

Code of Practice

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Safety and Health at Work in Confined Spaces



Occupational Safety and Health Branch
Labour Department

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This Code of Practice is prepared by the
Occupational Safety and Health Branch
Labour Department

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1. Introduction

- 1.1 This Code of Practice aims at providing practical guidance and technical information for proprietors, contractors and the persons of any industrial undertakings so as to ensure the safety and health of all persons who would enter into or work in confined spaces. The advice and safety practices mentioned in this Code of Practice should *not* be considered as exhaustive to cover all legal requirements under the relevant safety and health regulations for the operation in confined spaces, nor it is intended to relieve the persons concerned with confined space work of their statutory responsibilities.
- 1.2 This code is issued by the Commissioner for Labour under Section 7A of the Factories and Industrial Undertakings Ordinance (Cap. 59) for the purpose of providing practical guidance in respect of the provisions of the Factories and Industrial Undertakings (Confined Spaces) Regulation (hereinafter called the “Regulation”).
- 1.3 This Code of Practice has a special legal status. Although failure to observe any provision of the Code of Practice is not itself an offence, that failure may be taken by a court in criminal proceedings as a relevant factor in determining whether or not a person has breached the relevant safety and health legislation under the Factories and Industrial Undertakings Ordinance.
- 1.4 The statutory provisions to which reference has been made in this code are in force as at 19 June 2000.

2. Interpretation

- 2.1 The Factories & Industrial Undertakings (Confined Spaces) Regulation (*F&IU(Confined Spaces) Reg.*) regulates work that takes place within a confined space in an industrial undertaking; and work that takes place in the immediate vicinity of, and is associated with work occurring within, a confined space (*sec. 3 of F&IU(Confined Spaces) Reg.*).
- 2.2 The terms used in this Code shall have the same meaning as those in the Factories & Industrial Undertakings (Confined Spaces) Regulation. For the purpose of this Code of Practice,
- “atmosphere” (大氣) refers to the gases, vapours, dusts, fumes or mists within a confined space.
- “hazard” (危害) is something with the potential to cause harm (this could include any atmospheric hazards, hazards from in-rush of mud or water, hazards from machines, substances or job methods, and other aspects of work in a confined space).
- “risk” (危險) expresses the likelihood that the harm from a particular hazard is realized and the severity of the harm.
- 2.3 For the definitions of “industrial undertaking”, “proprietor” and “contractor”, please refer to the Factories & Industrial Undertakings Ordinance (Cap.59).
- 2.4 Under the Regulation, a “confined space” is defined to mean any place in which, by virtue of its enclosed nature, there arises a reasonably foreseeable specified risk, and without limiting the generality of the foregoing, includes any chamber, tank, vat, pit, well, sewer, tunnel, pipe, flue, boiler, pressure receiver, hatch, caisson, shaft or silo in which such risk arises (*sec. 2 of F&IU(Confined Spaces) Reg.*).

- 2.5 Places having an enclosed nature, such as ducts, vessels, culverts, boreholes, bored piles, manholes, excavations, sumps, inspection pits, cofferdams, freight containers, ship cargo holds/tanks, ballast tanks, double bottoms, ships' engine rooms, buildings, building voids, some enclosed rooms (particularly plant rooms) and compartments within them, including some cellars and interiors of machines, plant or vehicles, and other places such as open-topped tanks and vats, wells, hatches, caissons, shafts, closed and unventilated or inadequately ventilated rooms, or constructions during their manufacture, may by reason of its construction, location or contents give rise to the specified risks.
- 2.6 Some places may, due to the work to be undertaken or a change in the condition inside the space or a change in the degree of enclosure or confinement, give rise to a specified risk.
- 2.7 The major hazards associated with the entry into or working in confined spaces arise through the combination of the confined nature of the place of work and the possible presence of substances or conditions which, taken together, could lead to the specified risks which threaten the safety and health of workers entering or staying in the confined space. The major hazards in a confined space include the presence of the following:
- (a) a flammable, explosive or oxygen enriched atmosphere;
 - (b) a harmful or toxic atmosphere;
 - (c) an oxygen deficient atmosphere;
 - (d) free flowing solids or liquids; and
 - (e) excessive heat.

The threats against the safety and health of workers include:-

- (a) serious injury arising from a fire or explosion;
- (b) loss of consciousness arising from an increase in body temperature caused by, for example, heat stress in the work environment;
- (c) loss of consciousness or asphyxiation arising from gas, fume, vapour or the lack of oxygen;
- (d) drowning arising from an increase in the level of liquid; or
- (e) asphyxiation arising from a free flowing solid or the inability to reach a respirable environment due to entrapment by a free flowing solid.

3. Responsibilities

- 3.1 To secure safety and health at work in a confined space, it requires the full commitment and co-operation of every party concerned. It is the duty of the proprietor or contractor responsible for a confined space to ensure that every operation in the confined space is safe and without risk to the personnel working inside, or in the vicinity of, the space. On the other hand, every person employed for the confined space work is required to co-operate with the proprietor or contractor to take reasonable care for the safety and health of not only himself, but also of other persons who may be affected by his acts or omissions at work.
- 3.2 A safe system of work should be established by the proprietor or contractor responsible for the space for every operation in a confined space. The system of work should include, but not limited to, the effective implementation of the following:
- to appoint a competent person to carry out risk assessment for work in the confined space and make recommendations on safety and health measures before undertaking the work (*sec. 5(1) of F&IU(Confined Spaces) Reg.*);
 - to ensure that all safety precautions as required under section 7 of the Regulation were carried out (*sec. 7 of F&IU(Confined Spaces) Reg.*);
 - to issue a certificate stating that all necessary precautions have been taken and specifying the period during which worker may remain safely in the confined space before a worker enters a confined space (*sec. 6(1)(iii) of F&IU(Confined Spaces) Reg.*);
 - to ensure that no workers other than certified workers enter or work in the confined space (*sec. 8(a) of F&IU(Confined Spaces) Reg.*);

- to ensure that a person is stationed outside the confined space to maintain communication with the workers inside (*sec. 8(b) of F&IU(Confined Spaces) Reg.*);
- to ensure the use of an approved breathing apparatus and other necessary personal protective equipment by worker inside the confined space (*sec. 9(i) and (ii) of F&IU(Confined Spaces) Reg.*);
- to formulate and implement appropriate procedures to deal with any serious and imminent danger to workers inside the confined space (*sec. 10(1) of F&IU(Confined Spaces) Reg.*);
- to provide necessary instructions, training and advice to all workers within a confined space or assisting with such work from immediately outside the confined space (*sec. 11(1) of F&IU(Confined Spaces) Reg.*).

