THE UNIVERSITY
OF BIRMINGHAM

Health and Safety Guidance

Safe Work in Confined Spaces

GUIDANCE/8/SWCS/98

Confined spaces can present very serious risks to people who have to enter and work in them. University Health and Safety Policy (UHSP/0/01) requires Heads of Budget Centres to identify risks and take appropriate action to eliminate or control those risks.

This document is intended to help Budget Centre Compliance with Health and Safety Policy. Guidance is given on **how to identify confined spaces**, the **possible dangers associated with confined spaces** and **suitable control measures.**

Further information and advice may be obtained from the Health and Safety Unit.

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INTRODUCTION

Work in confined spaces can present serious risks to people who have to enter them. There have been many avoidable deaths from such work. The risks include possible asphyxiation or poisoning from the atmosphere within the confined space and physical and physiological injuries and illness associated with working in cramped conditions.

In many cases work that requires entry into confined spaces will be under the control of Estate Management. However there may be occasions when individual budget centres have plant or equipment that requires entry.

It is absolutely essential that, before any work in a confined space is undertaken, the proposed work is thoroughly assessed and planned. Careful thought must be given to the need for entry or whether alternative methods can be used, and to the competence of those involved with the work.

The responsibility for effecting a rescue from a confined space lies with those who organise the work. The emergency services may be able to give assistance but they may not have the expertise or equipment to enter the confined space and effect a rescue.

It is strongly advised that University staff and students do not enter confined spaces from which rescue would be difficult. Consideration should be given to the use of specialist contractors or organisations.

GUIDANCE

1 APPLICATION OF THE GUIDANCE

This guidance is to be applied to work which involves confined spaces. It covers the planning and carrying out of the work and emergency arrangements.

Fulfilment of these requirements will ensure compliance with *The Safe Work in Confined Spaces Regulations 1997*.

2 WHO IS THE GUIDANCE AIMED AT?

This guidance is aimed at those who manage activities which involve work in confined spaces.

3. WHAT IS MEANT BY A CONFINED SPACE?

A confined space can be any space of an enclosed nature where there is a risk of death or serious injury from:

- the presence or creation of hazardous substances (either gaseous, liquid or solid);
- the presence or creation of dangerous conditions (e.g. a lack of oxygen, flowing material etc.);
- the degree of difficulty in the removal of an incapacitated person in case of injury or ill health.

Examples of possible confined spaces at the University:

Storage tanks	Sewers	Combustion chambers in furnaces
Vats	Caves, mines and tunnels	Boilers
Open topped chambers	Ductwork	Trenches, excavations and pits
Enclosed drains	Subways	Particular experimental equipment

It is not possible to provide a comprehensive list of confined spaces. Some places may become *confined spaces* when particular work is carried out or during their construction, fabrication or subsequent modification.

Hot and cold rooms, dark rooms and clean rooms are not usually considered as confined spaces. However activities in these rooms should still be assessed and procedures put in place in case of emergency, e.g. the person working collapsing or being trapped inside.

4. WHAT ARE THE DANGERS FROM CONFINED SPACES?

Some dangers arise from the existing state of the confined space, others will arise due to the work being undertaken.

Lack of oxygen

This can occur:

- inside steel tanks and vessels when rust forms;
- by oxygen being displaced by other gases either:
    i. naturally (e.g. following the action of groundwater on chalk and limestone which produces carbon dioxide which displaces normal air), or
    ii. due to an industrial or experimental process;
- where there is a reaction between some soils and oxygen in the atmosphere;
- when oxygen is consumed during work (e.g. during certain types of welding work).

Poisonous gas, fume or vapour

These can:

- build up in sewers and manholes and in pits connected to the system;
- enter tanks or vessels from connecting pipes;
- leak into trenches and pits in contaminated land (e.g. old refuse tips, gas works etc.);
- be produced by chemicals reacting together (e.g. cleaning agents);
- be produced by residues left in tanks, vessels etc. or remaining on internal surfaces or by disturbing liquids or solids that may be present;
- be produced by the work being undertaken (e.g. from welding or the use of volatile solvents, adhesives etc.).

Dust

- may be present in very high concentrations leading to a risk of asphyxiation.

Liquids and free flowing solids (e.g. grain):

- These can suddenly fill the space when disturbed;
- free flowing solids can partially solidify or ‘bridge’ and then collapse suddenly.

