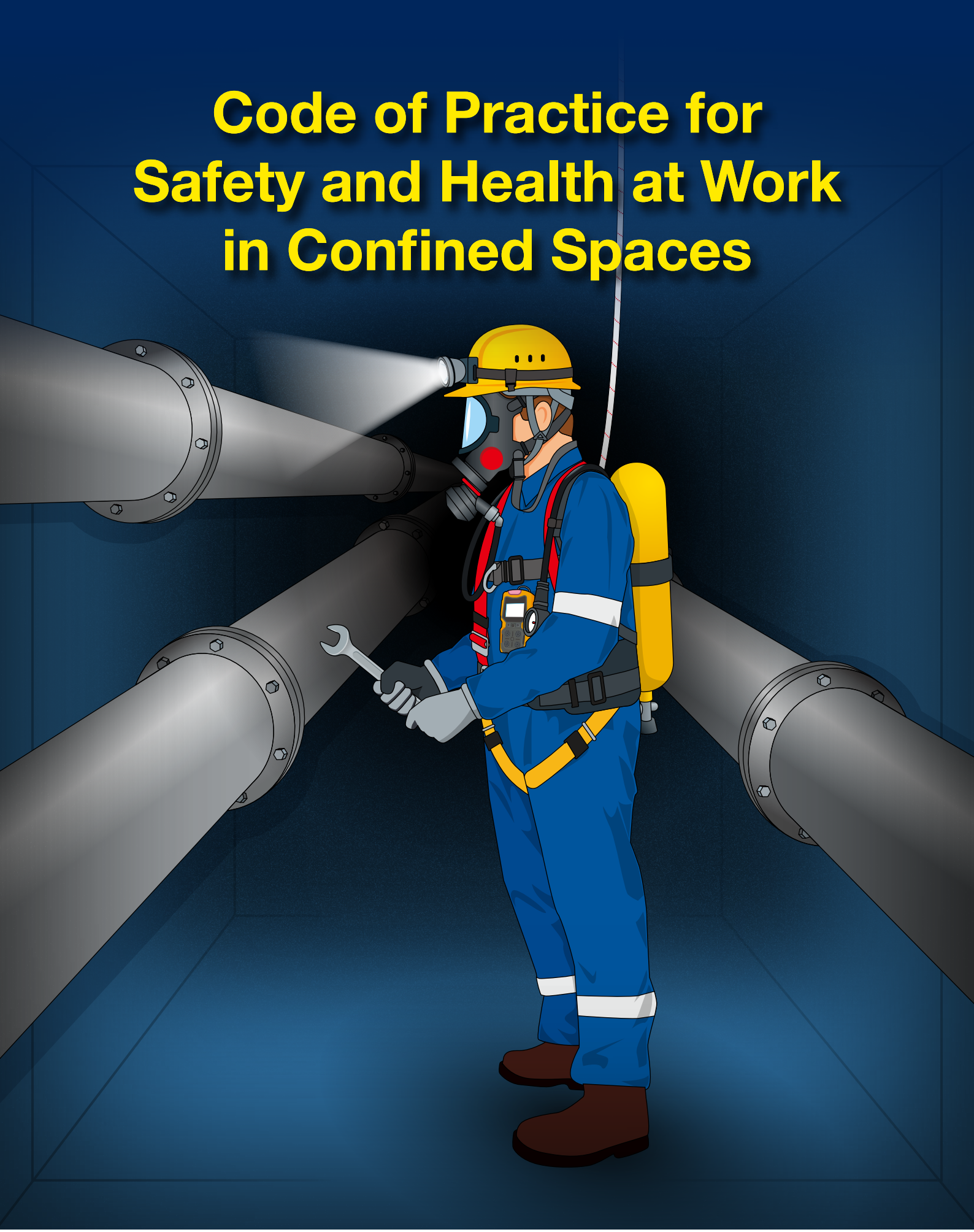
Code of Practice for Safety and Health at Work in Confined Spaces



Labour Department

Safety at work

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1. Introduction

1.1 This Code of Practice is issued by the Commissioner for Labour (hereinafter called "the Commissioner") 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 sections 6A & 6B of the Factories and Industrial Undertakings Ordinance and the requirements set out in the Factories and Industrial Undertakings (Confined Spaces) Regulation (hereinafter called "the Confined Spaces Regulation") regarding the safety and health at work in confined spaces.

1.2 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.

1.3 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 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.

1.4 In addition to the Confined Spaces Regulation, the Occupational Safety and Health Ordinance (Cap. 509) and the Factories and Industrial Undertakings Ordinance (Cap. 59), along with their subsidiary regulations, including (but not limited to) the Construction Sites (Safety) Regulations, the Factories and Industrial Undertakings (Lifting Appliances and Lifting Gear) Regulations, the Factories and Industrial Undertakings (Loadshifting Machinery) Regulation, the Factories and Industrial Undertakings (Protection of Eyes) Regulations, the Factories and Industrial Undertakings (Noise at Work) Regulation, the Factories and Industrial Undertakings (Electricity) Regulations, and other relevant legislation are applicable to work in confined spaces. The provisions of the legislation can be referred to the relevant guides to legislation, codes of practice, and guidelines published by the Labour Department.

1.5 The statutory provisions cited in this Code of Practice are those in force on 30 November 2024.

2. Interpretation

2.1 The Confined Spaces Regulation applies to all work that takes place within a confined space in an industrial undertaking; and work that takes place within the immediate vicinity of, and is associated with work occurring within, a confined space *[Section 3 of the Confined Spaces Regulation]*.

2.2 For the interpretations of "industrial undertaking", "proprietor" and "contractor", please refer to the Factories and Industrial Undertakings Ordinance.

2.3 Under the Confined Spaces Regulation, a "confined space" means 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 *[Section 2 of the Confined Spaces Regulation]*.

2.4 Under the Confined Spaces Regulation, "specified risk" means a risk of—

(a) serious injury to any person at work arising from a fire or explosion;

(b) the loss of consciousness of any person at work arising from an increase in body temperature;

(c) the loss of consciousness or asphyxiation of any person at work arising from gas, fume, vapour or the lack of oxygen;

(d) the drowning of any person at work arising from an increase in the level of liquid; or

(e) the asphyxiation of any person at work arising from a free flowing solid or the inability to reach a respirable environment due to entrapment by a free flowing solid *[Section 2 of the Confined Spaces Regulation]*.

2.5 Places having an enclosed nature and their compartments can give rise to specified risks due to their structure, location or contents. Common examples include 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, building voids, some enclosed rooms (particularly plant rooms/ mechanical rooms), some cellars and interiors of machines/ plant/vehicles, open-topped tanks and vats, wells, hatches, caissons, shafts, closed and unventilated or inadequately ventilated rooms, or constructions during their manufacture, etc.

2.6 Some places with enclosed nature can give rise to a specified risk due to the work to be undertaken, the material to be used, a change in the condition inside the space or the degree of enclosure/confinement. Typical examples include using volatile chemicals for waterproofing works in water tanks which can lead to the accumulation of chemicals and cause workers to lose consciousness, or using gasoline or diesel-powered engine equipment in poorly ventilated areas which can generate and accumulate carbon monoxide causing workers to asphyxiate.

2.7 "Approved breathing apparatus" means a breathing apparatus of a type approved by the Commissioner under section 12 of the Confined Spaces Regulation *[Section 2 of the Confined Spaces Regulation]*. The announcement of approved breathing apparatus will be published in Government Gazette and the list of approved breathing apparatus can be found on the Labour Department's website.

2.8 For the purpose of this Code of Practice,

- "hazard" (危害) is something with the potential to cause harm (this includes 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 realised and the severity of the harm.
- "atmospheric hazard" (空氣危害) refers to the presence of gases, vapours, dusts, fumes, smoke or oxygen-deficient air in a confined space, which potentially causes harm to the safety and health of persons staying in the confined space.

2.9 The major hazards associated with 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 following situations:

(a) flammable, explosive or oxygen enriched atmosphere;

(b) excessive environmental heat;

(c) toxic/harmful gases or oxygen deficient atmosphere;

(d) in-rush of liquid; or

(e) in-rush of free flowing solids.

The threats against the safety and health of workers include:

(a) serious injury arising from a fire or explosion;

(b) heat illnesses arising from an increase in body temperature;

(c) loss of consciousness or asphyxiation arising from atmospheric hazard;

(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.

2.10 When assessing whether a particular job constitutes "underground pipework" under section 9(b) of the Confined Spaces Regulation, the following determining factors should be considered:

(a) whether the work is performed within a confined space as interpreted under section 2 of the Confined Spaces Regulation;

(b) whether the aforementioned confined space is located underground; and

(c) whether the work involves any pipework which would have specified risk associated with atmospheric hazard.

2.11 "Competent person" means a person—

(a) who has attained the age of 18 years;

(b) who is either—

(i) a safety officer with registration under the Factories and Industrial Undertakings (Safety Officers and Safety Supervisors) Regulations; or

(ii) a person who holds a certificate issued by a person whom the Commissioner has authorised to certify persons as being competent to prepare risk assessment reports; and

(c) who has at least one year's relevant experience, after obtaining the registration or certification referred to in paragraph (b)(i) or (ii), in assessing risk to the safety and health of workers working in confined spaces *[Section 2 of the Confined Spaces Regulation]*.

2.12 "Certified worker" means a person—

(a) who has attained the age of 18 years; and

(b) who holds a certificate issued by a person whom the Commissioner has authorised to certify workers as being competent to work in a confined space *[Section 2 of the Confined Spaces Regulation]*.

2.13 "Standby person" means when a certified worker works in the confined space, another person, namely the "standby person", shall be assigned in accordance with section 8(b) of the Confined Spaces Regulation to be stationed outside the confined space to maintain communication with the worker inside the confined space and be responsible for contacting the emergency rescue team when necessary. The "standby person" shall have sufficient physical strength to be capable of pulling workers out of the confined space. The "standby person" may use mechanical devices to assist him when he is pulling the worker out of the confined space. *[Sections 9(a)(ii) and 9(b)(ii) of the Confined Spaces Regulation]*.

2.14 "Risk assessment report" refers to a written report with the assessment and recommendations prepared by a competent person in accordance with section 5 of the Confined Spaces Regulation. This Code of Practice provides a template of the "Risk Assessment Form for Confined Spaces " in Appendix I that competent persons should make reference to in order to ensure that the risk assessment report complies with all the elements stipulated in the Regulation.

2.15 "Permit-to-work Certificate" refers to a certificate for entering a confined space issued by the proprietor or contractor responsible for the confined space work before a worker enters the confined space for the first time after receiving a risk assessment report completed by a competent person and verifying that the risk assessment report covers all the matters specified in section 5(2) of the Confined Spaces Regulation and all necessary safety precautions have been taken. This Code of Practice provides a template of "Permit-to-work Certificate" in Appendix II that the responsible proprietor or contractor should make reference to in order to ensure that the "Permit-to-work Certificate" complies with all the elements stipulated in the Regulation.