3.3 The workers at a confined space should:

- observe the procedures as may be implemented by the proprietor or contractor (*sec. 13(a) of F&IU(Confined Spaces) Reg.*);
- observe the instructions and advice and attend the training as may be provided by the proprietor or contractor (*sec. 13(b) of F&IU(Confined Spaces) Reg.*);
- make full and proper use of, and forthwith report to the proprietor or contractor any fault or defect in, any safety equipment or emergency facilities provided under the Regulation (*sec. 13(c) of F&IU(Confined Spaces) Reg.*).

4. Certified Worker & Competent Person

- 4.1 To be competent to work safely in confined spaces, adequate training and experience in the work involved is essential. Training standards should be appropriate to the task, and to the individual's roles and responsibilities, so that work can be carried out safely.
- 4.2 Before a person is allowed to work in confined space as a certified worker, he is required to attend an approved safety training course in connection with confined space work and holds a relevant certificate (*sec. 8(a) and 2 of F&IU(Confined Spaces) Reg.*).
- 4.3 Before a person is allowed to carry out the duties as a competent person, he is required to attend an approved safety training course in connection with confined space work and holds a relevant certificate (*sec. 2 of F&IU(Confined Spaces) Reg.*).
- 4.4 The Commissioner for Labour will approve suitable training providers to offer such training courses and will authorize them to issue the relevant certificates for certified workers and competent persons. Guidelines for application for approval in respect of the training courses can be obtained from the Occupational Safety & Health Training Centre of the Labour Department. An up-to-date list of the approved training providers is available at the Occupational Safety and Health Training Centre.
- 4.5 A proprietor or contractor can organise training courses for his staff to become competent persons and certified workers, as far as the courses have been approved or accredited by the Commissioner for Labour.

- 4.6 The training provider should not issue a certificate for certified workers unless the worker has successfully completed a course that has been approved by the Commissioner for Labour in respect of safety and health while working in confined space (*sec. 4(1) of F&IU(Confined Spaces) Reg.*).
- 4.7 The training provider should not issue a certificate for competent persons unless the person has successfully completed a course that has been approved by the Commissioner for Labour in respect of preparing risk assessment reports (*sec. 4(2) of F&IU(Confined Spaces) Reg.*).

5. Risk Assessment & Recommendations

- 5.1 In view of the risk involved, working in confined spaces should be avoided as far as possible.
- 5.2 If it is not reasonably practicable to carry out the work without entering a confined space, then the proprietor or contractor responsible for the work undertaken in the confined space should appoint a competent person to carry out a risk assessment to identify the hazards likely to be present in the confined space, and to recommend necessary precautions to be taken, before allowing the workers to enter into and work in that space so as to ensure their safety and health.
- 5.3 The risk assessment should identify the hazards to the workers entering or working in the confined space, and also, for example, to the workers in the vicinity who could be affected by the work to be undertaken. The hazards to be considered should include not only those arising from the materials and substances present, or likely to be present in the confined space concerned, its previous uses and the work to be done, but also those which may be present by its proximity to other plants, processes and operations.
- 5.4 The process of a risk assessment should include a systematic examination and careful consideration of all the work activities required to be done, the previous contents in the confined space, the methods by which the work could be done, and the hazards inherent in the confined space in relation to the work, to the method proposed and to the design or construction of the confined space itself (including the layout and location of the confined space).
- 5.5 Before carrying out the risk assessment, all information about the confined space and the work to be taken in it should be gathered. For example, there may be information from the engineering drawings, working plans,

figures, photos or reports about relevant soil or geological conditions. Where necessary, a proper site investigation should be arranged to the actual spot of the confined space so as to have a more thorough knowledge about the nature and circumstances, in particular its effect on safety and health matters.

5.6 For identifying all the possible hazards which may be present in the confined space and evaluating fully the extent of all those associated risks, the risk assessment should cover the following aspects (*sec. 5(2)(a) of F&IU(Confined Spaces)Reg.*):

- (a) the work method to be used and the plant and materials to be used in work activities;
- (b) whether or not there is any hazardous gas, vapour, dust or fume present;
- (c) whether or not there is any deficiency in oxygen;
- (d) the possibility of ingress of hazardous gas, vapour, dust or fume;
- (e) the possibility of sludge or other deposits being present that are liable to give off hazardous gas, vapour, dust or fume;
- (f) the possibility of in-rush of free flowing solid or liquid;
- (g) the possibility of fire or explosion in the confined space; and
- (h) the possibility of loss of consciousness of a certified worker arising from an increase in body temperature.

5.7 The risk assessment report should also cover the following:

- (a) the recommendations on the measures required, including whether or not the use of approved breathing apparatus is necessary, having regard to the nature and duration of the work to be performed therein (*sec. 5(2)(b) of F&IU(Confined Spaces)Reg.*); and
- (b) the period during which workers may remain safely in the confined space (*sec. 5(2)(c) of F&IU(Confined Spaces)Reg.*).