Fire and explosion

May be caused by:

- the ignition of flammable vapours, gases, solvents, dust, etc. by a naked flame, friction, electrical arcing or static electricity, especially if there is an excess oxygen;

- hot work (e.g. welding) igniting the structure;
- chemical reaction.

Electric shock

Due to the use of electrical equipment:

- in wet or damp conditions,
- when working in metal enclosures.

Hot conditions

- may lead to a dangerous increase in body temperature and subsequent collapse etc.

Lack of space

may lead to injury through:

- contact with equipment etc;
- strains due to working, lifting awkwardly;
- being unable to move away in case of danger.

Confined and difficult entry and exit routes:

- can lead to a risk of falling off ladders etc.;
- difficulty in rescuing anyone who may be injured, unconscious etc.

5. ASSESSING THE RISKS

Before starting any work in a confined space a risk assessment should be carried, as required by the University Health and Safety Policy (UHSP/0/97). The risk assessment should consider the location and condition of the confined space and the work to be carried out in it. This means identifying all the hazards, making an assessment and determining what precautions to take.

Consideration should be made of:

- the task;
- the working environment;
- working materials and tools;
- the suitability of those carrying out the task;
- arrangements for emergency rescue.

If the assessment identifies risks of serious injury from working in a confined space then if at all possible entry into the confined space should be avoided.

AVOIDING ENTRY TO CONFINED SPACES

Check if the work can be done another way so that entry or work in confined spaces is avoided. Better work planning or a different approach can reduce the need for confined space working.

Decide if the intended work is really necessary, or could:

- the confined space itself be modified so that entry is not necessary;
- the work done from outside, e.g.:
    i. blockages may be able to be cleared by use of remotely operated rotating flail devices, vibrators or air purgers;
    ii. inspection, sampling and cleaning operations may be able to be done from outside the space using appropriate equipment and tools;
    iii. remote cameras may be able to be used for internal inspection of vessels.

If it is not possible to avoid entry to a confined space then, before work starts, there must be a safe system of work and adequate emergency procedures must be in place.

IF ENTRY TO A CONFINED SPACE CANNOT BE AVOIDED

If entry cannot be avoided into a confined space then it is necessary to have a safe system of work for entering and working inside the space.

The results of the risk assessment will identify the necessary precautions required to reduce the risk of injury and ill health. The precautions will depend on the nature of the confined space, the associated risk and the work involved.

The safe system of work, including the precautions identified, should be developed and put into practice. Everyone involved will need to be properly trained and instructed to make sure they know what to do and how to do it safely.

Appendix 1 is a checklist of the essential elements to be considered to help prepare a safe system of work.

Before work in confined spaces is carried out it is strongly advised that the Health and Safety Unit is consulted.

6. EMERGENCY PROCEDURES

When things go wrong, people may be exposed to serious and immediate danger. Effective arrangements for raising the alarm and carrying out rescue operations in an emergency are essential.

Emergency plans will depend on the nature of the confined space, the risks identified and consequently the likely nature of an emergency rescue. **The responsibility for rescue lies with those who organise the work and not the emergency services.**

Appendix 2 is a checklist of the essential elements that should be included in any emergency procedure.

APPENDIX 1

CHECKLIST FOR A SAFE SYSTEM OF WORK IN A CONFINED SPACE

Has a person been appointed to oversee the work?

This person should be given responsibility to ensure that the necessary precautions are taken and to ensure safety at each stage of the work. They may need to remain present whilst work is in progress.

Are persons suitable for the work?

- Do they have sufficient experience of the type of work to be carried out, and what instruction and training have they received?
- Where risk assessment highlights exceptional constraints as a result of the physical layout, are individuals of suitable build?
- Are they generally fit enough?
- Other factors may need to be considered, e.g. concerning claustrophobia, and medical advice on an individual's suitability.

Is isolation of equipment necessary?

Mechanical and electrical isolation of equipment is essential if it could otherwise operate, or be operated inadvertently. If gas, fume or vapour could enter the confined space, physical isolation of pipework etc. needs to be made. In all cases a check should be made to ensure isolation is effective. A permit to work system is essential.

Is cleaning necessary before entry?

This may be necessary to ensure fumes do not develop from residues etc. while the work is being done.

Is the size and position of the entrance suitable?