3. Responsibilities

3.1 To secure safety and health at work in a confined space requires the full commitment and cooperation of every party concerned. The proprietor or contractor responsible shall ensure that every operation in the confined space is safe and without risk to the personnel working inside or in the vicinity. On the other hand, every person employed for the confined space work must cooperate with the proprietor or contractor to take reasonable care for the safety and health of not only himself but also other persons who may be affected by his acts or omissions at work.

3.2 The proprietor or contractor responsible for the work in confined space shall ensure the effective implementation of (but not limited to) the following:

- to appoint a competent person to carry out a risk assessment for the working environment in the confined space and make recommendations on the safety precautions to ensure the safety and health of workers while working in the confined space *[Section 5(1) of the Confined Spaces Regulation]*;
- to ensure that all safety precautions as required under section 7 of the Confined Spaces Regulation have been carried out before the work commences *[Section 7 of the Confined Spaces Regulation]*;
- to issue a certificate before a worker enters a confined space stating that all necessary safety precautions required in the risk assessment report have been taken and specifying the period during which workers may remain safe in the confined space *[Section 6(1)(a)(iii) of the Confined Spaces Regulation]*;
- to ensure that no workers other than certified workers enter or work in the confined space *[Section 8(a) of the Confined Spaces Regulation]*;
- to ensure that a standby person is stationed outside the confined space to maintain communication with the workers inside *[Section 8(b) of the Confined Spaces Regulation]*;
- to confirm whether the work conducted in the confined space falls under underground pipework. If underground pipework is involved, the necessary safety precautions shall be implemented as required *[Section 9(b) of the Confined Spaces Regulation]*. If needed, seek advice and/or assistance from occupational safety and health professionals. Ensure that workers in the confined space comply with the recommendations in the risk assessment report or when performing underground pipework, use approved breathing apparatus and other necessary personal protective equipment properly *[Section 9 of the Confined Spaces Regulation]*;
- to formulate and implement appropriate procedures to deal with any serious and imminent danger to workers inside the confined space *[Section 10(1) of the Confined Spaces Regulation]*; and
- to provide necessary instructions, training and advice to all workers working within a confined space and those (including standby persons) assisting in such work from immediately outside the confined space *[Section 11(1) of the Confined Spaces Regulation]*.

3.3 The workers working in a confined space shall:

- observe the emergency procedures as may be implemented by the proprietor or contractor *[Section 13(a) of the Confined Spaces Regulation]*;
- observe the instructions and advice and attend the training as may be provided by the proprietor or contractor *[Section 13(b) of the Confined Spaces Regulation]*; and
- 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 Confined Spaces Regulation *[Section 13(c) of the Confined Spaces Regulation]*.

4. Certified Worker and 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 the individual's roles and responsibilities so that work can be carried out safely.

4.2 Before a person is allowed to work in a 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 valid certificate *[Sections 8(a) and 2 of the Confined Spaces Regulation]*.

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 valid certificate *[Section 2 of the Confined Spaces Regulation]*.

4.4 The Commissioner will approve suitable training course providers to offer such training courses and will authorise 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 and Health Training Centre of the Labour Department. An up-to-date list of the approved training course 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 long as the courses have been approved by the Commissioner.

4.6 The training course provider shall not issue a certificate for certified workers unless the worker has successfully completed a course that has been approved by the Commissioner in respect of safety and health while working in a confined space *[Section 4(1) of the Confined Spaces Regulation]*.

4.7 The training course provider shall not issue a certificate for competent persons unless the person has successfully completed a course that has been approved by the Commissioner in respect of preparing risk assessment reports *[Section 4(2) of the Confined Spaces Regulation]*.

5. Risk Assessment Report and Recommendations

5.1 The proprietor or contractor shall, as far as reasonably practicable, take alternative measures that can be substituted for workers from entering confined spaces for work. With the advancement in science and technology, there are many ways to conduct various works within the confined spaces without man-entry e.g. inspecting the internal part of a sewer by remote control monitoring, using suitable equipment and tools to perform sampling and cleaning work from outside of the confined space without requiring workers to enter the confined spaces, etc.

5.2 If it is not reasonably practicable to avoid workers entering a confined space for work, the proprietor or contractor responsible for the work undertaken in the confined space shall appoint a competent person to conduct a risk assessment before allowing workers to enter. The assessment shall identify the hazards likely to be present in the confined space and recommend necessary precautions to be taken to ensure the safety and health of workers *[Section 5(1) of the Confined Spaces Regulation]*.

5.3 The risk assessment shall identify the hazards to workers entering and working in the confined space and the potential impacts on workers in the vicinity due to such work. When identifying hazards, it is crucial to consider not only the materials and substances present within the confined space but also past and future work activities and potential hazards arising from nearby industrial installations, processes, and operations.

5.4 The risk assessment should encompass a comprehensive and systematic examination of all work activities in the confined space. This examination should include (but not limited to) the substances previously present in the confined space, upcoming work activities, work methods, materials to be used, potential hazards associated with working in the confined space, and potential hazards related to the design or structure of the confined space (including layout and location).

5.5 Before carrying out the risk assessment, all information about the confined space and the work to be done 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. The appointed competent person should conduct site investigation to have a more thorough knowledge of the location, nature and circumstances of the confined space, particularly 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 report prepared by the appointed competent person shall cover the following aspects *[Section 5(2)(a) of the Confined Spaces Regulation]*:

(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 of oxygen in air;

(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 worker arising from an increase in body temperature.

5.7 The risk assessment report shall 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 *[Section 5(2)(b) of the Confined Spaces Regulation]*; and

(b) the period during which workers may remain safely in the confined space *[Section 5(2)(c) of the Confined Spaces Regulation]*.

5.8 Where sludge or other deposits are present, and a competent person considers that there is a possibility that they will give off hazardous gas, vapour, dust or fume, he shall recommend the use of an approved breathing apparatus *[Sections 5(2)(b) & 5(3) of the Confined Spaces Regulation]*. It should be noted that if there are sludge or other deposits present, it is generally very likely for the trapped or dissolved gases such as, hydrogen sulphide, to be released during confined space work, especially drainage works.

5.9 A competent person, in evaluating the extent of the risks in a confined space, shall recommend the use of suitable monitoring equipment and specify how the equipment shall be used if he deems that there is a substantial likelihood of environmental changes occurring in the confined space during work that would increase the risks associated with the hazards described in paragraph 5.6 *[Sections 5(2) & 5(4) of the Confined Spaces Regulation]*.

5.10 The size and number of access and egress points of a confined space should be assessed individually, taking into the account of the activities to be carried out and the number of people involved. Due consideration should be given to the possible difficulties for access to and rescue from the confined space when determining the locations of manholes or openings to vessels, tanks, etc. There may be occasions when access and egress are so tortuous that temporary openings are needed. Different criteria should be applied when determining manhole dimensions for a confined space that extends over a significant length or height (such as sewers, pipes, culverts, small tunnels or shafts). Measures to improve access pathways, such as structural alterations to the confined space, could be considered. If the distance between manholes on drainages is considerably long, it may affect the degree of natural ventilation and the efficiency of rescue operations.

5.11 The recommendations on the necessary safety measures must include whether the use of approved breathing apparatus is necessary so that the workers can safely stay inside the confined space *[Section 5(2)(b) of the Confined Spaces Regulation]*. When there is any doubt about atmospheric hazards, suitable and approved breathing apparatus must be used, and the other necessary safety precautions must be taken accordingly. For the provisions regarding the use of breathing apparatus, please refer to Chapter 9 of this Code of Practice.

5.12 When workers enter a confined space to carry out underground pipework, there may be additional hazards, particularly atmospheric hazards. Therefore, a proprietor or contractor and a competent person should determine whether the work involving entry into the confined space relates to underground pipework. If underground pipework is involved, the workers must properly wear an approved breathing apparatus and use a suitable safety harness connected to a lifeline in accordance with section 9 of the Confined Spaces Regulation.

5.13 When making recommendations regarding confined space work, an important consideration is how the worker can be safely rescued from the confined space in case of an emergency.

5.14 During the risk assessment, if the competent person considers that the working environment may change adversely, he must recommend continuous monitoring or periodic monitoring of the working environment. The purpose of air monitoring is to ensure that the ventilation is adequate and that the atmospheric hazards inside the confined space are within an acceptable safety level. The requirements for testing, retesting and monitoring shall be determined by the competent person *[Section 5(4) of the Confined Spaces Regulation]*.

5.15 For precautions on air testing and monitoring and exposure limits for air impurities, please refer to paragraph 7.4 of this Code of Practice and the "Code of Practice on Control of Air Impurities (Chemical Substances) in the Workplace" and "Air Monitoring in the Workplace" published by the Labour Department.

5.16 When there is any circumstance indicating that the risk assessment is no longer valid or work arrangement has significantly changed, the work must be stopped. All workers must be evacuated immediately and the risk assessment should be reviewed. Workers must not enter the relevant confined space unless the work environment is confirmed to be safe.

5.17 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 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 *[Section 5(5) of the Confined Spaces Regulation]*.

5.18 The conditions of a confined space or the work conducted within it are likely to change. For example, the increase in the water level of drainages due to sudden rainfall, the increase in tide level, the release of toxic gas due to disturbance of sludge or deposits in the confined space, etc. If there is any reason to suspect that the previous assessment is no longer valid, a fresh risk assessment shall be conducted.

5.19 The risk assessment and related work arrangements should be reviewed regularly and in a timely manner. When carrying out long-term projects inside confined space, even in the absence of significant changes, as stated in paragraph 5.17, the proprietor or contractor should conduct regular reviews (e.g. at least once a month) of the work environment and processes to ensure that the risk assessment and recommendations remain valid.

5.20 A competent person shall record all significant assessment results in the risk assessment report, which includes (but not limited to) the hazards identified, the necessary safety precautions to be taken, the period during which workers may remain safely in the confined space and the relevant personal particulars of the competent person who was responsible for carrying out the risk assessment.

5.21 The competent person shall 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 *[Section 5(6) of the Confined Spaces Regulation]*. The proprietor or contractor should record the date and time of receiving the risk assessment report.

5.22 Competent persons should make reference to the template of the "Risk Assessment Form for Confined Spaces" provided in Appendix I of this Code of Practice to ensure that the risk assessments and related reports cover all the requirements specified in the Confined Spaces Regulation. The proprietor or contractor should also make reference to the template to verify that the received risk assessment report covers all the aspects mentioned in section 5(2) of the Confined Spaces Regulation.

5.23 The completed risk assessment report for confined space work shall 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 of Practice.

