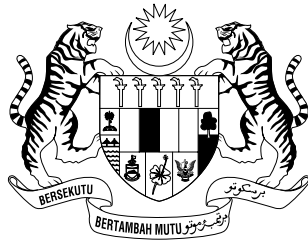




INDUSTRY CODE OF PRACTICE FOR SAFE WORKING IN A CONFINED SPACE 2010

**DEPARTMENT OF OCCUPATIONAL SAFETY AND HEALTH
MINISTRY OF HUMAN RESOURCES, MALAYSIA**

JKKP DP(S) 127/379/3-1



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FOREWORD

Working in a confined space can expose a person to a very risky situation that can cause diseases and injury which leads to an accident and death. Statistics have shown many fatalities involving workers working in a confined space such as working in a silo, storage tank, pressure vessel or tank, sewer system or communication system, trenches and others. In most cases the cause of death is due to inhaling of toxic gases or oxygen deficiency.

Investigations conducted by the Department of Occupational Safety and Health (DOSH) have found that most confined space accident were due to failure of the employer in establishing and providing a safe work system for working in a confined space. Another factor is due to lack of coordination and control of activities when executing more than one task at the same time. For example, working in a confined space can be hazardous when maintenance work on a piping system containing flammable substances connected to the confined space is done without proper coordination and control.

DOSH also noticed that one of the main reasons for these accidents is the sub-contacting of work to contractors that do not have knowledge and experience in working in a confined space. These contractors normally do not have proper work procedures and equipment for working in a confined space.

Thus, to overcome these problems, DOSH has published a code of practice for all safe working in a confined space in 2001 for the purposed of providing practical guidance to the employers, parties and employees for safe working in a confined space. However, after seven (7) years since it had been published, DOSH felt the code of practice need to be amended, so that it is consistent with current and future information and needs. This code is known as **Industry Code of Practice For Safe Working In A Confined Space 2010**.

I believe that in confined space, accident can be prevented or at least reduced if employers are committed and responsible toward their duties with regards to occupational safety and health issues such as by establishing and maintaining a safe work system for their organization and employees. I would like to emphasize to all employers to use this Industry Code of Practice For Safe Working In A Confined Space 2010 as a source of reference in developing a safe work system and also to fulfil one of their general duties under the Occupational Safety and Health Act 1994 and regulations made under this Act.

With this new industry code of practice, it is hoped that it will improve the employers awareness regard risks of working in a confined space and better compliance of Occupational Safety and Health Act 1994 and regulations made under this Act to create a more safe and healthy workplace. The industries are welcome to give any comment and recommendation to DOSH at any time so that improvements can be made to the industry code of practice.

Director General

Department of Occupational Safety and Health

Malaysia

2010

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PART I

PRELIMINARY

1.0 INTRODUCTION

1.1 Objective

This industry code of practice is intended to provide guidance for the safety and health of all persons who need to enter or work in confined spaces by preventing exposure to hazards which may otherwise be experienced when working in a confined space, and thereby prevent collapse, injury, illness or death arising from exposure to those hazards.

1.2 Application

1.2.1 This industry code of practice shall apply to works in a confined space.

1.2.2 This industry code of practice shall not apply to underground mining or works in a space at other than atmospheric pressure.

1.2.3 For the purpose of this industry code of practice, a person whose head or upper body is within a confined space is considered to have entered the confined space.

2. DEFINITIONS

“Act” means the Occupational Safety And Health Act 1994 [Act 514];

“*hazardous atmosphere*” means atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is escape unaided from a confined space), injury or acute illness from one or more of the following causes –

- a) oxygen content below 19.5 % or above 23.5 % by volume (at sea level);
- b) accumulation of flammable or explosive gas greater than 10 % of its LEL;
- c) accumulation of toxic gas equal to or exceeding its permissible exposure limit (PEL); or
- d) any other atmospheric condition that is immediately dangerous to life or health (IDLH).

“*inert atmosphere*” means an atmosphere with high level of asphyxiant gases, which contain little or no oxygen and primarily consist of inert or non-reactive gases or gases that have a high threshold before they react;

“*contaminant*” means any dust, fume, vapour, gas or other substance, the presence of which can be harmful to health and safety;

“*asphyxiant gases*” means gases that can cause unconsciousness or death by suffocation through direct oxygen displacement (physical asphyxiant) or interference with the body’s ability to absorb or transport oxygen to the tissues (chemical asphyxiant) . Examples of physical asphyxiant gases are nitrogen, argon, carbon dioxide and methane. Examples of chemical asphyxiant gases are carbon monoxide, hydrogen sulphide and hydrogen cyanide;

“*upper explosive limit (UEL)*” means the maximum concentration of gas that shall be present in air for an explosion is to occur;

“*lower explosive limit (LEL)*” means the minimum concentration of gas in air which shall be present before it is capable of being explosively ignited by an ignition source;

“*explosive (flammable) range*” means the range of flammable vapour-air or gas-air mixture between the Lower Explosive Limit (LEL) and Upper Explosive Limit (UEL);

“*acceptable entry conditions*” means the conditions that shall exist in a confined space to allow entry and to ensure that authorised entrant can safely enter into and work within the confined space;

“*prohibited condition*” means any condition in a confined space that is not allowed by the permit during the period when entry is authorised;

“*hot work*” means fire-, heat- or spark-producing operation such as welding, thermal or oxygen cutting, grinding, drilling, blasting, heating and cleaning operation using high temperature steam;

“*Director General*” means the Director General of Occupational Safety and Health appointed under subsection 5(1) of the Act;

“*contractor*” means a person who has entered into a contract, whether oral or in writing and whether express or implied, for the purpose of carrying out any work in a confined space and includes a main contractor or sub-contractor;

“*stand-by person*” means an employee who is appointed by the employer to station outside a confined spaces who monitors the authorised entrants and who performs all stand-by person’s duties assigned in the employer’s confined space programme and has attended a training course on safe working in confined space for authorise entrant and stand by person and passed the test or examination;

“*authorised entrant*” means an employee who is appointed by the employer to enter a confined space and has attended a training course on safe working in confined space for authorise entrant and stand by person and passed the test or examination;

“*engulfment*” means the surrounding and effective of a person by liquid or finely divided solid substances that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing;

“*owner of industry*” means an owner of any industry specified in First Schedule of the Act;

“*forced air ventilation*” means the use of mechanical devices, such as fans or air movers (venturis), to produce a safe atmosphere within a confined space;

“*authorised gas tester (AGT)*” means a person who appointed by employer to carry out atmosphere test and had attended a training course on safe working in confined space for authorised gas tester and entry supervisor and passed the test or examination;

“*permit issuer*” means a person who is trained as an entry supervisor and an authorised gas tester, and authorised by employer to issue the permit to work. He cannot be the same person who supervises the confined space entry activity;

“*entry supervisor*” means an employee who is appointed by the employer, responsible for supervising confined space entry and had attended a training course on safe working in confined space for authorised gas tester and entry supervisor and passed the test or examination;

“*purging*” means the method by which the contaminants are displaced from a confined space;

“*rescue services*” means the service provided by a trained team to rescue persons from confined spaces;

“*permit to work*” means the written or printed document that is provided by the employer to allow and control entry into a confined space;

“*confined space entry programme*” means the employer’s overall programme for controlling and, where appropriate, for protecting his employees from confined space hazards and for regulating employees entry into confined spaces;

“*confined space*” means an enclosed or partially enclosed space that is at atmospheric pressure during occupancy and is not intended or designed primarily as a place of work, and –

- a) is liable at any time to –
 - (i) have an atmosphere which contains potentially harmful levels of contaminants;
 - (ii) have an oxygen deficiency or excess; or
 - (iii) cause engulfment; and
- b) could have restricted means for entry and exit.

