, their associated hazards and risks and importantly the precautions and control measures that need to be implemented. The permit to work should be cancelled once the work to which it applies has finished.

Example of a permit to work system in Appendix 2

10. Emergency Procedures

The arrangements for emergency rescue work depend on the nature of the confined space, the risks identified and the likely nature of an emergency.

The emergency procedures should include consideration of

- (a) Rescue equipment
- (b) Raising the alarm
- (c) Safety of the rescuers
- (d) Fire safety
- (e) Control of plant, machinery and equipment
- (f) First aid
- (g) Rescue services

11. Training

Those likely to be working in confined spaces or involved in any emergency should be trained for that purpose. This should include

- (a) awareness of the confined space regulations
- (b) an understanding of the work to be undertaken
- (c) an understanding of safe systems of work and particularly permits-to-work
- (d) how emergencies can arise and how to deal with them

The training required will depend on the specific work in confined spaces and the individuals previous experience. See Appendix 3, Training

Appendix 1	Example of a Risk Assessment
Appendix 2	Example of a permit-to work system
Appendix 3	Training
Appendix 4	Checklist for Confined Space Working

References and further guidance

1. HSE Guidance and Codes of Practice

Management of health and safety at work. Management of health and safety regulations 1999. Approved Code of Practice and guidance (Second edition) L21 HSE Books 2000 ISBN 978 0 7176 2488 8

Workplace health, safety and welfare Approved Code of Practice and guidance on regulations L24 HSE Books 1992 ISBN 978 0 7176 0413 5

Safe use of work equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and guidance L22 (Third edition) HSE Books 2008 ISBN 978 0 7176 6295 1

Personal protective equipment at work (Second edition). Personal Protective Equipment at Work Regulations 1992 (as amended). Guidance on Regulations L25 (Second edition) HSE Books 2005 ISBN 978 0 7176 6139 8

Control of substances hazardous to health (Fifth edition). The Control of Substances Hazardous to Health Regulations 2002 (as amended). Approved Code of Practice and guidance L5 (Fifth edition) HSE Books 2005 ISBN 978 0 7176 2981 7

Controlling noise at work. The Control of Noise at Work Regulations 2005. Guidance on Regulations L108 (Second edition) HSE Books 2005 ISBN 978 0 7176 6164 0

Work with materials containing asbestos. Control of Asbestos Regulations 2006. Approved Code of Practice and guidance L143 HSE Books 2006 ISBN 978 0 7176 6202 7

Managing health and safety in construction. Construction (Design and Management) Regulations 2007. Approved Code of Practice L144 HSE Books 2007 ISBN 978 0 7176 6223 4

Respiratory protective equipment at work: A practical guide HSG53 (Third edition) HSE Books 2005 ISBN 978 0 7176 2904 6

First aid at work Approved Code of Practice and guidance L74 HSE Books 1997 ISBN 978 0 7176 1050 1

Guidance on permit-to-work systems: A guide for the petroleum, chemical and allied industries HSG250 HSE Books 2005 ISBN 978 0 7176 2943 5

WORKING IN A CONFINED SPACE

Report form number

Date

Compiled by

Position

Department

Risk assessment form

Can work be carried out from outside the confined space?	yes / no
- If 'YES' undertake the work but prohibit entry - If 'NO' adopt a permit-to-work system	
Is the work to be carried out without breathing apparatus?	yes / no
Is breathing apparatus available?	yes / no
If 'YES' the following steps should be followed: - isolate the area to prevent the ingress of harmful substances such as dust and fumes - test and continue monitoring the atmosphere for flammable and/or toxic vapours and to ensure there is sufficient oxygen - maintain and calibrate all detectors - remove sludge / residues if present - clean or purge any tank ; vessel before work is undertaken within, if necessary - ventilate the area	
Is it safe for entry without approved breathing apparatus	yes / no
if 'YES' the operation should be permitted in writing	
If 'NO', the system should be further cleaned / purged until it is made safe (or approved breathing apparatus should be worn)	
N.B. FACE-FIT TESTING: If approved breathing apparatus is to be worn, the following steps should be followed: - isolate the area to prevent the ingress of harmful substances, such as dust and fumes - monitor for dangerous occurrences, such as pressurisation, stream ingress, etc - ensure items of PPE are compatible - ensure it is practicable to wear the apparatus, such as comfort and fit	
Entering the confined space	
When a confined space is entered, consider these safeguards: - whether any electrical equipment should be isolated - use of non-sparking tools - does or could the atmosphere contain a flammable gas or vapour above the lower flammability limit for the particular substance - special precautions, such as use of safety harnesses, lifelines, breathing apparatus, etc - equipment and competent personnel must be on hand for rescue purposes, at all times - equipment and competent personnel must be on hand for revival purposes, at all times	