5.24 There may be other work-related hazards involved while working in confined spaces, for example, electricity, welding, dangerous substances, noise and dust, etc. The competent person should refer to other relevant Codes of Practice and guidelines and provide corresponding recommendations for safety precautions for work to be carried out in a confined space.

6. Compliance with Risk Assessment Report and Issuance of Certificate

6.1 Worker's entry into a confined space for work shall be permitted only after the issue of a valid certificate ("Permit-to-work Certificate") by the proprietor or contractor of the industrial undertaking within which the confined space work is carried out. Before commencing work, the proprietor or contractor should use the "permit-to-work" system to conduct an inspection to confirm the full implementation of the items in the risk assessment report.

6.2 The proprietor or contractor of the confined space work shall ensure all matters mentioned in section 5(2) of the Confined Spaces Regulation are covered after receiving a risk assessment report completed by the competent person and should assess whether underground pipework is involved. All necessary precautions shall be effectively implemented before considering issuing a certificate *[Section 6(1)(a)(ii) of the Confined Spaces Regulation]*. Such certificate shall specify the location and types of work to be done and shall state:

(a) that all necessary safety precautions in relation to the hazards identified in the risk assessment report have been taken *[Section 6(1)(a)(iii)(A) of the Confined Spaces Regulation]*; and

(b) the period during which workers may remain safely in the confined space *[Section 6(1)(a)(iii)(B) of the Confined Spaces Regulation]*.

6.3 To facilitate the implementation of the recommended safety precautions in the risk assessment report, the proprietor or contractor should list out the work to be done and items to be checked before allowing the workers to enter a confined space and the necessary precautions to be taken in the "Permit-to-work Certificate" to ensure safety and health of workers 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 effectively taken. A template of a "Permit-to-work Certificate" is provided in Appendix II of this Code of Practice for reference.

6.4 The proprietor or contractor should take suitable and sufficient steps to ensure that the safety precautions for entering the confined space have been continuously and effectively implemented. During the period when the workers temporarily left the confined space for lunch, tea breaks, etc., subject to paragraph 6.5, the certificate would still remain valid, and a fresh assessment would not be required after such short break. However, apart from these intermittent rest periods, a fresh assessment and certificate issuance must be required before allowing the workers to re-enter the confined space.

6.5 Notwithstanding paragraph 6.4, the proprietor or contractor must be aware that a fresh assessment shall be required from time to time would there be a significant change of conditions likely to affect the safety and health of workers in the confined space. Furthermore, after receiving the fresh assessment report, the proprietor or contractor must verify the given risk assessment report as described in paragraph 6.2. A certificate shall be issued before allowing the workers to enter the confined space.

6.6 The proprietor, contractor or his authorised person should sign the "Permit-to-work Certificate" to confirm that all safety precautions indicated on the certificate have been implemented effectively. If the proprietor or contractor authorises a person to issue a "Permit-to-work Certificate", the person should have sufficient knowledge of working in confined spaces and the safety precautions to be taken. In general, the authorised person should be a competent person as interpreted under the Confined Spaces Regulation. Since the person issuing the "Permit-to-work Certificate" needs to verify the contents of the risk assessment report as mentioned above, the person being authorised to issue the "Permit-to-work Certificate" should not be the competent person who completed the risk assessment report. Moreover, the person issuing the "Permit-to-work Certificate" should also clearly explain the content of the "Permit-to-work Certificate" to all workers and relevant persons involved in the confined space.

6.7 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.

6.8 The risk assessment report and certificate mentioned above shall be kept for one year after the work in the confined space has been completed and be made available for inspection at all reasonable times *[Section 6(2) of the Confined Spaces Regulation]*.

7. Safety Precautions Before Work Begins

7.1 A proprietor or contractor shall ensure that no worker enters a confined space for work unless safety precautions, including (but not limited to) isolation, purging, air testing and ventilation, have been taken before the work begins *[Section 7 of the Confined Spaces Regulation]*.

7.2 Isolation

7.2.1 The proprietor or contractor shall, 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 the confined space.

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

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 from being opened without authorisation or accidentally.

7.2.5 Ends of service pipes which are still connected to sources of hazardous gas must be properly sealed (e.g. by means of a metal blank or end-cap) *[Section 7(b) and 7(f)(i) of the Confined Spaces Regulation]*.

7.2.6 Any activities outside and in the vicinity of the confined space which may jeopardise the safety or health of workers inside a confined space should not be permitted. Barriers should be erected outside access openings of the confined space, with suitable warning signs and notices displayed.

7.2.7 The confined space should be isolated from all non-essential sources of heat.

7.2.8 Effective steps shall be taken to prevent 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 *[Section 7(f) of the Confined Spaces Regulation]*. Openings in a confined space (e.g. drain holes) shall be sealed off if there is any possibility of atmospheric hazards to flow back into the confined space from another area and contaminate it. Regarding the in-rush of water, particular attention should be given to the possible sudden changes in water level in drainage facilities due to rainfall in the catchment area, changes in tide levels, sudden discharge of floodwater into the drainage culverts, etc.

7.3 Purging

With regard to the circumstances of a particular confined space, before the proprietor or contractor allows workers to enter the confined space for work, the confined space shall be adequately purged by a suitable method, such as steam cleaning, inert gas purging, forced ventilation, etc. to remove all the hazardous substances contained in the confined space *[Section 7(d) of the Confined Spaces Regulation]*.

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 substances, or substances which are not readily volatile, preliminary treatment by repeated washing with water, other suitable solvents, or appropriate neutralising agent should be applied prior to steaming.

7.3.1.3 The period of steaming should be adequate to remove all the hazardous substances from the confined space thoroughly. 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 should 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 would not be any vacuum being formed 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 After purging, all liquid remaining in the confined space should be drained away or pumped out as appropriate, and sufficient ventilation should be provided to the confined space.

7.3.1.8 Consideration should be given to the potential exposure of workers outside the confined space to hazardous substances carried out by steam cleaning, and effective safety measures should be adopted to prevent workers outside the confined space and nearby workers from coming into contact with these hazardous substances.

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 in which an inert gas has been purged, the confined space shall 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 shall then be thoroughly tested against the deficiency of oxygen to make sure that there is adequate oxygen to support life.

7.3.2.3 Consideration should be given to the potential exposure of workers outside the confined space to hazardous substances carried out by inert gas purging, and effective safety measures should be adopted to prevent workers outside the confined space and nearby workers from inhaling these hazardous substances.

7.4 Air testing

7.4.1 Appropriate air testing of a confined space shall be carried out to ensure the absence of any hazardous gas and no deficiency of oxygen before it is certified to be safe to enter *[Section 7(c) of the Confined Spaces Regulation]*.

7.4.2 Air testing of a confined space should be conducted to decide and specify the related safety precautions necessary to be taken upon entry into such confined space.

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

7.4.4 The air testing should include the testing of the oxygen content and the presence of flammable, toxic or harmful gases, fumes or vapours. Appendix III provides information on common atmospheric hazards in confined spaces.

7.4.5 In selecting appropriate air monitoring equipment for air testing, the types and concentration ranges of atmospheric hazards, as well as parameters such as instrument type, detection range, error, accuracy, resolution, response time, and applicable environment should be considered. It is also essential to consider whether interference could reduce or compromise its detection capabilities.

7.4.6 All air monitoring equipment should be used in accordance with the operation manual from the manufacturer. All air monitoring equipment should be suitably calibrated and properly maintained as per the recommendations of the manufacturers, with records properly kept.

7.4.7 All air testing should be carried out with the correct testing methods. For instance, air at different levels and locations inside a confined space should be tested since hazardous gases with different densities relative to air may accumulate at different levels and locations of the confined space.

7.4.8 Air testing should be carried out outside the confined space, with air samples being drawn out from the confined space by suitable sample probes. It is crucial to ensure that the sampling probe and tubing are not blocked or kinked, and sufficient sampling time should be allowed for testing.

7.4.9 In case flammable or explosive gases or vapours may be present in the confined space, the air monitoring equipment should be of the explosion-proof type. It should have both audio and visual alarms so that it can quickly alert workers if a hazardous situation exists or is developing in the confined space.

7.4.10 In general, testing for oxygen should be performed first because most combustible gas testing meters are oxygen-dependent and do not provide reliable readings in an oxygen-deficient atmosphere.

7.4.11 In a confined space, the percentage of oxygen in air should not be less than 19.5% by volume nor greater than 22% by volume at normal atmospheric pressure.

7.4.12 The exposure limits for various gases, vapours, dust, or fumes in the air can be referenced from the "Occupational Exposure Limits" listed in the "Code of Practice on Control of Air Impurities (Chemical Substances) in the Workplace" published by the Labour Department. For chemicals that do not have established "Occupational Exposure Limits", the exposure limits should be referred to relevant international or national standard, or databases from reliable chemical manufacturers or recognised occupational safety and health professional organisations.

7.5 Ventilation

7.5.1 Adequate supply of respirable air and effective forced ventilation shall be provided inside the confined space *[Section 7(e) of the Confined Spaces Regulation]*. It includes the use of mechanical ventilation to supply an adequate fresh air to workers inside the confined space and prevent atmospheric hazards. In deciding the design and installation of a ventilation system, the following factors should be considered:

- Foreseeable atmospheric hazards and their risks that may be present or generated;
- Processes and equipment being used;
- Potential need to control environmental temperature and/or humidity; and
- Number of workers and their work locations, and whether ventilation requirements may need to be modified or impose limitations while work is in progress.

7.5.2 When supplying fresh air, the blower should be carefully positioned to avoid introducing contaminated air into the confined space.

7.5.3 The provision of ventilation to a confined space should not be considered as an alternative to the use of approved breathing apparatus where the atmosphere inside is likely to cause safety or health hazards to the workers therein.

7.5.4 Before entering the confined space, it shall be thoroughly purged by means of ventilation. As some hazardous gases (e.g. hydrogen sulphide, etc.) are heavier than air, the air hoses or ducts of fresh air should be directed or extended deep into the confined space. The atmosphere shall be confirmed safe by air testing. When working in confined space, the outlets of the fresh air hoses or ducts should be placed near the work locations of the workers to ensure adequate fresh air. In addition, the removal of air impurities can be facilitated by placing the inlets of the extraction air hoses or ducts near the source of air impurities. Additionally, exhaust device can be installed at the exit or ventilation openings of the confined space to aid in removing impurities and facilitating air exchange. However, it is crucial to consider the positioning of ventilation equipment to avoid short-circuiting and maintain effective air circulation within the confined space.