- 5.8 The size and number of access and egress points should be assessed individually dependent upon the activities to be carried out and the number of people involved. To determine the locations of manholes or openings to vessels, tanks, etc., due consideration should be given to the possible difficulties for access to and rescue from the confined space. There may be occasions when access and egress is so tortuous that temporary openings may be needed. Different criteria should be applied when determining manhole dimensions for a confined space that extends over a significant length or height, as in the case of sewers, pipes, culverts, small tunnels or shafts. Measures to improve access such as structural alterations to the confined space could be considered. The spacing of manholes on sewers and the absence of such access over considerable lengths may affect both the degree of natural ventilation and the efficiency to rescue.
- 5.9 The recommendations on the necessary safety measures should include whether the use of approved breathing apparatus is necessary so as to render the confined space safe for workers to stay inside. When there is any doubt as to the possible concentration level of the harmful atmosphere in a confined space, suitable and approved breathing apparatus should be used and the other necessary safety precautions should be taken accordingly. Provisions regarding the use of breathing apparatus are set out in Chapter 9 of this Code.
- 5.10 When making recommendations regarding a confined space work, an important consideration is how the worker can be safely rescued from the confined space in case of emergency.

- 5.11 During the risk assessment, if the competent person considers that there is a known possibility of adverse changes of working conditions, he should recommend a continuous monitoring or periodical monitoring of the working environment. The purpose is to ensure that the ventilation is adequate and that the atmosphere remains safe for working inside the confined space. The exact testing, retesting and monitoring requirement should be determined by the competent person.
- 5.12 In case it is possible that flammable or explosive gases or vapours would be present in the confined space, the equipment for atmospheric monitoring of the gases or vapours should be of the explosion proof type. It should have both visual and audible alarms so that it can alert workers if a hazardous situation exists or is developing in the confined space.
- 5.13 All the monitoring equipment used in connection with the atmospheric monitoring should be properly maintained and be calibrated periodically as per the recommendation of the manufacturer or supplier for accurate testing functions.
- 5.14 The risk assessment for confined space work should be repeated whenever necessary. The proprietor or contractor shall appoint a competent person to carry out a fresh risk assessment and make recommendations whenever there has been a significant change in the conditions of the confined space or of the work activities therein to which the previous assessment relates, or where there is reason to suspect that such change may occur, and that the change is likely to affect the safety and health of the workers therein (*sec. 5(5) of F&IU(Confined Spaces)Reg.*). Such changes may include, e.g. for sewers, the increase in the level of sewage or storm-water due to sudden rainfall, the increase in tide level, the evolution of toxic gas due to disturbance of sludge or deposits in the place, etc. Risk assessment should also be repeated if there is any reason to suspect that the previous assessment is no longer valid.

- 5.15 All the significant findings of a risk assessment should be recorded by the competent person in a risk assessment report, including the hazards identified, the necessary safety precautions to be taken, the type and the number of workers being affected, the period during which workers may remain safely in the confined space and the particulars of the competent person who has carried out the risk assessment.
- 5.16 The competent person should make available the risk assessment reports and recommendations to the proprietor or contractor within a reasonable time after the request for the reports and recommendations was made by the proprietor or contractor (*sec. 5(6) of F&IU(Confined Spaces) Reg.*), but it must be given before the proprietor or contractor allows the workers to enter into the confined space.
- 5.17 The completed risk assessment report for confined space work should be submitted to the proprietor or contractor of the industrial undertaking for his consideration for the issue of a certificate before the confined space work is carried out. Provisions regarding the issue of the certificate by the proprietor or contractor are set out in Chapter 6 of this Code.
- 5.18 There may be other work-related hazards for working in confined spaces arising out of, for example, electricity, welding, dangerous substances, noise and dust, etc. The competent person should recommend necessary safety precautions for work to be carried out in confined space having regard to the usually restrictive, and sometimes electrically conductive, nature of a confined space. Please refer to the other relevant code of practice and guidance materials.

6. Compliance with Risk Assessment Report and Issuance of Certificate

- 6.1 Entry into a confined space for work should be permitted only after the issue of a valid certificate by the proprietor or contractor of the industrial undertaking within which the confined space work is carried out.
- 6.2 The proprietor or contractor of the confined space work, after receiving a risk assessment report completed by the competent person, should then consider issuing a certificate. Such certificate should specify the location and types of work to be done, and should state:
- (a) that all necessary safety precautions in relation to the hazards identified in the risk assessment report have been taken (*sec. 6(1)(a)(iii)A of F&IU(Confined Spaces)Reg.*); and
 - (b) the period during which workers may remain safely in the confined space (*sec. 6(1)(a)(iii)B of F&IU(Confined Spaces)Reg.*).
- 6.3 The proprietor or contractor should take suitable and sufficient steps to ensure that the safety precautions taken for entering the confined space have been continuously and effectively maintained. During the period when the workers temporarily left the confined space for lunch, tea breaks, etc., subject to paragraph 6.4, the certificate would remain valid and a fresh assessment would not be required after the short break. Otherwise, a fresh assessment and issuance of certificate would be required before allowing the workers to re-enter the confined space.
- 6.4 Notwithstanding paragraph 6.3, the proprietor or contractor is reminded that a fresh assessment would be required from time to time should there be significant change of conditions likely to affect the safety and health of workers in the confined space. Furthermore, after receiving a fresh assessment report, the proprietor or contractor should issue a certificate accordingly before allowing the workers to enter the confined space.

