TORBAY COUNCIL

Confined Spaces
Safe Working Practices

INTRODUCTION
Any person planning, authorising, directing or supervising work in 'CONFINED SPACES' must comply with the Confined Spaces Regulations 1997.

These notes highlight the main principles contained within HSE guidance. They must be read in conjunction with the full detail contained within IND(G) 258 Safe Work in Confined Spaces.

BACKGROUND
The term 'confined space' has a wide application throughout industry. Some situations are fairly obviously confined spaces, e.g. reaction vessels, closed tanks, large ducts, sewers, and enclosed drains, but others which are less obvious can be equally dangerous - e.g. open topped tanks and vats (particularly where heavier-than-air gases or vapours may be present), closed and unventilated rooms and medium-sized and large furnaces and ovens, in which dangerous accumulation of gases can build up because of the restricted air circulation even though the door is left open.

Dangerous concentrations of gases and vapours can arise from sources both within and without confined spaces. Examples are:-

Gas or vapour remaining from a process which has previously been carried on in the confined space.

Gas or vapour which enters the space from adjoining plant, from which it has not been effectively isolated.

Fumes emitted when sludge or other deposits are disturbed during cleaning.

Fumes produced by an operation being carried on inside the confined space, e.g. welding, flame cutting, lead lining, rubber lining, brush and spray painting, painting or moulding glass reinforced plastics, use of adhesives or solvents.

Oxygen enrichment of the atmosphere caused by operations which involve an excess of oxygen (e.g. oxy-propane cutting). The risk is of enhanced combustibility and possible spontaneous combustion.

Similarly dangerous situations can arise in confined spaces where the atmosphere may be deficient in oxygen. This could result from purging with an inert gas to remove flammable or toxic gas or vapour. It can also occur where a vessel, particularly one constructed of steel, is

left completely closed for some time, when the oxygen in the air can be depleted by the formation of oxidation products on the inside surface of the vessel. Oxygen deficiency in drains may be caused by ingress of methane or by absorption of oxygen by certain constituents of soils. In such circumstances the risk is one of asphyxiation.

In considering the possibility of dangerous gas or vapour being present, account should be taken of previous uses of the plant, as well as its use immediately prior to entry. Accidents have occurred as a result of previous storage of toxic materials and can also arise, for example, from the disturbance of solvent-laden sludge or residues, the heating of residues during welding operations and from possible reactions between residues and materials being used during the work (solvents, linings, paints).

Safe Working
Safe working in confined spaces where there is likely to be danger from gas or vapour, or where there is likely to be a deficiency of oxygen, depends entirely on strict adherence to a well-devised system of precautions. As it is essential that such precautions are followed without exception on every relevant occasion, the system is best laid down in writing in the form of a 'permit-to-work' system.

Permits-to-Work
A permit-to-work is essentially a document which sets out the work to be done and the precautions to be taken. It predetermines a safe procedure and is a clear record that all forseeable hazards have been considered in advance and that all appropriate precautions are defined and taken in correct sequence. It does not, in itself, make the job safe, but is dependent for its effectiveness on the persons concerned carrying it out conscientiously (see Appendix 1).

Contractors
Special care should be taken to ensure that contractors who may be engaged to carry out specific tasks are included in any permit-to-work system that may be operating. Contractors' employees and representatives may be completely unaware of the nature of any special risks inherent in process plant, inexperienced in the use of safety equipment, and ignorant of safety or rescue procedures. MANAGEMENT SHOULD THEREFORE MAKE OBSERVANCE OF WORKS SAFETY RULES AND PROCEDURES, INCLUDING PERMIT-TO-WORK SYSTEMS, A CONDITION OF THE CONTRACT FOR THE JOB, AND BE PREPARED TO UNDERWRITE THIS WITH TRAINING, ADVICE AND PERSONNEL AS MAY BE NECESSARY.

In this respect it should be remembered that management has a duty in law to ensure a safe place of work, and safe means of access to that place of work, for every person employed or working in the area, including contractors' employees, and care should be taken to satisfy this responsibility.

SYSTEM OF WORK BASED ON THE USE OF A 'PERMIT-TO-WORK'
Assessment
The first and most important step is the assessment of the situation. This should be done by a responsible person who is experienced in the work, and where specialised plant is concerned, is thoroughly familiar with the relevant chemistry and engineering. The person appointed should be allowed sufficient time to consider each job, and personally check each stage of the action required in the issue of the permit.

The process of assessment should involve consideration of the work required to be done, the methods by which the work can be done, and the hazards inherent in the plant in relation to the work and to the method proposed.

In assessing the work and methods available, the first object should be to see whether entry into the plant by personnel is really necessary. Entry should be considered when no alternative method is available.

When entry must be made, the hazards to be considered should include not only those presented by the particular situation, previous uses and the work to be done, but also those which may be presented by proximity to other plant, processes or operations. An example of this would be where fumes might enter the area from a neighbouring source or process.