7.5.5 Certain processes and equipment, such as welding or the use of petrol/diesel-powered devices, can consume oxygen, release atmospheric hazards, and generate heat. Therefore, performing such process or using such equipment in confined space should be avoided if possible. Whenever performing such processes or using such equipment in confined space is unavoidable, adequate forced fresh air should be supplied at the worksite. Exhaust device and hoses or ducts should also be installed near the working location to remove air impurities and hot air effectively. For performing such processes or using such equipment outside the confined space, ingress of the atmospheric hazards or heat in confined space should be avoided.

7.5.6 Under no circumstances should oxygen be introduced into a confined space, which would create a danger of oxygen enrichment in the air.

7.6 Notwithstanding the above, a proprietor or contractor shall also take effective steps to prevent 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 *[Section 7(f) of the Confined Spaces Regulation]*. In that respect, particular attention should 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 shall ensure that all workers who enter or work in a confined space are certified workers *[Section 8(a) of the Confined Spaces Regulation]*. 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 shall provide all necessary equipment to ensure the safety and health of workers in a confined space *[Section 11(2) of the Confined Spaces Regulation]*. The equipment should be appropriately selected in respect of their types, purposes, functions and applications. The equipment should also be suitably calibrated, regularly checked and properly maintained, and records kept.

8.3 When work is being carried out in a confined space by a certified worker, the proprietor or contractor shall ensure that the relevant risk assessment report, with all its significant findings, is displayed in a conspicuous place at the entrance of the confined space. The related certificate shall also be displayed in a conspicuous place at the entrance of the confined space *[Section 8(c) of the Confined Spaces Regulation]*.

8.4 When work is being carried out in a confined space by a certified worker, a standby person must be assigned to station outside the confined space throughout the time of operation to maintain communication with the worker inside *[Section 8(b) of the Confined Spaces Regulation]*.

8.5 The standby person shall be trained on how to maintain communication with those workers inside the confined space, including the use of new technology to maintain effective communication with those workers inside the confined space. Additionally, a proprietor or contractor shall provide, to all workers working within a confined space or assisting with such work from immediately outside the confined space, such instructions, training and advice as are necessary to ensure the safety and health of all workers in the confined space *[Section 11(1) of the Confined Spaces Regulation]*.

8.6 The standby person shall 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 hazardous gases, power supply failure, failure of the forced ventilation system, etc.).

8.7 On the other hand, the workers inside a confined space shall keep communicating with the standby person, who can quickly summon assistance in the event of a hazardous situation inside the confined space.

8.8 If significant changes or abnormal conditions are observed in the working environment, particularly in air quality, soil conditions, or groundwater levels, or if adverse weather conditions that may pose potential risks to the safety and health of workers are known, work must be immediately suspended, and all workers must be evacuated. Subsequently, a thorough review of risk assessment and related work arrangements must be conducted. Work shall not be resumed unless the site environment is confirmed to be safe.

8.9 A proprietor or contractor shall 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 *[Section 8(d) of the Confined Spaces Regulation]*.

8.10 During the continuous or periodic monitoring of the working environment as recommended by the risk assessment, air monitoring equipment should have two levels of alarm systems to alert workers to take appropriate action. Where applicable, workers should wear continuous air monitoring equipment that provides audio and visual alarms to enable workers and standby personnel to be immediately aware of the danger, evacuate the site as quickly as possible, and arrange rescue. Information on alarm settings for air monitoring in confined spaces is provided in Appendix III.

8.11 Unless alternative suitable arrangements are made, the standby person shall have sufficient physical strength to be capable of pulling workers out from outside the confined space. The standby person may use mechanical devices to assist him when he is pulling the worker out of the confined space. The standby person should be responsible for contacting emergency rescue teams when necessary. A standby person should be a certified worker or competent person as defined by the Confined Spaces Regulation.

9. Use of Personal Protective Equipment

9.1 Whenever workers need to perform underground pipework in a confined space or where the use of approved breathing apparatus is recommended in the relevant risk assessment report, the proprietor or the contractor shall ensure that the following safety precautions, in addition to those mentioned in Chapters 7 and 8 of this Code of Practice, 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 *[Sections 9(a)(i) and 9(b)(i) of the Confined Spaces Regulation]*; and

(b) the person shall 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 *[Sections 9(a)(ii) and 9(b)(ii) of the Confined Spaces Regulation]*.

9.2 When workers enter a confined space to carry out underground pipework, there may be additional hazards, in particular atmospheric hazards. Therefore, a proprietor or contractor shall ensure that additional safety precautions set out in paragraph 9.1 are taken. Specifically, whenever workers need to enter a confined space for underground pipework, they must comply with the section 9 of the Confined Spaces Regulation, i.e. wearing approved breathing apparatus properly and a suitable safety harness connected with a lifeline. This legal requirement for underground pipework will not be exempted even though safety precautions listed in sections 7 and 8 of the Confined Spaces Regulation have been taken (e.g. every pipe or supply line has been properly blanked off, the confined space has been adequately purged and sufficiently cooled and ventilated, an adequate supply of respirable air and an effective forced ventilation have been provided, etc.).

9.3 A proprietor or contractor shall ensure that only approved breathing apparatus shall be used in connection with confined space work *[Section 12 of the Confined Spaces Regulation]*. 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 When selecting a suitable approved breathing apparatus, it should be based on the conditions, hazards, air 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 and work inside a confined space should well fit the worker's face and be worn appropriately.

9.6 It is strongly recommended that a proprietor or contractor should only allow those who are medically fit to use breathing apparatus to enter and work in a confined space with a breathing apparatus.

9.7 The service time of a self-contained type of approved breathing apparatus should be estimated with regard to the entry time, the consumption rate, the maximum working period, the estimated escape time required and other relevant factors.

9.8 All breathing apparatus for use in confined spaces should be properly maintained in clean and good working conditions. Never use defective breathing apparatus. All defective devices should be clearly marked as "defective" and removed from site.

9.9 The air quality supplied by approved breathing apparatus and air supply device should comply with the most up-to-date recognised international or national standard, e.g. BS EN 12021, GB/T 31975 or equivalent.

9.10 The person using the approved breathing apparatus should have received appropriate training in using that particular type or model of breathing apparatus. Before each use, the breathing apparatus should be:

(a) connected to air cylinder or other appropriate air supply device for providing respirable air;

(b) properly inspected for any physical damage on all parts and accessories; and

(c) functionally checked according to the user manual. Check items include "high pressure leak test", "positive pressure test", "cylinder pressure test", "whistle warning unit test", etc.

9.11 For an air-line type of breathing apparatus, the air supply rate should be so adjusted that a positive pressure is always maintained inside the face-piece.

9.12 To avoid air to be contaminated, the following precautions should be taken when using air-line type breathing apparatuses:

(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.

9.13 The proprietor or contractor should ensure that a 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.

9.14 The harness and lifeline 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 rescue operations in emergencies.

9.15 Reference should be made to the latest and recognised international or national standard, such as BS EN 1496 and BS EN 1497 or equivalent, when selecting rescue equipment, such as rescue harnesses and rescue lifting devices, for use in connection with confined space work.

9.16 The safety harness and rescue lifeline should be so adjusted and worn that the wearer could be drawn up with his head first through any manhole or opening of the confined space.

9.17 A proprietor or contractor should take steps to ensure that the rescue lifelines 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 shall formulate and implement appropriate procedures to deal with any serious and imminent danger to workers inside a confined space *[Section 10(1) of the Confined Spaces Regulation]*.

10.2 The emergency procedures should include situations that trigger evacuation, such as fire, adverse weather conditions (such as heavy rain), in-rush of large amounts of mud or water, undesirable changes to atmospheric hazards, failure of ventilation or fresh air supply system, and failure of emergency response equipment (such as communication devices, respirators, etc.).

10.3 Typical air monitoring equipment can set different levels of alarms according to the level of atmospheric hazards to remind workers and standby persons whether there are adverse changes in the confined space, so as to determine the corresponding actions that should be taken, including evacuation or arranging rescue. Technical details and recommendations for setting air monitoring alarms are provided in Appendix III.

10.4 A proprietor or contractor should set up arrangements to rescue workers working in a confined space promptly 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 of any other accident, for example, incapacitation caused by a fall.

10.5 A rescue team consisting of a 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. In general, sufficient rescue personnel and equipment should be arranged on the same worksite or near the confined space.

10.6 As to the number of trained persons required in a rescue team, the factors to be considered depend on the circumstances of the case, including the nature of the work, the hazards inherent in the confined space in relation to the work and the work methods proposed. 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.

10.7 All members of the rescue team shall have been properly and adequately trained in the related emergency rescue procedures, including the detailed particulars of an emergency rescue plan and full knowledge of how to properly use all the rescue equipment specified in section 10(2) of the Confined Spaces Regulation.

10.8 The proprietor or contractor may, where reasonably practicable, provide video surveillance or body-worn video cameras to workers who need to enter confined spaces. It allows the standby person outside the confined space to monitor the workers' work in real-time and promptly call for rescue when necessary.

10.9 Constant communication between the workers inside a confined space and the standby person shall be maintained throughout the period when the workers are working inside the confined space. An audio and visual alarm system shall be provided for the workers inside the confined space to alert the standby person, and vice versa, in case of emergency.

10.10 Each worker should be equipped with a personal motion-sensing alarm device which can emit audio and visual alarm so that the standby person outside is immediately alerted to arrange for rescue in case the worker inside confined space is unconscious.

10.11 Even in an emergency, the standby person should not enter the confined space. He should remain stationed outside the confined space and summon assistance from the rescue team and public emergency services (i.e. Hong Kong Police Force and Fire Services Department). He should brief the rescue personnel on the relevant circumstances of the incident upon their arrival.

10.12 Suitable and sufficient rescue equipment, including the standby approved breathing apparatus, safety harness, lifelines, reviving apparatus and emergency lighting, and properly trained rescue personnel shall be readily available for rescue purposes at all times when workers are working inside a confined space. Rescue equipment provided shall be appropriate in view of the likely emergencies identified in the risk assessment and be properly maintained. The resuscitation equipment should comply with the latest and recognised international or national standard, such as BS EN ISO 10651-4 or equivalent.

10.13 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.

10.14 Fire-fighting equipment suitable for use in confined spaces (such as water and foam type extinguishers) shall be provided, never use carbon dioxide gas or dry powder type fire extinguishers in confined spaces.

10.15 A proprietor or contractor shall devise a set of evacuation procedures for prompt evacuation of the workers from the confined space in case of a sudden change in the working or the environmental condition that may cause imminent danger to them.

10.16 If the risk assessment report does not recommend the use of an approved breathing apparatus to work in confined spaces and underground pipework is not involved, the proprietor or contractor should consider providing workers with emergency escape breathing apparatus based on the working environment of the confined space to allow workers to escape safely in emergencies. However, it should be noted that an emergency escape breathing apparatus is not a substitute for an approved breathing apparatus.

10.17 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 10.16, and adopted for each entry into a confined space.