- 6.5 The records of all certificates should be adequately maintained. The items in the certificates should be written or printed in permanent ink or otherwise so as to be indelible.
- 6.6 The certificate mentioned above should be kept for one year after the work in the confined space has been completed and be made available for inspection at all reasonable time (*sec. 6(2) of F&IU (Confined Spaces) Reg.*).
- 6.7 To facilitate risk assessment, a “Permit-to-work” system is recommended. A proprietor or contractor may set out in a “Permit-to-work” certificate the work to be done and items to be checked before entering a confined space and the necessary precautions to be taken to ensure safety and health at work in confined space. It reminds the proprietor or contractor to ensure that all foreseeable hazards and associated risks have been considered in advance and that all the necessary safety precautions are clearly defined and have been effectively taken. A sample of a “Permit-to-work” certificate is included in Appendix I of this Code of Practice.
- 6.8 A proprietor or contractor may make use of the “Permit-to-work” system for double checking the items made in risk assessment report and the certificate issued by them before commencement of work.

7. Safety Precautions Before Work Begins

7.1 A proprietor or contractor should ensure that no worker enters a confined space for work unless before the work begins, safety precautions including, but not limited to, isolation, purging, atmospheric testing and ventilation have been taken.

7.2 Isolation

7.2.1 The proprietor or contractor should, before allowing workers to enter a confined space, ensure that the confined space has been securely and completely isolated and separated from all the other connecting parts so as to prevent any materials which are liable to create a hazard from entering a confined space.

7.2.2 All the points of isolation should remain fully secure to ensure that the dangerous materials will not go into the confined space whilst the workers are working in it.

7.2.3 The confined space should be isolated from all unnecessary sources of power, e.g. electrical, mechanical, pneumatic, hydraulic, etc., by having them securely locked off, isolated and properly labelled as appropriate to avoid accidental switching of power back to the confined space.

7.2.4 All pipelines connected to a confined space should be completely shut off or blanked off as appropriate. All connected valves should be fully closed, locked off and properly labelled as appropriate to prevent being opened without authorization or accidentally.

7.2.5 Ends of service pipes which are still connected to sources of dangerous fume should be properly sealed by means of, e.g. metal blank, end-cap.

- 7.2.6 No work which may jeopardize the safety of workers inside a confined space should be permitted to be carried out outside and in the vicinity of the confined space. Barriers should be erected outside access openings of the confined space, with suitable warning signs and notices displayed. This is particularly important for floor openings, where hazards may arise from liquid spills, e.g. flammable liquid, solvents, or from sparks created by cutting or welding in the vicinity.
- 7.2.7 Openings in a confined space (e.g. drain holes) should be sealed off if there is any possibility of hazardous gases or vapours backing up from another area and contaminating the confined space.
- 7.2.8 The confined space should be isolated from all non-essential sources of heat.
- 7.2.9 Effective steps should be taken to prevent an ingress to the confined space of hazardous gas, vapour, dust or fume, or in-rush of mud, water or other free flowing liquids and solids. Regarding in-rush of water, particular attention should be given to the possible sudden changes in water level in sewers due to rainfall in the catchment area, changes in tide levels, sudden discharge of floodwater into the drainage culverts, etc.

7.3 Purging

Having regard to the circumstances of a particular confined space, before the proprietor or contractor allows workers to enter into and work in a confined space, the confined space should be adequately purged by suitable method, such as steam cleaning, inert gas purging, forced ventilation, etc. to remove all the hazardous substances contained in the confined space.

7.3.1 Steam cleaning

7.3.1.1 Steam-volatile substances in confined spaces could be removed by steam cleaning.

7.3.1.2 For removal of corrosive materials, or materials which are not readily volatile, preliminary treatment by repeated washing with water, or with other suitable solvents or appropriate neutralizing agent should be applied prior to steaming.

7.3.1.3 The period of steaming should be adequate to thoroughly remove all the dangerous materials from the confined space. The required period should be decided and checked by the person who has been appointed by the proprietor of the industrial undertaking for the steaming work.

7.3.1.4 It would be necessary to re-steam where the confined space has been left for more than a few hours after steaming.

7.3.1.5 During steaming, adequate outlets for steam and condensate should be provided so that no dangerous pressure should be built up inside the confined space.

7.3.1.6 After steaming, adequate air inlets should be provided so that there should not be any vacuum being caused in the confined space by cooling and condensation. To prevent any heat stress problem, sufficient cooling of the confined space to room temperature is essential before allowing workers to enter the space.

7.3.1.7 When purging has been completed, all liquid remaining in the confined space should be drained away or pumped out as appropriate, and manholes should be opened to allow ventilation.

7.3.2 Inert gas purging

7.3.2.1 To avoid the formation of an explosive mixture with air when a confined space containing flammable gas or vapour is opened up, the confined space may be purged by an inert gas (e.g. nitrogen, carbon dioxide).

7.3.2.2 If persons have to enter or approach a confined space which has been purged by an inert gas, the confined space should be purged again by fresh air so as to provide adequate oxygen into the confined space to support life. Thereafter, all parts of the air-purged confined space should then be thoroughly tested against the deficiency of oxygen to make sure that there is adequate oxygen to support life.

7.4 Atmospheric Testing

7.4.1 Atmospheric testing of a confined space should be carried out as appropriate before it is certified as being safe to enter.

7.4.2 Atmospheric testing of a confined space should be done for the purposes of deciding and specifying the related safety precautions necessary to be taken upon entry into such a confined space.

7.4.3 A proprietor or contractor should prohibit a worker from entering into the confined space until initial testing of the atmosphere of the confined space has been properly done from outside, with the testing results showing that the atmosphere inside the confined space is safe for entry.

7.4.4 The atmospheric testing should include the testing of the oxygen content, the presence of flammable, toxic or harmful gases, fumes or vapours. Hazardous gases commonly found in confined spaces such as sewers, include carbon monoxide (CO), hydrogen sulphide (H₂S), methane (CH₄) and other flammable gases.