The following are some examples of confined spaces –

- a) storage tanks, tankers, boilers, silos and other tank like compartment usually having a manhole for entry;
- b) open-topped spaces such as pits or degreasers;
- c) pipes, sewers, tunnels, shafts, ducts and similar structures; and
- d) any shipboard spaces entered through a small manhole, cargo tanks, cellular double bottom tanks, duct keels, ballasts and oil tanks.

The following are some examples of the activities in a confined space –

- a) cleaning of sludge and other waste materials;
- b) inspection of the physical integrity of process equipment;
- c) maintenance, including abrasive blasting and application of surface coatings;
- d) repair, including welding, modification and adjustments to mechanical equipment;
- e) rescue of workers who are injured or overcome inside the confined space; and
- f) construction purposes;

“permit system” means the employer’s written procedures for preparing and issuing permits for entry and for returning the confined space to service following termination of entry;

PART II

CONFINED SPACE ENTRY PROGRAMME

3. GENERAL REQUIREMENTS

- 3.1 The employer shall determine if his facility has any confined space, and if so, develop and maintain a record of confined spaces.
- 3.2 If a place of work has a confined space, the employer shall inform his employees and any other persons, by posting danger signs or by any other equally effective means, of the existence and location of the confined space, and the danger posed by them, especially when work is being executed. A sign reading “**DANGER --- CONFINED SPACE. DO NOT ENTER**” or using other similar meaning and in both Bahasa Malaysia and English would satisfy the requirement for a sign and shall be clearly visible.
- 3.3 If the employer decides that his employees have to enter a confined space, the employer shall develop and implement a confined space entry programme. This programme shall be documented and made available to the employees.
- 3.4 If the employer decides that his employees shall not enter a confined space, the employer shall take effective measures to prevent his employees and any other persons from entering the confined space.

4. CONFINED SPACE ENTRY PROGRAMME

- 4.1 The employer shall formulate a confined space entry programme if his employees required to enter and work in confined space.
- 4.2 The confined space entry programme shall include at least the following elements –
- 4.2.1 **Hazard identification**
- 4.2.1.1 The employer shall identify all hazards associated with working in the confined space.

4.2.1.2 Fatalities, severe injuries or disease may occur as a result of the following –

- a) oxygen deficiency in the confined space which may be caused by –
 - i. slow oxidation reactions of either organic or inorganic substances;
 - ii. rapid oxidation (combustion);
 - iii. the dilution of air with an inert gas or asphyxiant gas;
 - iv. absorption by grains, chemicals or soil; or
 - v. physical activity;
- b) excessive oxygen in the confined space which may be caused by a leaking oxygen supply fitting such as in gas cutting or heating equipment which can lead to fire or explosion;
- c) the presence of contaminants on surfaces or in the atmosphere. Contaminants may be in the form of solids, liquids, sludges, gases, vapours, fumes, or particulates. The sources of atmospheric contaminants encountered may include –
 - i. the manufacturing process;
 - ii. the substance stored or its by-products (for example, disturbing decomposed organic material in a tank can liberate toxic substances such as hydrogen sulphide, while biological hazards such as bacteria, viruses, or fungi may also be present); and
 - iii. the operation performed in the confined space (for example, painting with coating containing toxic or flammable substances, and welding or brazing with metal capable of producing toxic fumes);

- d) operation of moving equipment (for example, being trapped by augers, crushed by rotating or movement part such as conveyer belts);
- e) uncontrolled introduction of steam, water, or other gas or liquid;
- f) engulfment by solids (for example, grain, sand, flour, and fertilizer);
- g) electrocution; and
- h) explosion or fire.

4.2.1.3 Undertaking work in confined spaces may greatly increase the risk of injury from physical, chemical, biological, and psychological hazards, such as –

- a) noise, which may be caused by hammering or the use of equipment within the confined spaces;
- b) temperature, either high or low, which can result from the work process or the weather conditions, or where appropriate ventilation or appropriate clothing is not supplied or worn;
- c) radiation within a confined space (for example, from X-rays, radiation gauges, isotopes, lasers and welding);
- d) manual handling;
- e) slips, trips and falls; and
- f) claustrophobia.

4.2.2 Risk assessment

4.2.2.1 The employer shall carry out the risk assessment before carrying out work involving entry into a confined space.

4.2.2.2 The assessment shall include but not limited to –

- a) the nature of the confined space;
- b) factors to consider –
 - i. the number of persons occupying the confined space;
 - ii. the number of persons required outside the confined space to maintain equipment essential for the confined space task, to ensure adequate communication and observation of the persons within the confined space, and to properly initiate rescue procedures;
 - iii. duration of occupancy;
 - iv. the status of fitness and training of those persons involved in the confined space work;
 - v. adequacy of instructions for those person in any work procedure required, particularly those which are unusual or non-typical, including the use and limitation of any personal protective equipment and mechanical or other equipment to be used; and
 - vi. the availability and adequacy of appropriate personal protective equipment, protective clothing and rescue equipment for all persons likely to enter the confined spaces;
- c) the hazards identified in 4.2.1;
- d) the actual method selected and plan proposed –
 - i. all proposed operations and work procedures, particularly those that may cause a change in the conditions in the confined space;

- ii. the steps needed to bring the confined space to atmospheric pressure;
 - iii. the cleaning and purging method if required;
 - iv. the hot work method if required;
 - v. the soundness and security of the overall structure and the need for illumination and visibility;
 - vi. the need for additional protective measures, for example –
 - a) prohibition of hot work in adjacent areas;
 - b) prohibition of smoking and naked flames within the confined space and, where appropriate, the adjacent areas;
 - c) avoidance of contaminants of breathing atmosphere from operations or sources outside the confined space, such as from the exhaust of an internal combustion engine; and
 - d) prohibition of movement of equipment such as forklifts in adjacent areas;
 - vii. method of ventilation to maintain safe atmosphere; and
 - viii. evaluation of gases or substances;
- e) emergency and rescue procedures –
- i. arrangement for rescue, first aid and resuscitation; and
 - ii. communication between authorised entrant with standby person, and/or standby person with rescue services.

4.2.2.3 As required under Occupational Safety and Health (Use and Standards of Exposure of Chemicals Hazardous to Health) Regulations 2000, the assessment shall be carried out by an assessor if there is any chemical hazardous to health used in the confined spaces.

4.2.2.4 The employer shall ensure that the assessment is revised whenever there is evidence to indicate that it is no longer valid or every 5 years or directed by Director General, Deputy Director General or the Director of Occupational Safety and Health.

4.2.2.5 Risk assessment method may be in accordance with the Guidelines for Hazard Identification, Risk Assessment and Risk Control produced by Department or other relevant risk assessment method.

4.2.2.6 Example of the risk assessment is given in **Appendix A** and the sample of risk assessment form are given in **Appendix B**.

4.2.3 Risk control

Based on the risk assessment, the employer shall establish and implement the procedures and practices of hazard control that provide safe entry into the confined space. It shall include, but not be limited to the following –

- a) specifying acceptable entry conditions;
- b) isolating the confined space;
- c) purging, inerting, flushing or ventilating the confined space as necessary to eliminate or control atmospheric hazards; and
- d) verifying that conditions in the confined space are acceptable for entry throughout the duration of an authorised entry. This can be done by testing the confined space atmosphere before every entry and if necessary during the course of entry operations.

4.2.4 Stand-by person

Provision of at least one stand-by person outside the confined space into which entry is authorised for the duration of entry operations.