10.18 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 shall provide adequate and suitable information, instructions, training and supervision to all persons involved, directly or indirectly, in confined space work, including workers working in a confined space, safety supervisory personnel, 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 information, instructions and training:

(a) when they are recruited by a proprietor or contractor of an industrial undertaking; and

(b) when they are required to be exposed to new or increased risks due to a change of responsibilities, using new work equipment or a new system of work.

11.3 The safety and health information, instructions and 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 about 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; and

(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 spaces is found to be unsatisfactory.

11.4 The relevant information and instructions related to confined space work should be provided at suitable locations, taking into account the knowledge and experience of workers or other relevant personnel so that the workers can understand clearly. Such information or instructions could be in written form, symbols, diagrams, notices or any other appropriate forms that are relevant to the concerned confined space work and clearly understandable by the workers.

11.5 Training for confined space work 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 of Practice, shall be trained on how to maintain communication with the workers inside the confined space (such as the use of new technology) 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 should **not** be used to improve oxygen content in air inside a confined space in all situations. It is recommended that some members of the rescue team be provided with first-aid training, including cardiopulmonary resuscitation.

11.8 The proprietor or contractor shall provide all necessary equipment to ensure the safety and health of workers in a confined space *[Section 11(2) of the Confined Spaces Regulation]*.

11.9 When continuous monitoring or periodic monitoring of the working environment due to adverse changes in the conditions of a confined space or the work conducted within it is recommended in the risk assessment report, the proprietor or contractor should provide every worker entering the confined space to work such as hand-dug tunnelling or drainage work with a set of emergency escape breathing apparatus and ensure workers to bring with them, unless the worker is using an approved breathing apparatus therein. The proprietor or contractor should ensure adequate supply of respirable air from the emergency escape breathing apparatus to allow workers to escape safely in emergencies. The emergency escape breathing apparatus should comply with the most up-to-date recognised international or national standard, e.g. BS EN 1146, GB 38451 or equivalent.

11.10 The proprietor or contractor should provide adequate information, instructions, training and supervision to the workers to ensure their proper use and wearing of the emergency escape breathing apparatus. The proprietor or contractor should take appropriate steps to ensure the proper functioning of the emergency escape breathing apparatus, such as suitable storage, proper maintenance and regular inspection.

12. Safe System of Work

12.1 According to section 6A of the Factories and Industrial Undertakings Ordinance, it shall be the duty of every proprietor of an industrial undertaking to ensure, so far as is reasonably practicable, the health and safety at work of all persons employed by him at the industrial undertaking, including the followings:

(a) the provision and maintenance of plant and systems of work that are, so far as is reasonably practicable, safe and without risks to health;

(b) arrangements for ensuring, so far as is reasonably practicable, safety and absence of risks to health in connection with the use, handling, storage and transport of articles and substances;

(c) the provision of such information, instruction, training and supervision as is necessary to ensure, so far as is reasonably practicable, the health and safety at work of all persons employed by him at the industrial undertaking;

(d) so far as is reasonably practicable as regards any part of the industrial undertaking under the proprietor's control, the maintenance of it in a condition that is safe and without risks to health and the provision and maintenance of means of access to and egress from it that are safe and without such risks; and

(e) the provision and maintenance of a working environment for all persons employed by him at the industrial undertaking that is, so far as is reasonably practicable, safe, and without risks to health.

12.2 According to section 6B of the Factories and Industrial Undertakings Ordinance, it shall be the duty of every person employed at an industrial undertaking while at work-

(a) to take reasonable care for the health and safety of the person and of other persons who may be affected by the person's acts or omissions at work; and

(b) as regards any duty or requirement imposed on a proprietor of the industrial undertaking or on any other person by this Ordinance for securing the health and safety of persons employed at the industrial undertaking, to co-operate with the proprietor or other person so far as is necessary to enable that duty or requirement to be performed or complied with.

12.3 In order to ensure, so far as is reasonably practicable, the establishment of a safe system of work for working in confined spaces, in addition to complying with the provisions of this Code of Practice, it is also necessary to follow the "Guidance Notes on Safety and Health of Hand-Dug Tunnelling Work" published by the Labour Department when carrying out hand-dug tunnel works, and the recommendations outlined in the "Guidance Notes on Safety and Health for Prevention of Gas Poisoning in Drainage Works" published by the Labour Department when carrying out drainage works within confined spaces.

12.4 Even if workers are in the immediate vicinity of the confined space and perform associated work in that confined space, the proprietor or contractor shall appoint a competent person to assess the reasonably foreseeable risk arising from the work (e.g. releasing of hazardous gases or falling from height, etc.) and make recommendations on measures necessary to ensure the safety and health of workers.

12.5 The proprietor, contractor and occupier of the workplace should take adequate steps to ensure the confined space within the workplace is well-segregated to avoid trespassing, for example, the confined space should be locked up when left vacant, all entrances of the confined space should be securely controlled, and entry and exit log should be recorded and kept.

12.6 The proprietor or contractor should have a system for access control on the confined space work, recording the workers entering and leaving the confined space and ensuring only relevant workers are allowed to enter the confined space. Common practices include setting up a "tag in/tag out" notice at the entrance of a confined space so that people outside the confined space can easily be aware of workers' details and the time of entering the confined space. This provides crucial information for the safety supervisory personnel, standby person and rescue team. It helps to check the compliance of the safety requirements and ensures the effective execution of the contingency plan in case of emergency situations.

12.7 The proprietor or contractor shall exercise sufficient supervision over confined space work, including recording videos[1] at the entrance and exit of the confined space throughout the entire work period to monitor that relevant personnel have complied with the safety precautions. The video records shall be kept for one year after the work is completed and made available for inspection within a reasonable timeframe.

12.8 The proprietor or contractor should establish and implement an effective system to ensure that all individuals who enter and stay or work inside a confined space have exited the confined space within a specified timeframe.

[1] The proprietor or contractor shall record the video and handle the data collected in accordance with the Personal Data (Privacy) Ordinance (Cap. 486). For details, please refer to the Ordinance, relevant code of practice and publications, e.g. "Guidance on CCTV Surveillance and Use of Drones", etc.

Appendix I Risk Assessment Form for Confined Spaces

Location of work : _____

Description of work : _____

Main Contractor/Proprietor : _____

Subcontractor (if applicable) : _____

Name of Competent Person : _____

Certificate No. : _____ Validity Period : _____(Year) _____ (Month) _____ (Day)

Add a ✓ to appropriate boxes

1.	Contents of Risk Assessment		
1.1	☐ This work falls under the provisions of section 3 of the Factories and Industrial Undertakings (Confined Spaces) Regulation, as it involves work performed within a confined space or in close proximity to a confined space, and is related to work conducted within a confined space. Work methods to be adopted in the confined space works[1] : _____ Plant to be used in the confined space works[1] : _____ Materials to be used in the confined space works[1] : _____ (If the work does not involve any worker entering the confined space[1], the following measures shall be taken to ensure that no workers enter the confined space : _____ _____)		
	Assessment Items	**Result(s)**	**Safety Precautions Required**
1.2	Is the confined space works an **underground pipework** as described in section 9(b) of the Factories and Industrial Undertakings (Confined Spaces) Regulation?	☐ Yes	☐ Ensure that any person entering or remaining in that particular confined space is properly (i) wearing a suitable approved breathing apparatus; and (ii) wearing a suitable safety harness connected to a lifeline. ☐ Monitor the air in the confined space continuously until everyone has left the confined space.
		☐ No (Reasons provided as follows : _____ _____ _____)	_____ _____ _____
1.3	Is there any **hazardous** gas, vapour, dust or fume, or **deficiency of oxygen** present in the confined space?	☐ Yes	☐ Ensure that any person entering or remaining in that particular confined space is properly (i) wearing a suitable approved breathing apparatus; and (ii) wearing a suitable safety harness connected to a lifeline. ☐ Monitor the air in the confined space continuously until everyone has left the confined space.
		☐ No (Reasons provided as follows : _____ _____ _____)	_____ _____ _____

[1] The Competent Person should obtain information of work methods, plant and materials to be used for the particular confined space works from the Main Contractor/ Subcontractor/ Proprietor in order to complete the risk assessment. The Main Contractor/ Subcontractor / Proprietor shall ensure the risk assessment report is displayed in a conspicuous place at the entrance of the confined space.

<table>
<tr><th></th><th>Assessment Items</th><th>Consequence [2]</th><th>Likelihood [2]</th><th>Risk [2]</th><th>Safety Precautions Required</th></tr>
<tr><td rowspan="3">1.4</td><td rowspan="3"><u>Ingress</u> of hazardous gas, vapour, dust or fume to the confined space</td><td rowspan="3">☐ Very Serious (3)
☐ Serious (2)</td><td rowspan="3">☐ Very likely (3)
☐ Possible (2)
☐ Unlikely (1)</td><td>☐ High risk (>=6)</td><td>_____
_____
_____</td></tr>
<tr><td>☐ Moderate risk (3-4)</td><td>_____
_____
_____</td></tr>
<tr><td>☐ Low risk (<=2)</td><td>_____
_____
_____</td></tr>
<tr><td rowspan="4">1.5</td><td rowspan="2">Are there any <u>sludge or other deposits being present</u> that are <u>liable to give off hazardous gas, vapour, dust or fume</u> in the confined space?</td><td rowspan="2"></td><td rowspan="2"></td><td rowspan="2">☐ High risk (>=6)</td><td rowspan="3">☐ Ensure that any person entering or remaining in that particular confined space is properly (i) wearing a suitable approved breathing apparatus; and (ii) wearing a suitable safety harness connected to a lifeline.
☐ Monitor the air in the confined space continuously until everyone has left the confined space.
_____
_____
_____</td></tr>
<tr><td>☐ Yes, sludge or other deposits are present in the confined space.

Unless the sludge and other deposits are completely removed and purged, otherwise if there are sludge or other deposits present, it is generally very likely for the trapped or dissolved gases such as hydrogen sulphide to be released in confined space work, in particular drainage works.</td><td>☐ Very Serious (3)
☐ Serious (2)</td><td>☐ Very likely (3)
☐ Possible (2)
☐ Unlikely (1)</td><td>☐ Moderate risk (3-4)</td></tr>
<tr><td>☐ Low risk (<=2)</td><td>_____
_____
_____
_____</td></tr>
<tr><td>☐ No, sludge or other deposits are not present in the confined space.</td><td colspan="2">(Reasons provided as follows :
_____
_____
_____)</td><td></td></tr>
</table>

[2] Regarding the definitions of 'severity of consequences', 'likelihood of occurrence' and 'risk rating' please refer to the risk rating table in the final section of this assessment form.