- 7.4.5 All atmospheric testing should be carried out by means of suitable testing equipment with correct testing methods. For instance, air at different levels and locations inside a confined space should be tested since dangerous gases with different densities relative to air may accumulate at different levels and locations of the confined space.
- 7.4.6 Atmospheric testing should be made outside the confined space, with air samples being drawn out by suitable sample probes.
- 7.4.7 The gas testing equipment used in atmospheric air testing should be of the explosion proof type.
- 7.4.8 In general, testing for oxygen should be performed first because most combustible gas testing meters are oxygen dependent and does not provide reliable readings in an oxygen deficient atmosphere.
- 7.4.9 All testing meters and equipment should be properly and correctly used for the purpose of atmospheric testing for confined space. The manufacturers' instruction manuals on the proper use of those meters and equipment should be strictly followed. All testing meters and equipment should be suitably calibrated and properly maintained as per the recommendations of the equipment manufacturers, with records properly kept.
- 7.4.10 The percentage of oxygen in a confined space should not be less than 19.5% by volume nor greater than 23% by volume at normal atmospheric pressure.
- 7.4.11 For the exposure limits of various dangerous gases, reference should be made to the publications made by the Labour Department, the Health and Safety Executive (HSE) of the UK, the American Conference of Governmental Industrial Hygienists' (ACGIH) and other relevant authorities on occupational exposure limits.

7.5 Ventilation

- 7.5.1 Adequate and effective ventilation should be maintained for supplying sufficient respirable fresh air for workers inside a confined space. In that respect, forced ventilation may be required instead of natural ventilation.
- 7.5.2 In deciding the ventilation air exchange rate, it should take into account that some work tasks, e.g. gas welding, consume oxygen and some tasks, e.g. paint spraying, contaminate the atmosphere. It would be required to provide adequate air change to remove the hazardous substances evolved and maintain sufficient fresh air supply while work is in progress.
- 7.5.3 The provision of ventilation to a confined space should not be considered as an alternative to the use of breathing apparatus where the atmosphere inside is likely to cause safety or health hazards to the workers therein.
- 7.5.4 In all cases of forced ventilation to supply fresh air into a confined space, the air-line or trunking should be introduced or extended to the bottom of the confined space, for removal of gases or vapours heavier than air and for effective air circulation.
- 7.5.5 Under no circumstances should oxygen be introduced into a confined space which would create a danger of oxygen enrichment in the atmosphere.
- 7.6 Notwithstanding the above, a proprietor or contractor should also take effective steps to prevent an ingress to the confined space of hazardous gas, vapour, dust or fume; and an in-rush into the confined space of free flowing solid or liquid (*sec.7(f) of F&IU(Confined Spaces) Reg.*). In that respect, particular attention has to be paid to any possible ingress, in-rush, spillage or leakage of the substances through the ingress, egress or openings of the confined space from areas or places surrounded.

8. Safety Precautions When Work Is Being Undertaken

- 8.1 A proprietor or contractor should ensure that all workers who enter or work in a confined space are certified workers (*sec. 8(a) of F&IU(Confined Spaces) Reg.*). When allocating work to confined space workers, every step should be taken to ensure that the demands of the work activities do not exceed the workers' skills and abilities to carry out the work without risks to themselves or others.
- 8.2 A proprietor or contractor should provide all necessary equipment to ensure the safety and health of workers working in a confined space (*sec. 11(2) of F&IU(Confined Spaces) Reg.*). The equipment should be properly selected in respect of their types, purposes, functions and applications. The equipment should also be suitably calibrated, regularly checked and properly maintained, with records properly kept.
- 8.3 When work is being carried out in a confined space by a certified worker, the proprietor or contractor should ensure that the relevant risk assessment report, with all its significant findings, are displayed in a conspicuous place at the entrance of the confined space. The related certificate should also be displayed in a conspicuous place at the entrance of the confined space (*sec. 8(c) of F&IU(Confined Spaces) Reg.*).
- 8.4 When work is being carried out in a confined space by a certified worker, another worker (the "standby person") should be assigned to station outside the confined space throughout the time of operation to maintain communication with the worker inside.
- 8.5 The standby person should be trained on how to maintain communication with those workers working inside the confined space.

- 8.6 The standby person should keep the workers inside the confined space informed of any change in environmental conditions that would adversely affect their safety in the confined space (e.g. heavy rain leading to flooding, emergencies such as fires, spillage of toxic, corrosive or flammable liquids, releasing of dangerous gases, power supply failure, failure of forced ventilation system, etc.).
- 8.7 Similarly the workers inside a confined space should keep the standby person informed should any dangerous situations arise inside the confined space so that the standby person can call for assistance.
- 8.8 A proprietor or contractor should ensure that the safety precautions, which are taken before work begins in the confined space, continue to be effective whilst the workers remain in the confined space.

9. Use of Personal Protective Equipment

- 9.1 Where the use of approved breathing apparatus is recommended in the relevant risk assessment report, the proprietor or the contractor should ensure that the following safety precautions, in addition to those mentioned in Chapters 7 and 8 of this Code, are taken:
- (a) a person entering or remaining in a confined space is properly wearing an approved breathing apparatus of a type that gives appropriate protection given the nature of the confined space (*sec. 9(i) of F&IU(Confined Spaces) Reg.*); and
 - (b) the person should be wearing a suitable safety harness connected to a lifeline that is strong enough to enable him to be pulled out, and that the free end is held by a person outside the confined space who has sufficient physical strength to be capable of pulling the person out of the confined space (*sec. 9(ii) of F&IU(Confined Spaces) Reg.*).
- 9.2 When workers enter into a confined space to carry out underground pipework, there may be additional hazards arising from the accidental leakage from the underground pipes, e.g. flammable gases, fuel oil, sewage, hazardous substances etc., into the confined space. Therefore, a proprietor or contractor should ensure that additional safety precautions set out in paragraph 9.1 are taken.
- 9.3 A proprietor or contractor should ensure that only approved breathing apparatus, that is breathing apparatus which has been approved by the Commissioner for Labour under section 12 of Factories and Industrial Undertakings (Confined Spaces) Regulation, should be used in connection with confined space work. The name or description of the type of breathing apparatus which has been approved by the Commissioner will be published in the Gazette.