4.2.5 Monitoring of multiple confined spaces

For monitoring of multiple confined spaces by a single stand-by person, the programme shall include the means and procedures to enable the stand-by person to respond to an emergency affecting one or more of the confined spaces being monitored without distraction from the stand-by person's responsibilities under these Industry Code of Practices.

4.2.6 Permit system

The employer shall develop a written system for preparation, issuance, implementation, and cancellation of permit to work.

4.2.7 Sign-posting

Confined space warning signages shall be posted at conspicuous places when work is being carried out after the issuance of the permit to work.

4.2.8 Employee training

The employer shall ensure that their employees who are involved in confined space operation have undergone training on confined space safety course approved by the Director General and passed the examination.

4.2.9 Equipment

The employer shall provide appropriate equipment as follow –

- a) atmosphere testing and monitoring equipment;
- b) personal protective equipment as far as practicable if engineering and work practice controls do not adequately protect authorised entrants;
- c) forced air ventilation equipment require for achieving acceptable entry conditions;
- d) lighting equipment needed to enable authorised entrants to see clearly, work safely and to be able to exit the confined space quickly in case of emergency;
- e) barriers and shields;
- f) equipment for safe ingress and egress for authorised entrants, such as ladders, winch and tripod;
- g) emergency and rescue equipment; and
- h) any other equipment necessary for safe entry into and rescue from confined spaces.

4.2.10 Means of Communication

The means of communication may vary depending upon the type of work being done and the nature of the work place. In most instances communication devices such as telephone or walkie talkie are preferred. There may be instances that other methods of communication may be used such as verbal communication, hand signal, light and cord signal.

4.2.11 External hazard protection

Protection such as physical barriers shall be provided to control potential hazards posed by pedestrians and vehicles.

4.2.12 Identification of the duties

- a) The employer shall designate and identify the duties of employees to be an authorised entrant, stand-by person, entry supervisor, authorised gas tester, permit issuer or other related personnel in entry operation.
- b) The employer shall ensure that the personnel mention in (a) carried out their duties as specified in Part IV.

4.2.13 Information to the contractor

The employer shall provide and brief contractors with information about the confined space hazards, safety rules and emergency procedures in compliance with this Industry Code of Practice.

4.2.14 Coordination of entry operations involving employees of more than one contractor working simultaneously

Procedures shall be developed and implemented when these employees are working at the same time as authorised entrants in a confined space, so that employees of one contractor do not endanger the employees of any other contractor.

4.2.15 Conclusion of entry

Procedures necessary for concluding the entry after entry operations have been completed, such as closing off a confined space and closing the permit shall be developed and implemented. After closing the permit to work, a proper debriefing shall be conducted.

4.3 Reviewing of confined space entry programme

- 4.3.1 The confined space entry programme shall be reviewed when the employer has reasons to believe that the measures taken under the confined space entry programme may not protect employees and that there is a need to revise the programme to correct deficiencies found to exist before subsequent entries are authorised.

4.3.2 The employer shall also review the programme or performances, using the cancelled permit after each entry and revise the programme if necessary, to ensure that employees participating in entry operations are protected from confined space hazards. Employers may perform a single annual review covering all cancelled permit entries performed during a 12-month period. If no entry is performed during this period, no review is necessary.

4.3.3 The employer shall also review the programme if there any revision to the existing law or as directed by Director General.

4.4 **Emergency procedures**

No two emergencies are the same, as each emergency procedure is created specifically for each potential accident or emergency. However there are some general principles that shall be addressed in order to develop a complete emergency procedure.

4.4.1 **Alarm**

4.4.1.1 System or arrangement shall be put in place to enable an employee to raise an emergency alarm, so that the earliest possible action to control the situation can be activated. Alarm system can vary and will depend on the workplace.

4.4.1.2 There shall be adequate number of points from which the alarm can be raised either directly, via a signal or message to a permanently manned location. The alarm shall alert the person in charge, who shall assess the situation and activate appropriate emergency procedures, and the same time the standby person shall instruct the authorised entrant to evacuate the confined space immediately.

4.4.1.3 In the areas where there is high level of noise, it may be necessary to install more than one audible alarm transmitter with flashing lights. Automatic alarms may be appropriate on some sites.

4.4.2 **Emergency action**

Emergency action is the necessary action to be taken during emergency which includes the sequence of action to be done and decisions to be made to control the emergency situation. An action plan for emergency shall be prepared in advance.

4.4.3 Evacuation, rescue and first aid

The evacuation, rescue and first aid procedures shall address at least the following –

- a) evacuation shall be to a predetermined safe assembly point;
- b) the procedure shall designate someone to record all employees arrive at the assembly point;
- c) account for all employees;
- d) activate the rescue team or summon the rescue services to search for missing employees;
- e) apply first aid on injured person, only if qualified person available; and
- f) inform the nearest hospital if necessary.

4.4.4 Rescue procedures.

Emergency procedures, including provision for rescue equipment, shall be established and implemented. Arrangements shall take into account the following –

- a) the shape and size of the confined space;
- b) the nature of the task to be performed;
- c) obstacles within the confined space and the size and position of the means of ingress to and egress from the confined space; and
- d) the number of persons occupying the confined space and the number of persons required outside the confined space to maintain equipment essential for the confined space task, to ensure adequate communication with the persons within the confined space, to observe persons within the confined space, and to properly initiate rescue procedures if required.

4.4.5 Communication

4.4.5.1 Communication is a crucial factor in handling an emergency. The communication procedure involves the co-ordination and flow of information within the company or the work site and outside of the company. At the work site, the person in charge shall be the entry supervisor.

4.4.5.2 Communication shall be established between the following persons –

- a) the site manager;
- b) entry supervisor;
- c) individual authorising entry;
- d) rescue team; and
- e) any other rescue and emergency services e.g Fire & Rescue Department, Hospital.

PART III

DETAIL REQUIREMENTS

5. PERMIT SYSTEM

- 5.1 Before entry is authorised, the employer shall document the completion of measures as required by paragraph 4.2.3.
- 5.2 Before entry begins, the permit issuer identified on the permit to work shall issue the permit to work to authorise entry. The permit issuer shall not be the same person to supervise the work.
- 5.3 Entry supervisor shall accept the permit condition by signing the permit to work and subsequently organised the entry activity.
- 5.4 The completed permit to work shall be made available at the time of entry to all authorised entrants, by posting it at the entry portal, so that the entrants can confirm that pre-entry preparations have been completed.
- 5.5 The duration of the permit to work shall be stated and shall not exceed the time required to complete the assigned task or job identified in the permit to work in accordance with the purpose of entry or eight hours, which ever is shorter. The permit to work may be extended by entry supervisor only once for a maximum of four hours, provided all the terms and conditions remain the same.
- 5.6 The entry supervisor shall terminate entry and cancel the entry permit to work when a condition that is not allowed under the permit to work arises in or near the confined spaces, for example if there is a significant change in risk. Any problem encountered during an entry operation shall be noted on the pertinent permit to work so that appropriate revisions to the confined space entry programme can be made.
- 5.7 The permit to work shall be closed by entry supervisor after all works are completed.