	Assessment Items	Consequence [2]	Likelihood [2]	Risk [2]	Safety Precautions Required
1.6	**In-rush** into the confined space of free flowing solid or liquid	☐ Very Serious (3) ☐ Serious (2) ☐ Mild (1)	☐ Very likely (3) ☐ Possible (2) ☐ Unlikely (1)	☐ High risk (>=6)	
				☐ Moderate risk (3-4)	
				☐ Low risk (<=2)	
1.7	**A fire or explosion** in the confined space	☐ Very Serious (3) ☐ Serious (2) ☐ Mild (1)	☐ Very likely (3) ☐ Possible (2) ☐ Unlikely (1)	☐ High risk (>=6)	
				☐ Moderate risk (3-4)	
				☐ Low risk (<=2)	
1.8	The **ambient temperature** in the confined space that may lead to loss of consciousness of a certified worker arising from an increase in body temperature	☐ Very Serious (3) ☐ Serious (2) ☐ Mild (1)	☐ Very likely (3) ☐ Possible (2) ☐ Unlikely (1)	☐ High risk (>=6)	
				☐ Moderate risk (3-4)	
				☐ Low risk (<=2)	
1.9	**Change in the environment** leading to an increased risk of the above hazards during the course of the work in the confined space	☐ Very Serious (3) ☐ Serious (2) ☐ Mild (1)	☐ Very likely (3) ☐ Possible (2) ☐ Unlikely (1)	☐ High risk (>=6)	
				☐ Moderate risk (3-4)	
				☐ Low risk (<=2)	

[2] Regarding the definitions of 'severity of consequences', 'likelihood of occurrence' and 'risk rating' please refer to the risk rating table in the final section of this assessment form.

	Assessment Items	Consequence [2]	Likelihood [2]	Risk [2]	Safety Precautions Required
1.10	**Risk of worker falling from height** during the course of the work in the confined space or its proximity	☐ Very Serious (3) ☐ Serious (2) ☐ Mild (1)	☐ Very likely (3) ☐ Possible (2) ☐ Unlikely (1)	☐ High risk (>=6)	
				☐ Moderate risk (3-4)	
				☐ Low risk (<=2)	
1.11	Others (please specify: _____ _____)	☐ Very Serious (3) ☐ Serious (2) ☐ Mild (1)	☐ Very likely (3) ☐ Possible (2) ☐ Unlikely (1)	☐ High risk (>=6)	
				☐ Moderate risk (3-4)	
				☐ Low risk (<=2)	
1.12	Others (please specify: _____ _____)	☐ Very Serious (3) ☐ Serious (2) ☐ Mild (1)	☐ Very likely (3) ☐ Possible (2) ☐ Unlikely (1)	☐ High risk (>=6)	
				☐ Moderate risk (3-4)	
				☐ Low risk (<=2)	
1.13	Period during which certified workers may remain safely in the confined space: _____hour(s)				

[2] Regarding the definitions of 'severity of consequences', 'likelihood of occurrence' and 'risk rating' please refer to the risk rating table in the final section of this assessment form.

2	**Safety precautions must be taken when entering and working into the confined space** —— Apart from the aforementioned safety precautions required with respect to the risk assessment, the proprietor or contractor must ensure that all the following safety precautions are taken before allowing certified workers to work in confined spaces:
	☐ Every piece of mechanical equipment in the confined space, which is liable to cause danger, has been disconnected from its power source, with warning notice displayed and its power source locked out;
	☐ Every pipe or supply line whose contents are liable to create a hazard has been properly blanked off;
	☐ The confined space has been tested to ensure the absence of any hazardous gas and no deficiency of oxygen;
	☐ The confined space has been adequately purged and sufficiently cooled and ventilated, having regard to the circumstances of the particular confined space, to ensure that it is a safe workplace;
	☐ An adequate supply of respirable air and an effective forced ventilation have been provided inside the confined space;
	☐ Effective steps have been taken to prevent - (i) an ingress to the confined space of hazardous gas, vapour, dust or fume; and (ii) an in-rush into the confined space of free flowing solid or liquid;
	☐ Before entering and working in the confined space, the following air testing of the confined space has been conducted with appropriate air monitoring equipment of explosion-proof design: ☐ Oxygen ☐ LEL ☐ Hydrogen sulphide ☐ Carbon monoxide ☐ Others : _____; ☐ Continuous air monitoring has to be conducted until everyone has left the confined space;
	☐ Formulated appropriate emergency procedures to deal with any serious and imminent danger to workers inside the confined space, including the provision of a sufficient supply of the following items in a satisfactory condition (and keeping them readily available) (a) approved breathing apparatus; (b) suitable apparatus for reviving an unconscious worker; (c) vessels containing oxygen or air; (d) safety harnesses and ropes; and (e) an audio and visual alarm by which the workers inside the confined space can alert those outside;
	☐ The emergency rescue team is composed of a sufficient number of trained personnel who are ready to carry out emergency procedures in case of accident. All members of the emergency rescue team have been properly and adequately trained in the related emergency rescue procedures, including the details of the emergency rescue plan and full knowledge on how to properly use all the rescue equipment;
	☐ Instructions, training and advice are provided to all workers within a confined space or assisting with such work from immediately outside the confined space to ensure the safety and health of all workers, including posting up or displaying a clearly visible warning sign in a conspicuous place at the entrance to the confined space, indicating the specified hazards and safety precautions taken in the confined space;
	☐ All necessary equipment is provided to ensure the safety and health of workers in the confined space, including the provision of suitable air monitoring equipment of explosion-proof design for continuous air monitoring if necessary;
	☐ Only certified workers are allowed to enter or work in the confined space;
	☐ At least one “Standby Person” is stationed outside the confined space to maintain communication with the workers inside the confined space;
	☐ The risk assessment report and the Permit-to-work Certificate shall be displayed in a conspicuous place at the entrance of the confined space; and
	☐ The safety precautions listed above are effective continuously while the workers remain in the confined space.
	☐ Other safety precautions: _____

I confirmed that I have at least one year of relevant experience, after obtaining registration as Safety Officer or the certificate as Competent Person, in assessing risk to the safety and health of workers working in confined spaces, and have been appointed by the above-mentioned Main Contractor/ Subcontractor/Proprietor to be the competent person to carry out an assessment in the aforesaid confined space works in accordance with section 5(1) of the Factories and Industrial Undertakings (Confined Spaces) Regulation.

I confirmed that, the true to the best of my knowledge and belief, the risk of the working condition in the confined space was assessed according to the requirements of section 5(6) of the Factories and Industrial Undertakings (Confined Spaces) Regulation, and recommendations of control measures were made under the section with respect to the safety and health of workers working in the confined space.

Signature of the Competent Person
conducted the above risk assessment : _____

Name : _____

Date and time : _____

Receipt of the risk assessment report

Recipient signature : _____

Name : _____

Post : _____

Date and time : _____

Risk Assessment Table

Likelihood / Consequence	**Unlikely (1)** (Rather remote, though conceivable)	**Possible (2)** (Event to be expected)	**Very likely (3)** (Occurs repeatedly)
Very serious (3) Accident causing immediate danger to life or serious bodily injury (Example: gas poisoning, hypoxia, drowning)	**(3) Moderate Risk**	**(6) High Risk**	**(9) High Risk**
Serious (2) Accident causing moderate bodily injury (Example: fracture, skin ulcer, etc.)	**(2) Low Risk**	**(4) Moderate Risk**	**(6) High Risk**
Mild (1) Accident resulting in mild bodily injury (Example: eye irritation from dust, cough)	**(1) Low Risk**	**(2) Low Risk**	**(3) Moderate Risk**

	High Risk
	Moderate Risk
	Low Risk

Appendix II Permit-to-work Certificate

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 template of the Permit-to-work Certificate is included.

2. A proprietor or contractor of a confined space shall issue the workers a Permit-to-work Certificate before allowing them to enter or work in the confined space.

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 remaining (if any) after cleaning;

   (d) the results of the air 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.

4. After receiving a risk assessment report completed by a competent person, the proprietor or contractor of the confined space work shall confirm that all necessary safety precautions have been implemented effectively and should assess whether underground pipework is involved before issuing a Permit-to-work Certificate.

5. The Permit-to-work Certificate should be properly signed for confirmation by the proprietor or contractor or persons authorised by him (e.g. safety supervisory personnel of confined space work). The items in the certificate should be written or printed in permanent ink or otherwise so as to be indelible.

6. The contents of the Permit-to-work Certificate shall be clearly explained to all the workers and persons involved in the confined space work.

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.

8. The Permit-to-work Certificate shall be displayed conspicuously at the entrance of the confined space.

9. A Permit-to-work Certificate should be 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.

10. When work in the confined space is 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 that all personnel have been warned that the confined space is no longer safe for entry.

11. A proprietor or contractor should confirm 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 Permit-to-work Certificate to confirm that the work activities in the confined space have been completed and that another Permit-to-work Certificate will be required for entering the confined space again. Additionally, effective measures should be taken to ensure that no worker enters the confined space during the period when the completed Permit-to-work Certificate is being delivered to the proprietor or contractor for proper cancellation.

12. The proprietor or contractor shall ensure no worker stays in the confined space when the Permit-to-work Certificate expires. The proprietor or contractor should ensure all workers leave the confined space by the expiry of the Permit-to-work Certificate. If the work has not yet been completed by the expiry of the Permit-to-work Certificate, the proprietor or contractor shall cancel the expired Permit-to-work Certificate and confirm that all necessary safety precautions have been implemented effectively before issuing another Permit-to-work Certificate to allow workers entering the confined space to continue their work.

13. 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.