Is it large enough to allow workers wearing all the necessary equipment to climb in and out easily, and provide ready access and egress in an emergency?

Does the ventilation need improving?

It may be possible to increase the number of openings and therefore improve ventilation. Mechanical ventilation may be necessary to ensure an adequate supply of fresh air.

Warning: fumes in the exhaust from petrol and diesel engines are so dangerous that use of such equipment in confined spaces should never be allowed.

Care should also be taken when siting such equipment near a confined space as the fumes produced may enter the confined space.

Is it necessary to test the air?

This may be necessary to check that the air is free from both toxic and flammable vapours, that there is sufficient oxygen and that it is fit to breathe. Testing should be carried out by a competent person using suitable gas detection and oxygen deficiency monitoring equipment. Where the risk assessment indicates that conditions may change, or as a further precaution, continuous monitoring of the air may be necessary.
All detection and monitoring equipment must be correctly calibrated.

Is breathing apparatus required?

This is essential if the air inside the space cannot be made fit to breathe because of gas, fume or vapour present, or lack of oxygen. Never try to 'sweeten' the air in a confined space with oxygen as this can greatly increase the risk of a fire or explosion.
If breathing apparatus is required the work must be carried out by specialist contractors.

University personnel must not carry out work in confined spaces which requires the wearing of breathing apparatus.

Are special tools and lighting required?

Non-sparking tools and specially protected lighting are essential where flammable or potentially explosive atmospheres are likely. In certain confined spaces (e.g. inside metal tanks) suitable precautions to prevent electric shock include use of extra low voltage equipment (typically less than 25v) and, where necessary, residual current devices.

Are emergency arrangements in place?

These will need to cover the necessary equipment, training and practice drills. (See Appendix 2.) Remember the responsibility for effecting a rescue lies with those organising the work and not the emergency services. **If rescue from the confined space would be difficult then the work should not be carried out by University personnel but by specialist contractors or organisations.**

Are rescue harnesses provided?

Lifelines and associated lifting equipment attached to harnesses should run back to a point outside the confined space.

Are communications adequate?

An adequate communications system is needed to enable communication between people inside and outside the confined space and to summon help in an emergency.

How is the alarm to be raised?

It is necessary to station someone outside to keep watch and to communicate with anyone inside, raise the alarm quickly in an emergency, and take charge of the rescue procedures.

Is a 'permit-to-work' necessary?

A permit-to-work ensures a formal check is undertaken to ensure all the elements of a safe system of work are in place before people are allowed to enter or work in the confined space. It is also a means of communication between management, supervisors, and those carrying out the hazardous work.

Essential features of a permit-to-work are:
clear identification of who may authorise particular jobs (and any limits to their authority) and who is responsible for specifying the necessary precautions (e.g. isolation, air testing, emergency arrangements etc);

provision for ensuring that any contractors engaged to carry out work are included;

training and instruction in the issue of permits;

monitoring and auditing to ensure that the system works as intended.

APPENDIX 2

CHECKLIST FOR EMERGENCY PROCEDURES

Organisation

Who will take charge if an emergency arises? The supervisor should be appointed to take immediate charge until a nominated senior member of staff arrives.

Communications

Can an emergency be communicated from inside the confined space to people outside so that rescue procedures can start? Remember out of hours work, weekends and times when the University is closed, e.g. holidays. Also, consider what might happen and how the alarm can be raised.

Rescue and resuscitation equipment

Provision of suitable rescue and resuscitation equipment will depend on the likely emergencies identified. Where such equipment is provided for use by rescuers, training in correct operation is essential. Lifting gear may be required to lift a casualty to safety. This should be set up before work commences.

Capabilities of rescuers

There need to be properly trained people, sufficiently fit to carry out their task, ready at hand, and capable of using any equipment provided for rescue, e.g. lifelines and lifting gear and fire-fighting equipment. Rescuers also need to be protected against the cause of the emergency.

Shut down

It may be necessary to shut down adjacent plant before attempting emergency rescue.

First-aid procedures

Trained first aiders need to be available to make proper use of any necessary first-aid equipment provided.

Local emergency services

How are the local emergency services (e.g., fire service, cave rescue service etc.) made aware of an incident? What information about the particular dangers in the confined space is given to them on their arrival? Remember they cannot be relied on to effect a rescue.