- 9.4 The selection of a suitable approved breathing apparatus should depend upon the conditions, hazards, testing results of the confined space, and the work activities to be done inside the confined space.
- 9.5 All approved breathing apparatus to be used for entry into and work inside a confined space should well fit the workers and be properly worn.
- 9.6 It is strongly recommended that a proprietor or contractor should only allow those who are medically fit for using breathing apparatus to use breathing apparatus for entering into and working in a confined space.
- 9.7 The service time of self-contained type of approved breathing apparatus should be estimated having regard to the entry time, the consumption rate, the maximum working period, the estimated escape time and other relevant factors.
- 9.8 The quality of the breathing air supplied by an approved breathing apparatus should comply with the most up-to-date recognized international or national standard, e.g. British Standard BS 4275.
- 9.9 For air-line type of breathing apparatus, the air supply rate should be so adjusted that a positive pressure is always maintained inside the face-pieces.
- 9.10 To avoid contamination of the supply of air, the following precautions should be taken when using air-line type breathing apparatus:
- (a) The air supply equipment should be maintained according to manufacturer's instructions.
 - (b) The air intake should be properly located to avoid sucking-in of contaminated air such as engine exhaust.

- (c) The air supply equipment used should be designed for supplying breathing air. Those designed for industrial purposes are not allowed.
 - (d) Air hose which may be oil impregnated or otherwise contaminated should not be used.
- 9.11 All the breathing apparatus for use in confined spaces should be properly maintained in good working conditions.
- 9.12 The proprietor or contractor should ensure that sufficient number of persons are available outside the confined space for holding the free ends of the lifelines and, as far as practicable, make available suitable and sufficient mechanical aids for lifting and rescue.
- 9.13 The harness and life-line should both be of sound construction and be made of suitable materials so that they will be able to withstand the strain imposed on them during emergencies.
- 9.14 Reference should be made to recognized international standards such as British Standard BS EN 1496:1996 and BS EN 1497:1996 or equivalent when selecting rescue equipment, such as rescue harnesses and rescue lifting devices, for use in connection with confined space work.
- 9.15 The safety harness and rescue life-line should be so adjusted and worn that the wearer could be drawn up with head first through any manhole or opening of the confined space.
- 9.16 A proprietor or contractor should take steps to ensure that the rescue life-lines in use are free from any possible entanglement with, or damaged by, any pipes, fittings, protruding parts, sharp edges or other obstacles inside the confined space.

10. Emergency Procedures

- 10.1 A proprietor or contractor should formulate and implement appropriate procedures to deal with any serious and imminent danger to workers inside a confined space (*sec. 10(1) of F&IU(Confined Spaces) Reg.*).
- 10.2 A proprietor or contractor should set up arrangements for rescue of workers working in a confined space in case of an emergency. Arrangements for emergency rescue will depend on the nature of the confined space, the risks identified and the likely nature of an emergency rescue. Account has to be taken not only of accidents arising from a specified risk, but also any other accident, for example, incapacitation after a fall.
- 10.3 A rescue team consisting of sufficient number of trained persons, should be readily available. They should readily reach the confined space in time and be able to get the persons inside the confined space out in case of emergency.
- 10.4 As to the number of trained persons required in a rescue team, several factors, including the nature of work, the hazards inherent in the confined space in relation to the work and work methods proposed, need to be considered depending on the circumstances of the case. In devising an emergency plan, a proprietor or contractor should assess the above factors against the knowledge and experience of the rescue team in such work and recommend the most suitable number of rescue persons required.
- 10.5 All members of the rescue team should have been properly and adequately trained in the related emergency rescue procedures, including the detailed particulars of an emergency rescue plan and full knowledge on how to properly use all those rescue equipment.

- 10.6 Communication between the workers inside a confined space and the standby person should be maintained throughout the period when the workers are working inside the confined space. An audio and visual alarm system should be provided for the workers inside the confined space to alert the standby person, and vice versa, in case of emergency.
- 10.7 Even in case of emergency, the standby person should not enter the confined space. He should remain stationed outside the confined space and summon assistance of the rescue team and public emergency services (i.e. the Police and the Fire Services). He should stay outside the confined space and brief the rescue personnel of the relevant circumstances of the incident upon their arrival.
- 10.8 Suitable and sufficient rescue equipment, including standby approved breathing apparatus, safety harness, life-lines, reviving apparatus and emergency lighting, and properly trained rescue personnel should be readily available for rescue purposes at all times when workers are working inside a confined space. Rescue equipment provided should be appropriate in view of the likely emergencies identified in the risk assessment and be properly maintained. For the use of resuscitators, reference should be made to recognized international or national standard such as British Standard BS 6850:1987 Specification for Ventilatory Resuscitators or equivalent.
- 10.9 Where practicable, appropriate lifting equipment, e.g. rescue hoist or winch, split-leg tripod with a frame-mounted hoist and one-man access cradle should be available for rescue purposes.
- 10.10 A proprietor or contractor should devise an evacuation procedure for prompt evacuation from the confined space in case of a sudden change in the working or the environmental condition that may cause imminent danger to the workers working in a confined space.

- 10.11 An emergency response plan should be properly formulated, including all the suitable rescue arrangements and the appropriate emergency procedures, as stated in paragraphs 10.1 to 10.10, and adopted for each entry into a confined space.
- 10.12 Drills for the rescue and emergency procedures should be conducted periodically for testing of the emergency response plan, and for practising the procedures and use of rescue equipment.