6. PERMIT TO WORK

6.1 The confined space permit to work shall be the overriding permit.

6.2 The permit to work that documents compliance with this Industry Code of Practice and authorises entry into a confined space shall contain the following information –

- a) the confined space to be entered;
- b) the purpose of entry;
- c) the date and the authorised duration of the permit to work;
- d) the authorised entrants within the confined space, by name or by such other means as will enable the stand-by person to determine quickly and accurately, for the duration of the permit to work, which authorised entrants are inside the confined space;
- e) the permit issuer who sign the permit to work;
- f) the entry supervisor;
- g) the hazards of the confined space to be entered;
- h) the measures used to isolate the confined space and to eliminate or control confined space hazards before entry. These measures can include the lockout or tagging of equipment and procedures for purging, inerting, ventilating, and flushing confined spaces;
- i) the acceptable entry conditions. Refer to the Occupational Safety and Health (Use and Standards of Exposure of Chemicals Hazardous to Health) Regulations 2000 for the list of permissible exposure limits;
- j) the results of initial and periodic atmospheric tests performed and accompanied by the names of authorised gas tester and an indication of the type of tests performed;

- k) the communication procedures used by authorised entrants and stand-by persons to maintain contact during the entry;
- l) equipment, such as personal protective equipment, testing equipment, communication equipment, emergency alarm system, and rescue equipment, to be provided;
- m) any other information which is necessary to be included, given the circumstances of the particular confined space, in order to ensure entrant's safety;
- n) stand-by personnel and rescue arrangements; and
- o) any additional permit, such as permit for hot work that has been issued to authorise work in the confined space. Integrated permit system is also acceptable. For additional information on hot work, refer to **Appendix C**.

6.3 **Appendix D** shows an example of a typical permit to work.

7. ISOLATION REQUIREMENTS

7.1 Isolation of services supplied to a confined space is required, where owing to the nature of the space or the nature of the services or the material conveyed by the services, accidental or inadvertent introduction of the material or movement or actuation of machinery would create a hazard.

7.2 The employer shall take positive steps to ensure the following but not limited to –

- a) positive isolation to prevent accidental introduction into the confined space of materials, through equipment such as piping, ducts, drains, conveyors, service pipes, or fire protection equipment. Closing of a valve is not considered as a positive isolation;
- b) de-energisation and lock-out, or de-energisation and tag out, or both, of machinery, mixers, agitators or other equipment containing moving parts in the confined space. This may require additional isolation, blocking or de-energisation of the machinery itself to guard against the release of stored energy (for example, springs); and

- c) isolation of all other energy sources which may be external to but still capable of affecting the confined space, for example heating or refrigerating media.

7.3 Methods of isolation from hazardous materials

A confined space shall be isolated before entry is permitted. The method of isolation shall be determined based on the risk involved and in accordance with one of the methods described below or by an alternative method ensuring equivalent security –

- a) removal of a valve, spool piece, or expansion joint in piping leading to, and as close as possible to, the confined space, and blanking or capping the open end of the piping leading to the confined space. The blank or cap shall be identified to indicate its purpose. Blanks or caps shall be of a material that is compatible with the liquid, vapour or gas with which they are in contact. The material shall also have sufficient strength to withstand the maximum operating pressure, including surges, which can be built up in the piping;
- b) insertion of a suitable full-pressure spade (blank) in piping between the flanges nearest to the confined space;
- c) where neither of the methods described in (a) or (b) is practicable, isolation by means of closing and locking, or closing and tagging, or both, of at least two valves in the piping leading to the confined space. Where practicable, a drain valve between the two valves shall also be locked open or tagged open to atmosphere as part of this method; and
- d) if isolation of the space is not feasible because the space is too large or is part of a continuous system (such as a sewer), pre-entry testing performed in accordance to paragraph 8.6.1.1 to extent feasible shall be considered as fulfilling the isolation requirement.

7.4 Methods of isolation from moving parts

Before entry is permitted into any confined space, which can move, or in which agitators, fans or other moving parts of potential hazard to personnel are present, the possibility of movement shall be prevented by the relevant method described below or by alternative methods offering

equivalent security. Where practicable, equipment or devices with stored energy, including hydraulic, pneumatic, electrical, chemical, mechanical, thermal or other types of energy, shall be reduced to a zero energy condition –

- a) the authorised entrant shall place a lock or tag, or both, on the open circuit-breaker or isolating switch supplying electric power to equipment with hazardous moving parts, to indicate that a person is in a confined space and that such isolation shall not be removed until all persons have left the confined space. When a lock is used, the key shall be kept in the possession of the authorised entrant;
- b) where a power source cannot be controlled readily or effectively, a belt or other mechanical linkage shall be disconnected and tagged to indicate that a person is in a confined space and that such belt or linkage shall not be reconnected until all persons have left the confined space;
- c) where (a) and (b) are not practicable, moveable components shall be blocked, and switches, clutches or other controls shall be tagged to indicate that a person is in a confined space and that such blocks and tags shall not be removed until all persons have left the space.

NOTE: Where more than one person is to work in the confined space, there shall be a system developed so that the isolating device is locked, or tagged, or both, by each person entering the confined space.

7.5 Removal of means of isolation

7.5.1 There shall be a system to ensure the removal of locks, tags, blanks or other protective factors are removed only by the person who originally installed them.

7.5.2 Activation or energization of the system shall be done by the person who originally deactivated or deenergized them or any other person who has adequate knowledge and skills. and has been authorized by the entry supervisor or permit issuer to perform correctly the task.

8. REQUIREMENTS TO ENSURE SAFETY OF ATMOSPHERE

- 8.1 No person shall enter a confined space until the level of exposure is brought down below the permissible exposure limit and all risks from physical, chemical, ergonomic, psychological, radioactive and/or biological hazards are reduced as low as practicable.
- 8.2 Precautions shall be taken to establish and maintain a safe atmosphere within the confined space, for the duration of occupancy.
- 8.3 Precautions/actions, shall be implemented to establish and maintain a safe breathing atmosphere in a confined space. The following action shall be done –
- a) initial cleaning;
 - b) purging;
 - c) testing and evaluation of the atmosphere in the confined space;
 - d) retest and/or monitoring; and
 - e) ventilation.

Note: When the safe atmosphere cannot be achieved, entry into the confined space shall be carried out in accordance to the requirement specified in paragraph 9.

8.4 Initial cleaning

- 8.4.1 Where practicable, all solids and liquids, which are liable to present a hazard to persons inside the confined space, shall be removed from the confined space prior to entry of such persons. For additional information on cleaning, refer to **Appendix E**.

8.4.2 The cleaning processes and methods used may need to be adapted to meet each separate set of circumstances. Consideration shall be made on potentially dangerous materials that may be trapped in sludge, scale or other deposit.

8.4.3 Potentially dangerous material may be trapped in sludge, scale or other deposits, brickwork or behind loose linings, in liquid traps, or in instrument fittings, and may be released only when, for example, it is disturbed or heat is applied. Similarly, such material may lodge in joints in vessels or in bends of connecting pipes or other places where removal is difficult.

8.5 **Purging**

8.5.1 Where necessary, the confined space shall be cleared of contaminants by use of a suitable purging agent. Care shall be taken in the purging of a confined space to prevent collapse of the enclosure due to pressure differentials.

8.5.2 When flammable contaminants are to be purged, purging and ventilation equipment designed for use in hazardous locations shall be employed and precautions shall be taken to eliminate all sources of ignition, including static electricity discharges.

8.5.3 The methods employed shall ensure that any contaminants removed from the confined space are exhausted to a location where they present no hazard to persons or equipment.

8.5.4 When inert gas use for purging, forced air ventilation shall be carried out to remove the inert gas to acceptable level to ensure safe entry condition.

8.6 **Testing and evaluation in a confined space**

8.6.1 Evaluation of a confined space conditions shall be conducted as follows when entry operations are conducted –

8.6.1.1 Pre-entry check

- a) test conditions in the confined space to determine if acceptable entry conditions exists before entry is authorised, except that, if isolation of the space is not feasible because the space is too large or is part of a continuous system (such as a sewer), pre-entry testing shall be performed to the extent feasible before entry is authorised;
- b) the atmosphere shall be tested by an authorised gas tester;
- c) when testing for atmospheric hazards, the first test is for oxygen, followed by flammable gases and vapours, and finally for toxic gases and vapours;
- d) testing and evaluation of the atmosphere and a survey of other hazards shall be performed from outside the confined space, before any entry occurs. The results shall be recorded on the permit to work;
- e) testing and evaluation of more remote regions within the confined space may be performed once the area next to the point of entry to the confined space has been made safe; and
- f) If the result of the test failed, more effective ventilation shall be applied to achieve the safe entry condition.