The ultimate object of the assessment of the situation is to determine what steps should be taken to make the job safe and what precautions should be adopted during the actual working.

A typical sequence of operations is shown in the diagram at Appendix 2.

Consideration
Considerations must include:-

The need to withdraw the plant or area of work from general service.

Isolate all dangerous services and routes of access to safeguard the work area.

Clean the area thoroughly and purge all possible hazardous substances to prevent the risk of explosion or asphyxiation due to lack of air/oxygen etc. Special care must be taken throughout the cleaning process.

After cleaning safely, test results, i.e. prove the area is safe for work. This may involve technical testing for gases and other toxic material. Confirm oxygen levels are adequate.

The person in charge must consider:-

Whether the space is safe for entry without breathing apparatus for a limited ‘safe’ period OR

Breathing apparatus and lifeline should be worn.

STATUTORY DUTY
The employer, through his representative (manager or supervisor) has certain legal obligations for work involving entry into confined spaces. They are summarised in the following paragraphs.

ENTRY INTO A POSSIBLE FUME CONTAMINATED ATMOSPHERE
No-one may enter or remain for any purpose in a confined space which has at any time contained or is likely to contain fumes liable to cause a person to be overcome, unless:

1. He is wearing suitable breathing apparatus.

2. He has been authorised to enter by a responsible person.

3. He is wearing a belt with a rope securely attached.

4. A person keeping watch outside and capable of pulling him out is holding the free end of the rope.

5. A person is standing by fully equipped with breathing apparatus and protective clothing in case of emergency.

6. There is a method of communication.

7. There is a plan for emergency procedures which include:-

    - Rescue and resuscitation equipment
    - Raising the alarm and rescue
    - Safeguarding the rescued
    - Fire safety
    - Control of plant
    - First Aid
    - Public emergency services
    - Communication
    - Training

Alternatively, a person may enter or work in a confined space without breathing apparatus provided that:

1. Effective steps have been taken to avoid ingress of dangerous fumes.

2. Sludge or other deposits liable to give off dangerous fumes have been removed.

3. The space contains no other material liable to give off such fumes.

4. The space has been adequately ventilated and tested for fumes.

5. There is a supply of air adequate for respiration.

6. The space has been certified by a responsible person as being safe for entry for a specified period without breathing apparatus.

7. Items 2-7 for entry with breathing apparatus still apply.

The person who enters the confined space must be warned when the safe period specified in para 6 above will expire. In all cases a sufficient supply of approved breathing apparatus, belts and ropes, and suitable reviving apparatus and oxygen must be kept readily available, properly maintained and regularly examined.

OXYGEN DEFICIENT ATMOSPHERES

No-one may enter or remain in a confined space in which the atmosphere is liable to be deficient in oxygen unless either he is wearing a suitable breathing apparatus, or the space has

been and remains adequately ventilated and a responsible person has tested and certified it as safe for entry without breathing apparatus.

MANHOLE OPENINGS INTO CONFINED SPACES
Unless there is other adequate means of egress, confined spaces should be provided with manholes having a minimum clear opening of 24ins (600mm). In the case of tank wagons and other mobile plant the minimum dimensions at 16 ins by 14 ins (407mm x 356mm) or, if circular 16 ins (407mm) in diameter.

It should be appreciated that these are minimum standards; it is desirable that they should be exceeded whenever possible.

OTHER PRECAUTIONS
Where there is a danger of static discharge causing a fire or explosion, special precautions, e.g. earthing and bonding of trunking and/or airlines to the metalwork of the confined space should be taken.

It will often be necessary to carry out further testing of the atmosphere inside the confined space whilst work is in progress. Such tests are necessary to ensure that the atmosphere remains safe and that the ventilation is adequate.

Whilst a worker is inside a confined space he should be kept under constant observation by an attendant outside. If the worker is wearing a lifeline, care should be taken to ensure that it does not become entangled on pipes and fittings inside the plant.

According to the nature of the work and the risk, the working spell should be interrupted by rest periods, during which the worker is able to leave the space and be in the open air. He must, in any case, leave the space when the time limit stated on the permit-to-work has expired.

BREATHING APPARATUS
Only suitably approved self-contained breathing apparatus must be used.

The breathing apparatus must consist of a properly fitted helmet or face-piece with necessary connections to an approved supply of ordinary air.

The breathing apparatus should be well fitting and properly worn. When using an airline type of breathing apparatus, take filtered air from a supply under positive pressure at the inside of the face-piece.

Apparatus of the canister respirator or cartridge type should NOT be used. Such equipment does not provide adequate protection against high concentrations of contaminants, and is useless in atmospheres where there is a deficiency of oxygen.