11. Provision of Information, Instructions, Training etc.

- 11.1 A proprietor or contractor should provide adequate and suitable training to all persons involved, directly or indirectly, in confined space work, including workers working in a confined space, supervisors, management staff, standby persons, all members of the rescue team and other workers assisting with such work in the immediate vicinity of the confined space, so as to ensure the safety and health of all the persons involved in the confined space work activities.
- 11.2 All the workers involved in confined space work should be provided with adequate and suitable safety and health training:
- (a) when they are recruited by a proprietor or contractor of an industrial undertaking; and
 - (b) when they are exposed to new or increased risks due to change of responsibilities, introduction of a new work equipment or introduction of a new system of work.
- 11.3 The safety training provided by a proprietor or contractor to confined space workers should include, but not limited to, the following:
- (a) Induction safety training for all new employees to ensure a thorough safety orientation. Sufficient information of the confined space should be given to the employees, e.g. the nature of the work to be done, hazards involved and precautionary measures required;
 - (b) On-the-job safety training for those who have received induction safety training. On-the-job safety training should include observation of and participation in the actual work practices or in some simulated working conditions whilst under close supervision;

(c) Refresher safety training which should be conducted periodically and as frequently as needed. Re-training should also be provided to workers whose safety performance in work in confined space is found to be unsatisfactory.

- 11.4 The relevant information or instructions to be given to the workers should be capable of being understood by the workers or other relevant personnel, taking into account their knowledge and experience. Such information or instructions could be in written form, symbols, diagrams, notices or any other forms as appropriate, so long as they can be clearly understood by the workers and are relevant to the concerned confined space work.
- 11.5 Training should involve demonstrations and practical exercises. It is particularly important that workers are familiar with both the equipment and the procedures in the confined space work.
- 11.6 The standby persons, as mentioned in paragraph 8.4 of this code, should be trained on how to maintain communication with the workers inside the confined space and to call for support in case of emergency.
- 11.7 Members of the rescue team should be adequately and properly trained in rescue arrangements, emergency procedures, associated risks and correct use of all rescue equipment. They should also be instructed that oxygen gas should not be used to improve oxygen content inside a confined space in all situations. It is recommended that some members of the rescue team should be provided with first-aid training including cardiopulmonary resuscitation.

Appendix I Permit-to-Work System

- AI.1 A Permit-to-work system is a means to ensure the safety and health of the workers who enter and work in a confined space. The following paragraphs give a brief framework of the system. A sample of Permit-to-work certificate is included. Further guidance may be obtained from the Labour Department.
- AI.2 A proprietor or contractor of a confined space should issue to the workers a Permit-to-work certificate before allowing them to enter into or work in the confined space.
- AI.3 The Permit-to-work certificate should record the following:
- (a) the findings in the risk assessment report completed by the competent person;
 - (b) the effectiveness of the isolation and withdrawal from service;
 - (c) the amount of sludge or other deposits (if any) after cleaning;
 - (d) the results of the atmospheric testing;
 - (e) the nature of work to be done;
 - (f) the conditions and features of the confined space; and
 - (g) the period during which workers may remain safely in the confined space.
- AI.4 The proprietor or contractor of the confined space work, after receiving a risk assessment report completed by a competent person, should determine to issue a Permit-to-work certificate.
- AI.5 The Permit-to-work certificate should be properly signed for confirmation by the proprietor or contractor or persons authorized by him. The items in the certificate should be written in ink or otherwise so as to be indelible.

- AI.6 The contents of the Permit-to-work certificate should be clearly explained to all the workers and persons involved in the confined space work.
- AI.7 All the safety requirements, necessary precautions and relevant conditions or limitations stated in the Permit-to-work certificate should be strictly observed and followed by all the workers and persons involved in the confined space work.
- AI.8 The Permit-to-work certificate should be displayed conspicuously at the entrance of the confined space.
- AI.9 If the work has not yet been completed by the expiry of the Permit-to-work certificate, an extension of the certificate is required. The proprietor or contractor or persons authorized by him should visit the confined space and satisfy himself (by testing if necessary) that the conditions have not materially altered since he first issued the certificate. If the conditions have materially altered, the proprietor or contractor should cause the competent person to re-assess the situation, specify what further precautions are required to ensure the safety and health of the workers and state in the Permit-to-work certificate the extended time of expiry.
- AI.10 In case extension of time of the certificate is required, application for extension of time should be made before the certificate is expired. In no way should blanket approval be given beforehand or retrospectively.
- AI.11 A Permit-to-work certificate should be properly cancelled when the work activities in the confined space to which it refers have been completed and the confined space is clear of workers, equipment and spare material.

- AI.12 When work in the confined space was completed, the Permit-to-work certificate should be returned to the proprietor or contractor by the person to whom it was issued. This person should sign a declaration that all personnel and equipment have been removed from the site, and the personnel have been warned that the confined space is no longer safe for entry.
- AI.13 A proprietor or contractor should check that the work covered by the Permit-to-work certificate has been properly completed. He should then sign a final confirmation of cancellation of the certificate to confirm that the work activities in the confined space have been completed and that another certificate will be required for entering the confined space again. Effective measures should be taken to ensure that no worker would enter the confined space during the period when the completed Permit-to-work certificate is being delivered to the proprietor or contractor for proper cancellation.
- AI.14 The records of all Permit-to-work certificates should be properly maintained for one year after the certificates have been cancelled and be available for inspection.