8.6.1.2 During entry

- a) if entry is authorised, entry conditions shall be continuously monitored in the areas where authorised entrants are working. Test or monitor the confined space as necessary to determine if acceptable entry conditions are being maintained during the course of entry conditions;
- b) assess whether there is any hazard from hazardous atmospheres and extremes of temperature; and
- c) if a hazardous atmosphere is detected during entry or during work in the confined space –

- i. every employee shall leave the space immediately;
- ii. entry supervisor shall cancel the permit to work immediately and review the condition;
- iii. the space shall be evaluated to determine how the hazardous atmosphere has developed; and
- iv. measures shall be implemented to protect employees from the hazardous atmosphere before any subsequent entry takes place.

8.6.2 The atmosphere shall be tested by an authorised gas tester initially and continuous monitoring may be done by an authorised gas tester or an authorised entrant. The continuous monitoring of atmospheric condition shall be carried out consistent with the hazards identified and the risk assessment.

8.6.3 Retesting is considered necessary because of the probable gradual release of the hazardous gas due to deliberate or accidental disturbance of the sludge or other objects, which have trapped or absorbed the contaminants.

8.6.4 **Appendix F** shows an additional recommendation for atmospheric testing.

8.6.5 It is essential to ensure that the instrument used is –

- a) direct reading instrument;
- b) calibrated as per manufacturer's recommendation;
- c) suitable for measuring the presence of gases required to be tested; and
- d) some instruments, for example the oxygen meter, are only used for measuring oxygen content. They shall not be used to indicate the presence of any toxic or flammable gases. However, there are now a number of instruments that are capable of taking measurement for oxygen content, flammable content, and toxic content spontaneously.

8.7 Ventilation

8.7.1 Ventilation shall be provided continuously throughout the period of occupancy in the confined space.

8.7.2 When continuous forced air ventilation is used, the following shall apply –

- a) an authorised entrant shall not enter the space until the forced air ventilation has eliminated any hazardous atmosphere;
- b) the forced air ventilation shall be so directed as to ventilate the immediate areas where an authorised entrant is or will be present within the space and shall continue until he has left the space;
- c) the air supply for the forced air ventilation shall be from a clean source, free from any contaminants and may not increase the hazards in the space;
- d) the atmosphere within the space shall be periodically tested as necessary to ensure that the continuous forced air ventilation is preventing the accumulation of a hazardous atmosphere; and
- e) exhaust from equipment shall be directed away from the confined space access or the inlet of the ventilation fan.

8.7.3 Where the maintenance of a safe working environment in a confined space is dependent on forced air ventilation equipment, for example a fan, the equipment shall –

- a) be continuously monitored while the confined space is occupied; and
- b) have the controls (including any remote power supply) clearly identified and tagged to guard against unauthorised interference.

8.7.4 Exhaust facilities shall be arranged to ensure that any contaminated air exhausted from the confined space does not present any hazard to other persons or equipment.

8.7.5 Oxygen shall not be used to ventilate a confined space. Oxygen enrichment (excess) of an atmosphere can result in increased flammability level and the likelihood of explosion or fire is heightened.

9. ENTRY INTO HAZARDOUS ATMOSPHERE

9.1 Entry into confined space containing hazardous atmosphere shall only be allowed under the following conditions –

- a) the atmosphere inside the confined space could not be brought to safe working conditions despite all reasonable effort made to purge, clean and ventilate the space;
- b) the nature of the work procedure within the confined space is likely to degrade or contaminate the atmosphere in the confined space (for example, hot work, painting, changing of catalyst or removal of sludge);and
- c) introduction of air into the confined space would pose additional risk to health and safety aspect of authorised entrant and the activities carried out therein; or would detrimentally affect the product, equipment or other substances contained in the confined space. Under these conditions, entry into the confined space are normally carried out under inert atmosphere.

9.2 Authorised entrant entering into hazardous atmosphere shall use suitable self-contained breathing apparatus (SCBA), compressed airline breathing apparatus or special life supporting system depending on the nature of works and hazards involved. For example, air-line respirator and self-contained breathing apparatus (SCBA) which are commonly available in refineries and chemical plants do not provide adequate safeguards to cover risks associated with work in an inert gas or nitrogen atmosphere. This work can only be carried out by authorised entrant who has been trained and competent on use of appropriate type of breathing apparatus shall be allowed to use the equipment for entry into hazardous atmosphere.

- 9.3 Continuous gas monitoring for LEL shall be carried out during entry into hazardous atmosphere. Oxygen deficient atmosphere could have an effect on the reliability of explosimeter. For example, a standard catalytic gas detector could give false readings in oxygen deficient atmosphere and therefore requires special techniques and interpretation of results. Therefore, proper type of explosimeter which could give true indication of the level of flammable gas shall be used in hazardous atmosphere.

Hot work must not be undertaken if the explosimeter reading exceeds 1% LEL.

Confined space shall not be entered if the explosimeter reading is equal to or greater than 10% LEL. If entry is still necessary, appropriate positive pressure air-supplied breathing apparatus shall be used and the entry shall be made under inert atmosphere as specified in paragraph 9.8.

- 9.4 The following requirements shall be included as part of rescue plan for entry into hazardous environment –

- a) an authorised entrant entering a hazardous atmosphere shall wear a safety harness with a lifeline attached to facilitate rescue operation in an emergency situation. The free end of the lifeline shall be tended at all times by a standby person stationed outside the confined space. The use of a lifeline is not required if the risk assessment identifies obstructions or other conditions that make its use impractical or unsafe, but the harness must still be worn so that a lifeline can be quickly attached by a rescuer;
- b) appropriate number of air-supplied breathing apparatus shall be put on standby outside the confined space for use by the rescuer in an emergency situation. The minimum number of rescuer shall be a team of two;
- c) an authorised entrant entering a hazardous atmosphere shall carry with him an escape set or additional supply of breathing air cylinder for use in case of emergency; and
- d) in certain circumstances, such as work inside spheres or tall columns, it may be necessary to use a safety harness in conjunction with a special winch, or pulley, or additional manpower, to ensure prompt response in an emergency requiring the removal of authorised entrants from the confined space. In this case, the required equipment shall also be set-up at the work location before entry starts.

9.5 Where compressed airline breathing apparatus is used for entry into hazardous atmosphere, the airline coupling shall only operate on breathing air system using dedicated coupling with double locking mechanism. The coupling shall not be compatible with nitrogen, oxygen or other gas systems. Valves on supply lines for service air i.e plant of instrument air or other gases within the vicinity shall be chain-locked.

9.6 The conditions of compressed airline system such as the hoses and fitting, air purifying element (filter), pressure relief valve, pressure regulator, pressure gauge and the compressed air cylinder or compressor shall be monitored at all times by trained personnel to ensure continuous air supply whenever the airline system is in use during entry.

9.7 The number of authorised entrant permitted to enter a confined space shall be limited according to the available space, the number of escape routes and the rescue facilities.