A Template of "Permit-to-work Certificate" for Entry into Confined Space

Location of work : _____

Description of work : _____

Main Contractor/Proprietor : _____

Name of the Competent Person appointed : _____

Date and time of risk assessment : _____

Date & time for entry to the confined space : _____(Year) _____ (Month) _____ (Day) from _____ *am/pm (Time)

This permit-to-work certificate is valid until : _____(Year) _____ (Month) _____ (Day) _____*am/pm (Time)

* Please delete if not applicable

<table>
<tr><th colspan="5">Workers</th></tr>
<tr><td></td><td colspan="4">Certified Worker</td></tr>
<tr><td></td><td colspan="4">Maximum duration that certified workers are allowed to stay in the confined space : _____ Hour(s)</td></tr>
<tr><td></td><td>Name</td><td>Reference No. of Certificate</td><td>Validity Period</td><td>Signature</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td colspan="4">Standby Person</td></tr>
<tr><td></td><td>Name</td><td>Date of training</td><td>Responsibility</td><td>Signature</td></tr>
<tr><td></td><td></td><td></td><td rowspan="4">✓ Maintain communication with the workers inside the confined space, and call for support in case of emergency;
✓ Brief the rescue personnel of the relevant circumstances of the incident upon their arrival in case of emergency;
✓ Even in case of emergency, the standby person should not enter the confined space.</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td colspan="4">Onsite Rescue Personnel</td></tr>
<tr><td></td><td>Name</td><td>Date received training for rescue in emergency</td><td>Responsibility</td><td>Signature</td></tr>
<tr><td></td><td></td><td></td><td rowspan="3">✓ Familiar with the details of the emergency rescue plan;
✓ Know how to properly operate all rescue equipment provided.</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>

Add a ✓ to appropriate boxes ☐

Underground Pipework
☐ This confined space work is underground pipework as described in section 9(b) of the Factories and Industrial Undertakings (Confined Spaces) Regulation, and therefore contractor / proprietor has to ☐ Ensure that any person entering or remaining in that particular confined space is properly i. wearing a suitable approved breathing apparatus; and ii. wearing a suitable safety harness connected to a lifeline. ☐ Use appropriate air monitoring equipment of explosion-proof design to monitor the air in the confined space continuously until everyone has left the confined space; and _____ _____
☐ This confined space work is **NOT underground pipework** as described in section 9(b) of the Factories and Industrial Undertakings (Confined Spaces) Regulation with the reason(s) stated as follows: _____ _____
Remarks : Must choose one out of the two options above

Isolation Measures		
	Signature	Date & time
☐ Normal services in the confined space have been suspended.		
☐ All unnecessary sources of power (Electrical/ Mechanical/ Pneumatic/ Hydraulic/ Others: _____) have been isolated.		
☐ All pipelines connected to the confined space have been completely shut off or blanked off		
☐ The ends of all service pipes connected to hazardous gas sources have been sealed.		
☐ Non-essential heat sources have been isolated.		
☐ Other sources of danger have been isolated (please specify _____).		
☐ All isolated or closed connections have been locked off and properly labelled to prevent from being opened without authorisation or accidentally.		

Purging and Ventilation Control Measures		
	Signature	Date & time
☐ The confined space has been purged/cleaned adequately. (Method : _____)		
☐ All hazardous substances stored inside the confined space have been removed.		
☐ Adequate respirable air and effective forced ventilation have been provided.		

Add a ✓ to appropriate boxes ☐

Air Testing Results
Testing Date (YYYY/MM/DD) : ____________________ Model of air monitoring equipment : ________________ Serial number of air monitoring equipment : ___________ Calibration Expiry Date (YYYY/MM/DD) : _____________
Testing Location : ______________________________ Testing Time : _________*am/pm ☐ O_2 : _________ % ☐ LEL(Percentage) : _________ % ☐ H_2S : _________ ppm ☐ CO : _________ ppm ☐ ____________________
Testing Location : ______________________________ Testing Time : _________*am/pm ☐ O_2 : _________ % ☐ LEL(Percentage) : _________ % ☐ H_2S : _________ ppm ☐ CO : _________ ppm ☐ ____________________
Testing Location : ______________________________ Testing Time : _________*am/pm ☐ O_2 : _________ % ☐ LEL(Percentage) : _________ % ☐ H_2S : _________ ppm ☐ CO : _________ ppm ☐ ____________________
☐ After the air testing, I confirm that there is no hazardous gas and no oxygen-deficient situation in this confined space. Responsible person for conducting the air testing Name : ____________________ Signature : ____________________

Add a ✓ to appropriate boxes ☐

Safety Precautions for Entry into the Confined Space
☐ Every piece of mechanical equipment in the confined space, which is liable to cause danger, has been disconnected from its power source, with warning notice displayed and its power source locked out;
☐ Every pipe or supply line whose contents are liable to create a hazard has been properly blanked off;
☐ The confined space has been tested to ensure the absence of any hazardous gas and no deficiency of oxygen;
☐ The confined space has been adequately purged and sufficiently cooled and ventilated, having regard to the circumstances of the particular confined space, to ensure that it is a safe workplace;
☐ An adequate supply of respirable air and an effective forced ventilation have been provided inside the confined space;
☐ Effective steps have been taken to prevent - (i) an ingress to the confined space of hazardous gas, vapour, dust or fume; and (ii) an in-rush into the confined space of free flowing solid or liquid;
☐ Formulated appropriate emergency procedures to deal with any serious and imminent danger to workers inside the confined space, including the provision of a sufficient supply of the following items in a satisfactory condition (and keeping them readily available): (a) approved breathing apparatus; (b) suitable apparatus for reviving an unconscious worker; (c) vessels containing oxygen or air; (d) safety harnesses and ropes; and (e) an audio and visual alarm by which the workers inside the confined space can alert those outside;
☐ The emergency rescue team is composed of a sufficient number of trained personnel who are ready to carry out emergency procedures in case of accident. All members of the emergency rescue team have been properly and adequately trained in the related emergency rescue procedures, including the details of the emergency rescue plan and full knowledge on how to properly use all the rescue equipment;
☐ Instructions, training and advice are provided to all workers within a confined space or assisting with such work from immediately outside the confined space to ensure the safety and health of all workers, including posting up or displaying a clearly visible warning sign in a conspicuous place at the entrance to the confined space, indicating the specified hazards and safety precautions taken in the confined space;
☐ All necessary equipment is provided to ensure the safety and health of workers in the confined space, including the provision of suitable air monitoring equipment of explosion proof design for continuous air monitoring if necessary;
☐ Only certified worker is allowed to enter or work in the confined space;
☐ At least one “Standby Person” is stationed outside the confined space to maintain communication with the workers inside the confined space;
☐ The risk assessment report and this permit-to-work certificate should be displayed in a conspicuous place at the entrance of the confined space;
☐ The safety precautions listed above are effective continuously while the workers remain in the confined space;
☐ Video recording at the entrance and exit of the confined space throughout the entire work period is arranged to monitor that relevant personnel have complied with the safety precautions.

Add a ✓ to appropriate boxes ☐

Emergency Rescue Equipment Provided
☐ Approved breathing apparatus : _____ set
☐ Apparatus for reviving an unconscious worker : _____ set
☐ Vessels containing oxygen or air : _____ set
☐ Safety harnesses and ropes : _____ set
☐ Audio and visual alarm by which the workers inside the confined space can alert those outside : _____ set
☐ Other relevant emergency rescue equipment, including : ☐ Tripods and winches; ☐ _____
☐ I confirm that the above emergency rescue equipment is sufficient with satisfactory condition and are readily available.

List of Protective Equipment Provided
General
☐ Forced ventilation device : _____ set
☐ Continuous air monitoring equipment : _____ set
☐ Walkie-talkie (explosion-proof design) : _____ set
☐ Shield : _____ set
☐ Lighting device : _____ set
☐ Others (Please specify) : _____
Personal Protective Equipment
☐ Approved breathing apparatus : _____ set (excluding for emergency use)
☐ Audio and visual alarm : _____ set
☐ Protective clothing : _____ piece
☐ Head, Hand & Foot Protection : _____ piece
☐ Life Lines & Harness : _____ set
☐ Eye Protection : _____ set
☐ Ear Protection : _____ set
☐ Others (Please specify) : _____

Declaration by the Proprietor/Contractor or Authorised Representative

Permit-to-work Certificate

I am the proprietor/ contractor/ authorised representative* of the confined space work mentioned above. I confirm that the risk assessment report by the competent person mentioned above covers all matters stated in section 5(2) of the Factories and Industrial Undertakings (Confined Spaces) Regulation, and I certify that all necessary safety precautions in accordance with the risk assessment report have been taken, and I hereby, issue this Permit-to-work Certificate.

This permit-to-work certificate is valid until (Date & Time):

_____(Year) _____(Month)_____ (Day) _____ *am/pm (Time)

Signature : _____

Name : _____

Post : _____

Date & time : _____

* Please delete if not applicable

Receipt of Permit-to-work Certificate

(To be filled by the supervisor or person in-charge of the work)

I have read and understood the content of the Permit-to work Certificate, and shall undertake to work in accordance with all the conditions laid down in this certificate.

Signature : _____

Name : _____

Post : _____

Date & time : _____

Proof of Completion

(To be filled by the supervisor or person in-charge of the work)

I confirm that the confined space work mentioned above has been completed and that all assigned persons, materials and equipment have been withdrawn from the site, the personnel have been warned that the confined space is no longer safe for entry and I hereby sign to confirm.

Signature : _____

Name : _____

Post : _____

Date & time : _____

Cancellation of Permit-to-work Certificate

I am the proprietor/ contractor/ authorised representative* of the confined space work mentioned above. I hereby sign to confirm the cancellation of this Permit-to-work Certificate. I understand that a new permit-to-work certificate will be required if work is to be continued.

Signature : _____

Name : _____

Post : _____

Date & time : _____

* Please delete if not applicable

Appendix III Setting Up Air Monitoring Alarm

1. Working in confined space can pose risks to the safety and health of workers, including atmospheric hazards. Typical situations that cause loss of consciousness or ability to escape due to atmospheric hazards include: (1) concentrations of flammable or explosive gases or vapours, etc. exceeding their Lower Explosive Limit (LEL), (2) concentrations of toxic or harmful substances in the air exceeding their Occupational Exposure Limit (OEL) or Immediately Dangerous to Life or Health (IDLH) concentrations, and (3) the air becoming oxygen-enriched or deficient. For detailed information on common hazardous gases/chemicals in confined spaces and occupational hygiene standards, please refer to paragraphs 11 to 16 below.

2. Examples of possible atmospheric hazards in confined spaces include:
   - Fire or chemical spill happens in confined spaces;
   - Failure of the ventilation or fresh air supply systems in confined spaces;
   - Fire or chemical spillage happens outside confined spaces, which could affect the quality of fresh air intake;
   - Disturbance of the sewage, sediment, or sludge can release the trapped or dissolved hydrogen sulphide gas, etc., thus rising the concentration of the hazardous gases in the air rapidly; and
   - Use of volatile chemicals in confined spaces, etc.

3. A number of hazardous gases, such as carbon monoxide, are colourless and odourless. On the other hand, some hazardous gases like hydrogen sulphide may have an unpleasant smell at low concentrations, but such smell disappears at higher concentrations due to olfactory fatigue. It can be very wrong and dangerous if workers think they can recognise the presence of hazardous gases by scent. In certain situations, competent person may recommend continuous monitoring or periodic monitoring of the working environment. Workers should be equipped with continuous air monitoring equipment that provides audio and visual alarms, where applicable, in order to immediately alert the workers and standby persons the imminent situations regarding the air quality and presence of hazardous gases in confined spaces, and activate evacuation or arrange rescue as soon as possible.

4. The air monitoring equipment should have a two-level alarm system to alert workers to take appropriate actions correspondingly. Level 1 Alarm is a warning level indicating that there is a threat of atmospheric hazards, but the situation of worker is still safe. Action should be taken to determine the cause of the threat and implement appropriate remedial measures. Under normal circumstances, when reaching Level 2 Alarm level, it indicates the atmospheric hazards pose risks to the workers, the emergency procedures should be activated, and the workers should be evacuated immediately.