ADDITIONAL SAFEGUARDS
In addition to wearing breathing apparatus the person entering the confined space should, where practicable, wear a safety harness and lifeline, and the free end of the line should be held by a person outside the space. The person outside should be in constant attendance when work is being done inside the confined space, and be capable of pulling the person inside the space out of it in case of emergencies. The harness and line should be so adjusted and worn

that the wearer can be drawn up head first through any manhole or opening. An armlet attached to the lifeline and fastened to the wrist or forearm of the wearer is one method of enabling this to be done easily. The harness of the lifeline should be of suitable construction (e.g. to BS1397: 1967) and the lifeline should be made of suitable rope (e.g. to BS3776: 1964) so that they are well able to stand the strain likely to be imposed on them.

Flammable and/or explosive gases or vapours may pose special problems when work is being done by persons wearing breathing apparatus. It is essential that the concentration of a flammable gas or vapour is not allowed to rise above one quarter of its lower explosive limit. The adequacy of the ventilation should be assessed by testing the atmosphere with a correctly calibrated explosimeter.

EMERGENCY PROCEDURES

Equipment and trained personnel should be readily available for rescue purposes at all times when a person is inside a confined space. Training and practice in rescue techniques is essential. In addition, whenever possible, other workers should be within call so that they can be summoned to assist in the lifting. The equipment available should include additional sets of breathing apparatus, lifelines and reviving apparatus and oxygen, and the man keeping watch outside the confined space should be capable of summoning assistance rapidly in emergencies.

If entry has been allowed without breathing apparatus, and the person inside has been overcome, it should be assumed that entry for rescue is unsafe without breathing apparatus. Oxygen should NOT be used to improve the atmosphere inside a confined space after a person has been overcome.

TRAINING

Training is necessary for supervisors, persons likely to enter confined spaces to carry out work, attendants, and a rescue team. All persons in such positions must be properly trained in:-

1. Use of the equipment provided, including a knowledge of its construction and working.

2. Check procedures when donning apparatus.

3. How to deal with malfunctions and failures of equipment during use.

4. Works; emergency procedures

5. Artificial respiration.

6. The purpose, use and termination of a ‘Permit-to-Work’.

All personnel likely to be concerned with entry into confined spaces must be made fully aware of the dangers involved and the precautions to be taken.

The training should be reinforced by practices, particularly rescue practices, and refresher courses, talks, etc. should be given as necessary.

The monthly examination of the equipment should be made by a competent person, who should sign a report containing the following particulars:-

1. The employers' name and occupation.

2. The address of the site or premises.

3. In the case of breathing apparatus or reviving apparatus, the particulars of the type of apparatus and of the distinguishing number or mark together with a description sufficient to identify the apparatus, and the name of the maker.

4. In the case of a belt or rope, the distinguishing number or mark and a description sufficient to identify the belt or rope.

5. The date of the examination and by whom it was carried out.

6. The condition of the apparatus, belt or rope, and particulars of any defect found at the examination.

7. In the case of a compressed oxygen apparatus, a compressed air apparatus or a reviving apparatus, the pressure of oxygen or air as the case may be, in the supply cylinder. Atmospheric testing and sampling equipment, oxygen meters, explosimeters, any special ventilating equipment, etc. should also be regularly maintained, and, where applicable, calibrated. Where manufacturer's recommendations are available these should be followed. It is particularly important that explosimeters are well maintained and frequently calibrated.

For further information:-
See also:
- Permit-to-Work
- Competent person
- Sewer Foremen etc.

PERMIT TO WORK CERTIFICATE

PLANT DETAILS (location, identifying number, etc) WORK TO BE DONE		ACCEPTANCE OF CERTIFICATE	**I have read and understood this certificate and will undertake to work in accordance with the conditions in it.** Signed: Date: Time:
WITHDRAWAL FROM SERVICE	The above plant has been removed from service and persons under my supervision have been informed Signed: Date: Time:	COMPLETION OF WORK	**The work has been completed and all personnel under my supervision, materials and equipment have been withdrawn**. Signed: Date: Time:
ISOLATION	The above plant has been isolated from all sources of ingress of dangerous fumes, etc. Signed: The above plant has been isolated from all sources of electrical and mechanical power. Signed: The above plant has been isolated from all sources of heat Signed: Date: Time:	REQUEST FOR EXTENSION	**The work has not been completed and permission to continue is requested** Signed: Date: Time:
CLEANING AND PURGING	The above plant has been freed of dangerous materials Material(s) Method(s) Signed: Date: Time:	EXTENSION	**I have re-examined the plant detailed above and confirm that the certificate may be extended to expire at**: Further precautions: Signed: Date: Time:
TESTING	Contaminants tested: Results: Signed: Date: Time:	CANCELLATION	**The permit to work is now cancelled. a new permit will be required if work is to continue** Signed: Date: Time:
I certify that I have personally examined the plant detailed above and satisfied myself that the above particulars are correct. (1) **The plant is safe for entry without breathing apparatus*** (2) **Breathing apparatus must be worn*** Other precautions necessary: Time of expiry of certificate: Signed: Date: Time		RETURN TO SERVICE	**I accept the above plant back into service** Signed: Date: Time:

*Delete (1) or (2)

Appendix 2

CONFINED SPACES
SEQUENCE OF WORK