9.8 **Entry into inert atmosphere**

9.8.1 The purpose for introduction of inert atmosphere inside confined spaces are as follows –

- a) prevention of flammable and explosive conditions through elimination of fuel (gas, solvent or flammable materials), air or oxygen and energy in the form of heat, spark or flame;
- b) prevention of chemical reaction or oxidation of substances contained in the confined space e.g. for the purpose of quality control or preservation of products, catalysts or other substances or equipment inside the confined space; and
- c) prevention of other hazardous conditions through elimination of corrosive, toxic, infectious or harmful gases.

9.8.2 Selection and application of inert gas requires careful matching of processes and products so as not to introduce other hazards resulting from chemical reactions.

9.8.3 Special safety considerations when working under inert atmosphere –

- a) the main hazard associated with inert atmosphere is asphyxiation either as a result of direct displacement of oxygen in the air or interference with the body's ability to absorb or transport oxygen to the tissues. Asphyxiation effects may exist within several feet of an open manhole. Extreme care must be taken while working near open manhole where inert gas e.g. nitrogen, carbon monoxide or other asphyxiant gas is used or contained in the confined space. The area shall be barricaded and warning signage shall be conspicuously posted at strategic point. Personnel must use appropriate respiratory protection to avoid being overcome by these gases;
- b) great care must be taken when working with inert atmosphere containing toxic substances such as carbon monoxide to ensure that authorised entrant inside and personnel outside the confined space are not exposed to even dilute concentration of gas. If the tank had contained a toxic substance, the concentration of this substance shall also be measured at locations in close proximity of open manholes outside the confined space to ensure that it is not present at a level that is toxic to employees;
- c) if inert gas is constantly introduced and vented as part of the procedure to maintain inert atmosphere inside a confined space, a system shall be established to effectively maintain atmospheric pressure and to monitor and reduce potential pressure built-up inside the confined space;
- d) inert atmosphere inside of any space is immediately dangerous to life and health (IDLH), a standby person and two other who are dedicated emergency response personnel who is trained in rescue techniques shall be present and equipped with an equivalent or superior protective equipment in case rescue is required; and
- e) an independent back-up supply of the inert gas (e.g N₂) must be provided to allow the confined space to be evacuated and made safe in the event of a loss of the primary supply.

10. RESCUE AND EMERGENCY SERVICES

10.1 General

The need for the rescue of authorised entrant from a confined space and the provision of first aid, either in the confined space or after rescue from the space, may arise. Therefore, the employer shall establish a rescue and first aid procedures, and provisions need to be planned, established, and shall regularly rehearsed. The employer may opt to seek assistance from rescue services such as Fire & Rescue Department, Hospital etc.

10.2 Rescue procedures.

Rescue procedures, including provision for rescue equipment as specified at paragraph 4.4.4 shall be established and implemented.

10.3 Rescue and emergency services.

Procedures and the means for summoning rescue and emergency services shall be developed and implemented. This programme shall incorporate procedures for rescuing entrants from confined spaces, for providing necessary emergency services to rescue authorised entrant, and for preventing unauthorised personnel from attempting a rescue. The rescue and emergency services can be summoned immediately.

10.4 The employer shall provide a regular training in the proper use of personal protective equipment.

10.5 All personnel who may be involved in any way with rescues from a confined space shall be aware that –

- a) well-planned and well-executed rescue procedures are essential and shall be followed at all times; and
- b) in an emergency, the spontaneous reaction to immediately enter and attempt a rescue from a confined space may lead to multiple fatalities, not only of those persons need to be rescued but also of those who attempt to rescue.

10.6 The following requirements apply to employers who have employees enter confined spaces to perform rescue services –

- a) the employer shall ensure that each member of the rescue service is provided with, and is trained to use properly, the personal protective equipment and rescue equipment necessary for rescue from confined spaces. The emergency and rescue services team shall attend the course on rescue and emergency services conducted and certified by Malaysia Fire and Rescue Department (BOMBA);
- b) each member of the rescue service shall be trained to perform the assigned rescue duties. Each member of the rescue service shall also receive the training required of authorised entrants;
- c) each member of the rescue service shall practise confined space rescues at least once every 12 months, by means of simulated rescue operations in which they remove dummies, manikins, or actual persons from the actual confined spaces or from representative confined spaces. Representative confined spaces shall, with respect to opening size, configuration and accessibility, simulate the types of confined spaces from which rescue is to be performed;
- d) each member of the rescue service shall be trained in basic first aid and in cardio-pulmonary resuscitation (CPR). At least one member of the rescue service is holding current certification in first aid and in CPR; and
- e) each member of rescue service shall be certified physically and mentally fit to enter confined space as specified in paragraph 11.2.

10.7 When an employer arranges to have persons other than his employees perform confined space rescue, the employer shall –

- a) inform the rescue service of the hazards they may confront when called on to perform rescue at the employer's facility; and
- b) provide the rescue service with access to all confined spaces from which rescue may be necessary so that the rescue service can develop appropriate rescue plans and practise rescue operations as needed.

- 10.8 To facilitate non-entry rescue, retrieval systems or methods shall be used whenever an authorised entrant enters a confined space, unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant. Retrieval system shall meet the following requirements –
- a) each authorised entrant shall use a chest or full-body harness, with a retrieval line attached; and
 - b) the other end of the retrieval line shall be attached to a mechanical device or fixed point outside the confined space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary. A mechanical device shall be available to retrieve personnel from vertical type confined spaces more than 1.5 metres deep.

11. HEALTH REQUIREMENTS OF PERSONS WORKING IN CONFINED SPACE

- 11.1 There are physical and psychological stresses associated with work in a confined space. Apart from the quality of lighting and the fact of confinement, which may alter and restrict the way most people work, the lighting and confinement can exaggerate existing problems of poor vision, poor balance, poor mobility and poor blood circulation.
- 11.2 The employer shall ensure that his authorised entrant intending to work in confined space are certified physically and mentally fit determined by an occupational health doctor (OHD). The examination may be tailored to detect the following –
- a) history of fits, blackouts or fainting attacks;
 - b) heart disease or heart disorder;
 - c) chronic airway diseases such as asthma, bronchitis, or a shortness of breath on exertion;
 - d) deafness;
 - e) Meniere's disease or disease involving giddiness or loss of balance;

- f) claustrophobia or other mental disorder;
 - g) neurological and Musculo-Skeletal Disorder such as back pain or joint trouble that would limit mobility in confined spaces;
 - h) condition that limit movement in confined space such as gross obesity, pregnancy and physical handicap;
 - i) metabolic diseases;
 - j) serious defect in eyesight; and
 - k) any other disease or condition that may affect or endanger the person's safety and health while working in confined space.
- 11.3 Following the health surveillance in sub paragraph 11.2, the occupational health doctor (OHD) shall issue a health fitness certificate that shall be valid for a period of two (2) years. Example of health examination checklist is given in **Appendix G** and example of health fitness certificate is given in **Appendix H**.
- 11.4 The authorised entrant shall declare that he is fit to enter the confined space in writing prior to each entry. Example of health status declaration is given in **Appendix I**.
- 11.5 If the risk assessment shows that additional health surveillance is required, the employer shall conduct the additional health surveillance to the authorised entrant.
- 11.6 The employer shall ensure that the health surveillance record or a copy thereof is maintained in good order and the record kept for 30 years.

12. TRAINING

12.1 The employer shall provide training to all employees directly affected with working in confined spaces, so that employees acquire the understanding, knowledge, and skills necessary for the safe performance of the duties assigned under this Industry Code of practice.

12.2 Training shall be provided to every affected employee –

- a) before the employee is first assigned duties under this Industry Code of practice;
- b) before there is a change in assigned duties;
- c) whenever there is a change in confined space operations that presents a hazard which an employee has not previously been trained; and
- d) whenever the employer has reasons to believe either that there are deviations from the confined space entry procedures or that there are inadequacies in the employee's knowledge or use of these procedures.