Flammable or Explosive Substances in Air

5. The alarm for the presence of flammable or explosive gases is generally set using the Lower Explosive Limit (LEL). Level 1 Alarm (Warning) for the lower explosive limit should be set at 5% LEL, and Level 2 Alarm (Evacuation) should be set at 10% LEL. If a flammable or explosive substance has toxic/harmful properties simultaneously, the lower concentration of the two shall be used as the criterion for setting the alarm. For example, hydrogen sulphide must set the alarm at the concentration of its toxicity.

Toxic or Harmful Chemical Substances in Air

6. The setting of alarm levels for toxic or harmful chemicals in the air should make reference to the Occupational Exposure Limits if underground pipework is not involved and an approved breathing apparatus is not required as indicated in the risk assessment report. In this connection, the alarm levels for toxic or harmful chemicals in the air should be set as follows:

Level 1 Alarm[§]	Half of Occupational Exposure Limit - Short-Term Exposure Limit *[or 1.5 times of Occupational Exposure Limit - Time-Weighted Average[¶]]*
Level 2 Alarm[§]	Occupational Exposure Limit - Short-Term Exposure Limit *[or 3 times of Occupational Exposure Limit - Time-Weighted Average[¶]]*

[§] Alarm settings for measuring instruments should be rounded down to the nearest integer.

[¶] Only applicable to chemicals for which OEL-STEL have not been established.

7. In normal circumstances, properly worn approved breathing apparatus can provide a good protection to workers against atmospheric hazards but it is not entirely fail-safe. When workers are using approved breathing apparatus to enter confined spaces, it is a prudent approach to set Level 1 Alarm at half of IDLH concentration of the toxic or harmful chemical substance and Level 2 Alarm at the corresponding IDLH. For example, Level 1 and Level 2 Alarms for hydrogen sulphide gas can be set at 50ppm and 100ppm respectively.

8. Under the Factories and Industrial Undertakings Ordinance, it shall be the duty of every proprietor to ensure the provision and maintenance of a working environment for the proprietor's workers that is, so far as is reasonably practicable, safe, and without risks to health. In this regard, the proprietor should eliminate or substitute the atmospheric hazards and/or implement vigorous and robust engineering control measures to reduce the level of hazardous gases to below IDLH as far as possible rather than relying heavily on the use of personal protective equipment ("PPE"). The use of PPE should always be regarded as the last resort in the hierarchy of control measures, and is a supplement to, not in lieu of, effective engineering control measures and safe system of work. In rare circumstances where elimination or substitution is not possible and vigorous and robust engineering control measures adopted cannot reduce the level of hazardous gases below IDLH, the proprietor should consult occupational health professionals, in addition to the competent person appointed, to review the work situation and to develop and fully implement a written respiratory protection programme with required worksite-specific procedures and elements for required respirator use which is commensurate with the respiratory protection standards, 29 CFR 1910.134, required by the Occupational Safety and Health Administration, U.S. Department of Labor, to ensure the safety and health of the certified workers working in such high risk situation.

Excessive Level of Oxygen or Oxygen Deficiency in Air

9. There are about 21% by volume of oxygen in air under normal atmospheric pressure. A decrease in the percentage of oxygen in air can result in an oxygen-deficient environment, which can asphyxiate workers. Conversely, a high percentage of oxygen in air increases the risk of causing fires and explosions. Therefore, alarm thresholds for oxygen content in air (measured by volume) are set at 19.5% and 22% to warn workers of oxygen deficiency or excessive oxygen level environments respectively. Whenever the oxygen content alarm is activated, immediate evacuation should be carried out.

Setting Air Monitoring Alarm

10. The alarm levels for some common hazardous gases that can be encountered in confined spaces are recommended as follows:

For workers without using approved breathing apparatus to enter confined spaces	CH_4	H_2S	CO
Level 1 Alarm	5% LEL	7ppm	37ppm
Level 2 Alarm	10% LEL	15ppm	75ppm

Common Hazardous Gas in Confined Space and Occupational Safety and Hygiene Standards

11. Lower Explosive Limit (LEL) – LEL is the lowest concentration of a substance that will produce a flash fire or explosion when an ignition source (flame, spark, etc.) is present and is expressed in percent of vapour or gas in the air by volume.

12. "Occupational Exposure Limit (OEL)" refers to the airborne concentration(s) of individual chemical substances that represent levels that are regarded to impose no adverse health effects to nearly all workers on exposures by the route of inhalation. "Occupational Exposure Limit - Time-Weighted Average (OEL-TWA)" refers to the time-weighted average concentration of a chemical substance over an eight-hour working day for a five-day workweek, to which nearly all workers can be exposed day after day without adverse health effects. "Occupational Exposure Limit - Short-Term Exposure Limit (OEL-STEL)" refers to the 15-minute time-weighted average of the airborne concentration of a chemical substance. A list of OEL for chemical substances can be found in the "Code of Practice on Control of Air Impurities (Chemical Substances) in the Workplace" published by the Labour Department.

13. Under the situation of Immediately Dangerous to Life or Health (IDLH) concentrations, there will be an immediate or delayed threat to life, or it may cause irreversible health effects or impairment of the ability to escape. For IDLH concentrations, please refer to the values developed by the Ministry of Health of the People's Republic of China or the National Institute for Occupational Safety and Health (NIOSH) of the United States of America.

14. Hydrogen Sulphide (H_2S) is a deadly gas with a distinctive "rotten egg" odour that can be detected at very low concentrations. At concentrations above 100 ppm, hydrogen sulphide has a paralysing effect on the sense of smell. Even at lower concentrations, hydrogen sulphide can affect the olfactory nerve, and workers cannot detect the changes in concentrations. It can be produced and accumulated in confined spaces such as septic tanks, manholes or sewers. Hydrogen sulphide is heavier than air and thus settles in lower part of the confined space such as the bottom of manholes or sewers.

Hydrogen Sulphide (in ppm)	**Effect/ Exposure Limit**
Less than 1	Smells like rotten eggs
10	OEL-TWA
15	OEL-STEL
50-100	Paralysis of the olfactory nerve, irritation to the eye and respiratory tract, and inhalation may result in lung oedema that causes death
100	IDLH

15. Carbon Monoxide (CO) is a lethal colourless and odourless gas. Carbon monoxide is a product of incomplete combustion. When gasoline/diesel generators or other fuel-driven tools are used in inadequately ventilated workplaces, oxygen can also be consumed, and carbon monoxide can be produced and accumulated.

Carbon Monoxide (in ppm)	**Effect/ Exposure Limit**
25	OEL-TWA
350	Confusion, fainting on exertion and collapse
1200	IDLH

16. Methane (CH_4) is commonly generated when organic matter is decomposed by various bacterial processes. It is a colourless, odourless, extremely flammable and explosive gas that can cause fire and explosion. The accumulation of methane in a poorly ventilated area will displace normal air and result in an oxygen-deficient environment. Typical air monitoring equipment for confined spaces does not directly measure methane concentration. Instead, users can determine the presence of methane through the oxygen concentration and LEL. Methane is lighter than air and thus will accumulate in the upper part of the confined space.

List of References

1. Code of Practice on Safety Management
(Labour Department, Hong Kong)

2. Code of Practice on Control of Air Impurities (Chemical Substances) in the Workplace
(Labour Department, Hong Kong)

3. Guidance Notes on Safety and Health of Hand-dug Tunnelling Work
(Labour Department, Hong Kong)

4. Guidance Notes on Safety and Health for Prevention of Gas Poisoning in Drainage Works
(Labour Department, Hong Kong)

5. GB/T 31795-2015 Technical requirements for compressed air for respiratory protection
中華人民共和國國家標準 GB/T 31975—2015 呼吸防護用壓縮空氣技術要求
(中華人民共和國國家質量監督檢測檢疫總局、中國國家標準化管理委員會)

6. GBZ/T 205-2007 Specification of prevention and control on occupational hazards in confined space
中華人民共和國國家職業衛生標準GBZ/T 205—2007 密閉空間作業職業危害防護規範
(中華人民共和國衛生部)

7. GB 38451-2019 Respiratory protection — Self-contained open-circuit compressed air breathing apparatus for escape
中華人民共和國國家標準GB 38451—2019 呼吸防護自給開路式壓縮空氣逃生呼吸器
(中華人民共和國國家市場監督管理局、中國國家標準化管理委員會)

8. BS EN 529:2005 Respiratory protective devices — Recommendations for selection, use, care and maintenance — Guidance document
(British Standard Institution)

9. BS EN 1146:2005 Respiratory protective devices. Self-contained open-circuit compressed air breathing apparatus incorporating a hood for escape. Requirements, testing, marking
(British Standard Institution)

10. BS EN 1496:2017 Personal Fall Protection Equipment. Rescue Lifting Devices
(British Standard Institution)

11. BS EN 1497:2007 Personal Fall Protection Equipment. Rescue Harnesses
(British Standard Institution)

12. BS 6164:2019 Health and Safety in Tunnelling in the Construction Industry – Code of Practice
(British Standard Institution)

13. BS EN ISO 10651-4:2023 Lung ventilators - Part 4: Particular requirements for user-powered resuscitators
(British Standard Institution)

14. BS EN 12021:2014 Respiratory Equipment. Compressed Gases for Breathing Apparatus
(British Standard Institution)

15. Safe Work in Confined Spaces - Approved Code of Practice and Guidance
(Health and Safety Executive, UK)

16. Immediately Dangerous To Life or Health (IDLH) Values
(National Institute for Occupational Safety and Health, USA)

17. 29 CFR 1910.134 Occupational Safety and Health Standards - Respiratory Protection
(Occupational Safety and Health Administration, USA)

Enquiries and Complaints

Enquiries

If you wish to enquire about this Code of Practice or require advice on occupational safety and health (OSH) matters, please contact the Occupational Safety and Health Branch of the Labour Department (LD) through:

Telephone : 2559 2297 (auto-recording service available outside office hours)

Fax : 2915 1410

E-mail : enquiry@labour.gov.hk

Information on the services offered by LD and on major labour legislation is also available on our website at https://www.labour.gov.hk. The latest OSH information can be obtained through the LD's "OSH 2.0" Mobile Application. For details on the services offered by the Occupational Safety and Health Council, please call 2739 9000.

Labour Department's Website

"OSH 2.0" Mobile Application

Complaints

If you have any complaint about unsafe operations and environments at workplaces, please call the LD's OSH complaint hotline at 2542 2172 or fill out and submit an online OSH complaint form on our website. All complaints will be treated in the strictest confidence.

Online OSH Complaint Form

Occupational Safety and Health Branch
Labour Department

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