CONFINED SPACES		PERMIT TO WORK No.	
JOB DETAILS			
SPECIAL TOOLS TO BE USED			
JOB LOCATION/PLANT IDENTIFICATION			
This permit is only valid when all sections are complete If you are in doubt or don't understand then please ask. Remember, all accidents are preventable and it is people who get hurt and suffer pain. Please use this permit in the spirit intended and to protect yourself and others. Please ensure that you sign this permit-to-work. Do not proceed with your work until your permit has been authorised by the relevant member of staff.			
HAZARDS AND PRECAUTIONS TO BE TAKEN			
PRIMARY HAZARDS – fumes, electrics, gases, liquids, sludge, radiation, moving parts			
PLEASE ANSWER THE FOLLOWING QUESTIONS TRUTHFULLY		Yes	No
Are you qualified/trained to undertake this work?			
Has the confined space been isolated from all connected pipework?			
Has the confined space been purged with steam/water/air?			
Has the confined space been electrically isolated and locked out?			
Is the confined space below 30° on full cooling?			
Is a supply of respirable air assured/ventilation required?			
Is there an acceptable means of access to and escape from the confined space?			
Is breathing apparatus at hand and in good working order?			
Is a safety line/tripod/harness and any other back-up equipment to hand?			
Are there adequate emergency arrangements in place?			
Are you likely to come into contact with asbestos? If yes, please refer to Asbestos Present Permit-to-Work			
TIME OF TEST 1		TIME OF TEST 2	
OXYGEN %	PASS/FAIL	OXYGEN %	PASS/FAIL
CARBON MONOXIDE %	PASS/FAIL	CARBON MONOXIDE %	PASS/FAIL
CARBON DIOXIDE %	PASS/FAIL	CARBON DIOXIDE %	PASS/FAIL
OTHER (SPECIFY) %	PASS/FAIL	OTHER (SPECIFY) %	PASS/FAIL
Note: O ₂ depletion alarms typically activate at 19.5% oxygen and work should not be undertaken at or below this level. Carbon Monoxide and Carbon Dioxide are both toxic gases requiring individual monitoring.			
Other precautions required			
Other safety equipment required			
AUTHORISATION AND ACCEPTANCE			
I confirm that I have verified the above information and ensured that the necessary precautions have been taken. It is safe to carry out the work as defined above and the permit information has been explained to all workers involved. I accept responsibility for this work.			
PERSON IN CHARGE			
COMPANY			
SIGNATURE		DATE	TIME
AUTHORISING PERSON			
HANDBACK AND CANCELLATION			
I confirm that the work has been completed/partially completed* checked by myself and the area left in a safe and tidy condition (*delete as appropriate)			
PERSON IN CHARGE			
I have inspected the completely/partially completed* work and hereby cancel this permit (*delete as appropriate)			
AUTHORISING SIGNATURE		DATE	TIME

Training

1. Basic Confined Spaces Awareness Training is available from the Safety Office – see the training programme for details
2. For more specialist training see
 - (i) www.wata.co.uk
 - (ii) www.cityandguilds.com
3. The Maintenance Unit at Laundry Farm may also be able to assist with online training PC base training is not available online

Appendix 4

Checklist for confined spaces

Have all 'confined spaces' been identified?	☐ Yes	☐ No
Is compliance with the Confined Spaces Regulations 1997 required (identify individually)?	☐ Yes	☐ No
Has a risk assessment been undertaken on each one?	☐ 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, such as electrical supply, supply pipes, dust and gases?	☐ Yes	☐ No
Is the confined space empty of hazardous materials or moving parts?	☐ Yes	☐ No
Is the confined space clean and free from explosive or toxic residues or sludges?	☐ Yes	☐ No
Is there adequate ventilation? (natural or forced)	☐ Yes	☐ No
Are measures in place for atmospheric monitoring?	☐ Yes	☐ No
Is personal protective equipment required?	☐ Yes	☐ No
Is suitable and sufficient personal protective equipment available and well maintained?	☐ Yes	☐ No
Have employees been trained why and how to use personal protective equipment 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, with appropriate tests and signatures, been issued?	☐ Yes	☐ No
Has a safe system of work been provided, including 'locking off'?	☐ 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



Safety Office
Greenwich House
Maddingley Road
Cambridge CB3 0TX

Tel: 01223 333301
Fax: 01223 330256
safety@admin.cam.ac.uk
www.safety.admin.cam.ac.uk/

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