12.3 Training requirements for each employee involved in confined-space work such as authorised entrants, stand-by persons, authorised gas tester and entry supervisor shall include but not limited to the following –

12.3.1 Authorised Entrant and Standby Person

- a) authorised entrant and standby person has to attend a training course on working in confined space for authorised entrant and stand by person conducted by the National Institute of Occupational Safety and Health (NIOSH) or training provider registered with Director General, and passed the examination; and
- b) the training module shall be approved by Director General.

12.3.2 Authorised Gas Tester and Entry Supervisor

- a) authorised gas tester and entry supervisor has to attend training course for authorised gas tester and entry supervisor conducted by the National Institute of Occupational Safety and Health (NIOSH) or training provider registered with Director General, and passed the examination;
- b) authorised gas tester and entry supervisor shall be registered with Director General; and
- c) the training module shall be approved by Director General.

12.4 Retraining

All four categories of employee have to undergo a refresher course every two years using module approved by Director General.

- 12.5 The employer shall keep record of the training required under paragraph 12.2. The record shall contain the name of all employees who have attended the training, the result of the examination or test, the signatures or initials of the trainers, and the dates of the training. The record shall be available for inspection by the employees, members of the safety and health committee, or Director General.

13. ADDITIONAL PRECAUTIONS DURING OCCUPANCY OF CONFINED SPACE

13.1 Portable electrical equipment

- 13.1.1 Any hand-lamp, electric tool or other portable electrical equipment to be used in a confined space shall be connected to an earth-free extra low voltage supply in accordance with standards recognized by Energy Commission.

- 13.1.2 In addition, the equipment shall be fitted with a flexible supply cable of heavy-duty type. Cables shall be located, suspended or guarded to minimise accidental damage.

13.1.3 Where a flammable atmosphere is likely to exist, all portable electrical equipment such as lamp, torch light and other electrical instruments shall be explosion proof and intrinsically safe.

13.2 Suitability and safety of non-electrical equipment

13.2.1 Where a flammable atmosphere is likely to exist, precautions shall be taken to eliminate all sources of ignition.

13.2.2 Where possible use of pneumatic tools are preferred.

13.2.3 As far as is practicable, no cylinder of compressed gas, other than those used for self-contained breathing apparatus (SCBA) or emergency breathing apparatus, shall be taken into a confined space. The compressed gas supply to equipment in the confined space shall be turned off at the cylinder valve and the hose shall be removed and depressurised outside the confined spaces when not in use. A hose supplying gas-operated equipment used in a confined space shall be located, suspended or otherwise guarded to avoid accidental damage.

13.2.4 Where a portable ladder is used, particular care shall be taken to ensure it is adequately constructed and firmly secured to prevent movement.

13.3 Maintenance of equipment used for entry

13.3.1 All equipment shall be inspected prior to use.

13.3.2 The equipment used for the purposes of confined space entry or emergency services shall be maintained and thoroughly examined by a qualified person appointed by the employer at least once a month.

13.3.3 All other equipment used for entry shall be maintained and thoroughly examined by a qualified person appointed by the employer in accordance to manufacturer's recommendation.

13.3.4 A report on every such examination shall be kept available for inspection.

14. RECORD KEEPING

- 14.1 The employer shall retain each permit to work which has been cancelled and closed for at least 1 year or until the next entry which ever come later to facilitate the review of the confined space entry programme.
- 14.2 The employer shall also maintain all other relevant documents such as but not limited to reports of inspection, risk assessment, training record, medical record, rescue plan, confined space entry programme and checklist for the purpose of inspection by the Director General.

PART IV

DUTIES OF RESPONSIBLE PERSONS

15. DUTIES OF EMPLOYER AS OWNER OF INDUSTRY

Where the employer is an owner of industry, the employer shall –

- a) inform his employees and contractor that confined space entry is allowed only through compliance with the confined space entry programme stipulated under these Industry Code of Practice;
- b) inform his employees and contractor of the previously identified hazards and the employer's experience with the confined space;
- c) inform his employees and contractor of any precautions or procedures that the employer has implemented for the protection of employees in or near confined spaces where his employee or contractor's employee will be working;
- d) co-ordinate entry operation with the contractor, when both the employee and the contractor's employee will be working in or near confined spaces; and
- e) ensure that the contractor, permit issuer, entry supervisor, authorised gas tester, authorised entrants and stand-by person fulfil their duties specified under paragraph 16, 17, 18, 19, 20, and 21 respectively.

16. DUTIES OF EMPLOYER AS CONTRACTOR

Where the employer is a contractor, the employer shall –

- a) obtain all available information regarding confined space hazards and entry information from the owner of industry;

- b) cooperate with owner of industry when both the owner of industry's personnel and the contractor's personnel will be working in or near confined spaces;
- c) brief the owner of industry on their implementation of the confined space entry programme;
- d) inform the owner of industry of any hazards confronted or created during the entry operation in confined spaces, through a debriefing;
- e) if the contractor possesses the site, then they shall comply with the duties of the owner of industry; and
- f) ensure that the permit issuer, entry supervisor, authorised gas tester, authorised entrants and stand-by person fulfil their duties specified under paragraph 17, 18, 19, 20, and 21 respectively.

17. DUTIES OF PERMIT ISSUER

Each permit issuer shall –

- a) update his knowledge on hazards that may be faced during entry, including information on the mode, signs and symptoms, and consequences of the exposure;
- b) identify all hazards and recommends control measures to ensure safe entry;
- c) ensure there is no other incompatible activity in the vicinity of the confined space;
- d) authorise the permit to work; and
- e) endorse the cancellation and closure of the permit to work.

18. DUTIES OF ENTRY SUPERVISOR

Each entry supervisor shall -

- a) update his knowledge on hazards that may be faced during entry, including information on the mode, signs and symptoms, and consequences of the exposure;
- b) supervise all the activities before, during and after entry operation;
- c) verify by checking that the appropriate entries have been made on the permit to work, that all tests specified by the permit to work have been conducted and that all procedures and equipment specified by the permit to work are in place before the permit issuer authorise the permit to work and allow entry to begin;
- d) terminate the entry and cancel the permit to work if the acceptable entry condition cannot be maintained;
- e) close the permit to work at the completion of the entry;
- f) verify that rescue services are available before any entry and that the means for summoning them are operable;
- g) remove unauthorised individuals who enter or who attempt to enter the confined space during entry operations;
- h) determine that entry operations remain consistent with terms of the permit to work and that acceptable entry conditions are maintained, wherever responsibility for a confined space entry operation is transferred and at intervals dictated by the hazards and operations performed within the space;
- i) brief the entry team on the hazards, permit to work requirement and emergency procedures;

- j) conduct a debriefing session with the contractor or his employees at the conclusion of the entry operations regarding the confined space entry programme and any hazards confronted or created in confined spaces during entry operations;
- k) ensure means to restrict unauthorised entry are made available;
- l) be in charge of communication during emergency; and
- m) when an entry supervisor is required to be a permit issuer for a permit to work, he cannot be the entry supervisor for the work described in that permit to work.

19. DUTIES OF AUTHORISED GAS TESTER

Each authorised gas tester shall –

- a) update his knowledge on the hazards that may be faced during entry, including information on the mode, signs and symptoms, and consequences of the exposure;
- b) identify all chemical hazards and recommends control measures to ensure safe entry;
- c) be familiar with all confined space entry equipment used, for example emergency breathing apparatus, man riding winch, tripod, etc; and
- d) test and interpret the reading level of gaseous in the confined space.