AI.15 An example of Permit-to-work Certificate for Entry into Confined Space

- (1) Location of Work : _____

- (2) Description of Work : _____

- (3) Contractor/Proprietor : _____

- (4) Workers Assigned: (Names and Identification)
 Workers : _____

- Standby Persons : _____

- (5) Date & Time of Entry
 to the Confined Space : _____
- (6) Date & Time of Expiry
 of the Certificate : _____

Work Involved	Associated Hazards
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____

- Other Hazards Expected/Identified:**
1. _____
2. _____
3. _____
4. _____
5. _____

Isolation Checklist:

	Signed	Date & Time
<input type="checkbox"/> Normal service in the confined space suspended		
<input type="checkbox"/> All inlets and outlets isolated/blanked off		
<input type="checkbox"/> All power isolated (electrical/mechanical/hydraulic/others)		
<input type="checkbox"/> Heat source isolated		
<input type="checkbox"/> Other source of danger isolated (specify)		

Cleaning & Purging:

	Signed	Date & Time
<input type="checkbox"/> Purging & Cleaning (method: _____)		
<input type="checkbox"/> Inspection & Check		

Atmospheric Testing:

	Signed	Date & Time
<input type="checkbox"/> Oxygen content (%)		
<input type="checkbox"/> Flammable gases test (result:)		
<input type="checkbox"/> Toxic/Harmful gases test (result:)		
<input type="checkbox"/> Other (specify)		

Fire Precautions:

	Signed	Date & Time

Personal Safety Protection:

	Signed	Date & Time
<input type="checkbox"/> Ventilation Requirements		
<input type="checkbox"/> Respirators		
<input type="checkbox"/> Clothing		
<input type="checkbox"/> Head, Hand & Foot Protection		
<input type="checkbox"/> Shields		
<input type="checkbox"/> Life Lines & Harness		
<input type="checkbox"/> Lighting		
<input type="checkbox"/> Eye/Ear Protection		
<input type="checkbox"/> Other (specify)		

Other Safety Precautions:

Communication between workers and standby person (equipment and methods):

Evacuation Procedures:

Continuous Monitoring/Periodical Monitoring (equipment and methods)

Remarks:

Authorization:

(to be completed by the proprietor/contractor, or his authorized representatives)

I certify that I have personally checked all the above conditions and satisfied myself that all the above particulars are correct or have been implemented. I certify that:-

- (a) the confined space is safe for entry without breathing apparatus.
 to enter the confined space, approved breathing apparatus must be worn.
- (b) continuous monitoring is required.
 periodical monitoring is required.
 no foreseeable changes in the environment during the course of work, monitoring is not required.

(c) the necessary safety precautions for entering into the confined space are:

(d) date & time of expiry of the certificate: _____.

(e) all workers are certified workers.

Other remarks & limitations:

Signed by : _____

Position : _____

Date & Time: _____

Acceptance of Certificate:

(to be completed by the supervisor or the person-in-charge of the work)

I have read and understood this certificate and shall undertake to work in accordance with all the conditions laid down in it.

Signed by : _____

Position : _____

Date & Time: _____

Request for Extension of Time of the Certificate:

(to be completed by the supervisor or the person-in-charge of the work)

The work has not been completed as scheduled and permission to continue is requested.

Signed by : _____

Position : _____

Date & Time: _____

Extension of Certificate:

(to be completed by the proprietor/contractor, or his authorized representatives)

I have re-assessed and re-examined the confined space detailed above, and confirm that this certificate can be extended to expire _____ subject to:

(a) further safety precautions:

(b) remarks & limitations:

Signed by : _____
Position : _____
Date & Time: _____

Completion of Work

(to be completed by the supervisor or the person-in-charge of the work)

The work has been completed and all persons under my supervision, materials and equipment had been withdrawn.

Signed by : _____
Position : _____
Date & Time: _____

Cancellation of Certificate:

(to be completed by the proprietor/contractor, or his authorized representatives)

- (a) This Permit-to-work certificate is now cancelled; and
- (b) a new Permit-to-work certificate will be required if work is to be continued.

Signed by : _____
Position : _____
Date & Time: _____

Appendix II List of References

1. A Reference Note on Occupational Exposure Limits for Chemical Substances in the Work Environment
(Labour Department, Hong Kong)
2. BS 1129 : Portable Timber Ladders, Steps, Trestles and Lightweight Stagings
(Health and Safety Executive, United Kingdom)
3. BS 4275 : Guide to Implementing an effective Respiratory Protective Device Programme
(British Standard Institution, United Kingdom)
4. Code of Practice on Management of Health and Safety at Work
(Health and Safety Executive, United Kingdom)
5. Criteria For a Recommended Standard - Working in Confined Spaces
(Department of Health, Education and Welfare of United States)
6. Entry into Confined Spaces
(Industrial Accident Prevention Association of Canada)
7. Guidance Note CS1 - Industrial Use of Flammable Gas Detectors
(Health and Safety Executive, United Kingdom)
8. Guidance Note GS5 - Entry into Confined Spaces
(Health and Safety Executive, United Kingdom)
9. Occupational Exposure Limits EH 40
(Health and Safety Executive, United Kingdom)
10. Occupational Health and Safety Act & Regulations
(Ministry of Labour, Canada)

11. Occupational Health and Safety Management
(John Wiley & Sons Ltd., London)
12. Request For Assistance in Preventing Occupational Fatalities in Confined Spaces
(J. Donald Millar: National Institute for Occupational Safety and Health, United States)
13. Safe to Enter - Working in Confined Spaces
(W.F. Sampson: The Institution of Occupational Safety and Health, U. K.)
14. Safety in Confined Spaces
(Minister of Labour, Canada)
15. Safety Manual for Mechanical Plant Construction
(Oil and Chemical Plant Constructors' Association of United Kingdom)
16. Successful Health & Safety Management
(Health and Safety Executive, United Kingdom)
17. Threshold Limit Value (TLV) Occupational Exposure Guidelines
(American Conference of Governmental Industrial Hygienists, USA)
18. Work in Confined Spaces - Approved Code of Practice
(Health and Safety Executive, United Kingdom)

Enquiry

If you wish to enquire about this Code of Practice or require advice on occupational safety and health, you can contact the Occupational Safety and Health Branch through:

Telephone: 2559 2297 (auto-recording after office hours)

Fax : 2915 1410

E-mail : enquiry@labour.gov.hk

Information on the services offered by the Labour Department and on major labour legislation can also be found by visiting our Home Page on the Internet. Address of our Home Page is <http://www.labour.gov.hk/>.