20. DUTIES OF STAND-BY PERSON

Each stand-by person shall –

- a) have the knowledge of the hazards that may be faced during entry, including information on the mode, signs and symptoms, and consequences of the exposure;

- b) be aware of possible behavioural effects to authorised entrants due to exposure to hazard;
- c) continuously maintain an accurate count of authorised entrants in confined spaces and also ensure that the means used to identify authorised entrants accurately identifies who is in the confined space;
- d) make sure that the number of authorised entrant tally to the permit to work;
- e) remain within his assigned work area outside the confined space during entry operations until relieved by another stand-by person;
- f) communicate with authorised entrants and/or fire watch if available regularly to monitor entrant status and to alert entrants of the need to evacuate their space;
- g) monitor activities outside and inside of every confined space to determine if it is safe for entrants to remain in the confined space and orders the authorised entrants to evacuate a confined space immediately under any of the following circumstances –
 - i. if the stand-by person detects a prohibited condition;
 - ii. if the stand-by person detects the behavioural effects to any authorised entrant due to exposure to hazard;
 - iii. if the stand-by person detects a situation outside the space that could endanger the authorised entrants;
 - iv. if the stand-by person cannot effectively and safely perform all the duties; or
 - v. if any alarm is activated.
- h) summons rescue and other emergency services as soon as he determines that authorised entrants may need assistance to escape from confined space;

- i) takes the following actions when unauthorised persons approach or enter a confined space while the entry is in progress –
 - i. warn the unauthorised persons to stay away/out from the confined space; and
 - ii. inform the authorised entrants and entry supervisor if unauthorised persons have entered the confined space;
- j) perform non-entry rescue as specified by the employer's rescue procedures;
- k) not perform any duties that might interfere with the stand-by person's primary duties to monitor and protect the authorised entrants; and
- l) monitor the condition of equipment required for safe entry work such as lighting and ventilation.

21. DUTIES OF AUTHORISED ENTRANT

Each authorised entrant shall –

- a) have the knowledge of the hazards that may be faced during entry, including information on the mode, signs or symptoms, and the consequences of the exposure;
- b) declare his fitness in writing prior to entry into confined space as specified in **Appendix I**;
- c) use equipment required for the job including personal protective equipment correctly;
- d) communicate with the stand-by person regularly and alert the stand-by person whenever –

- i. he recognises any warning sign or symptom of exposure to a dangerous situation;
or
 - ii. he detects a prohibited condition.
- e) exit from the confined spaces as quickly as possible whenever –
- i. an order to evacuate is given by the stand-by person or the entry supervisor;
 - ii. he recognises any warning sign or symptom of exposure to a dangerous situation;
 - iii. he detects a prohibited condition; or
 - iv. an evacuation alarm is activated.

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APPENDIX A

SAMPLE OF RISK ASSESSMENT

(informative)

1. GENERAL

The following sample risk assessment provide appraisals of consideration that may apply to work in confined spaces. These risk assessments are general in nature and may apply to work in confined spaces, such as boilers, pressure vessels, silos, pits, pipes, sewers, shafts or ducts.

2. SAMPLE OF RISK ASSESSMENT

Part 1 The work to be undertaken:

Inserting and welding a side junction into a pipeline approximately 10 metres from the entry point to the confined space.

Part 2 The range of possible work methods which could be used:

Method (a): Perform the work from outside the confined space. This is not an option due to the remoteness of the work site.

Method (b): Access the confined space to perform the work using forced air ventilation taking care not to recirculate exhaust gases. Employ continuous gas monitoring.

Method (c): Access the confined space to perform the work using supplied-air respiratory devices. Employ continuous gas monitoring.

Part 3 The hazards present:

Estimated level of risk

LOW - - - - > HIGH

1 2 3 4 5

Chemical agents:

- (a) Harmful levels of hydrogen sulphide from disturbing sediments _ _ _ 4 _
- (b) Combustible gases or vapours from decomposition of organic material or infiltration of flammable materials through broken sections of pipes _ _ 3 _ _
- (c) Potentially explosive dusts 1 _ _ _ _
- (d) Oxygen deficiency from rusting processes _ _ _ 4 _

Physical agents:

- (a) Flooding from failure of the outlet pipe and associated structures _ _ 3 _ _
- (b) Thermal extremes 1 _ _ _ _
- (c) Noise _ 2 _ _ _

Part 4 Details of the actual method to be used for the particular work:

Method (b) Part 2 will be used with the following specific details to be noted and observed:

- a) Provide forced air ventilation through the tunnel (confined space) at a flow of 1500 litres per second.
- b) Prevent recirculation of exhaust gases.

- c) Open all hatches.
- d) Divert flow to one side while work is being conducted on the other.
- e) Block off small intermittent flow adjacent to entry point.
- f) Insert blanking piece at valve between pumped line and gravity line.
- g) Disconnect pipe from valve on gravity flow line and insert blanking piece.
- h) Flush clean prior to working on steelwork.
- i) Monitor gas conditions continuously as follows –
 - i. If any flammables occur, consider sealing the distribution channels with plywood and silastic before any hot work.
 - ii. Use specialist gas tester for hot work clearance associated with removal of existing steelwork.
 - iii. If any gas alarm occurs, stop work and evacuate.
- j) If significant oxycutting is necessary or welding fumes linger due to ineffective forced air ventilation, supplied-air respiratory devices shall be supplied and worn during the work process.

Part 5 Procedures for rescue and emergency services:

- a) Tripod and safety harness shall be used for access. Wear safety harness and other PPE, as appropriate, while working.
- b) Carry oxygen self-rescuers.
- c) Communication shall be available to standby person and emergency services either by radio or telephone.
- d) Standby and competent persons shall be fully trained in rescue procedures and first aid.

SAMPLE RISK ASSESSMENT FORM

Part 1 The work to be undertaken:

.....
.....

Part 2 The range of possible work methods which could be used:

Method (a)
Method (b)
Method (c)
Method (d)

Part 3 The hazards present :

Estimated level of risk
LOW - - - - - > HIGH
1 2 3 4 5

Chemical agents:

(a) Combustible gases or vapours — — — — —
(b) Potentially explosive dusts — — — — —
(c) Oxygen deficiency or excess — — — — —

Physical agents:

(a) Thermal extremes — — — — —
(b) Noise — — — — —

Part 4 Details of the actual method to be used for the particular work:

.....

Part 5 Procedures for emergency and rescue:

.....

APPENDIX C

ADDITIONAL RECOMMENDATIONS FOR THE CONDUCT OF HOT WORK IN CONFINED SPACES

1. GENERAL

Special care is necessary when hot work is undertaken in a confined space.

2. PERMITS

2.1 Hot work in, or on the exterior surfaces of an occupied confined space shall not be commenced until a hot-work permit to work has been issued.

2.2 The hot-work permit to work shall certify that appropriate precautions have been carried out and shall state the frequency of any tests necessary to ensure that safe conditions are maintained.

2.3 Aspects to be taken into account when considering the issue of a hot work permit to work shall include the following –

- a) when a confined space or a space adjacent thereto has contained a flammable or combustible liquid, vapour or gas, the hot work permit to work shall be issued only after inspection and testing have ensured that the following requirements have been achieved –
 - i. the concentration of flammable vapours or gases in the atmosphere is below 10% of the LEL;
 - ii. the liquid and solid residues have been removed as necessary to prevent the release of flammable vapours or gases that will raise the concentration above 10% of the LEL;
 - iii. all piping within the confined space has been found by test not to contain concentrations of flammable vapour or gas above 10% of the LEL.

- b) a confined space containing dry material that can create an explosive atmosphere when dispersed in air, the hot work permit to work shall be issued only after inspection has ensured that loose dust has been removed from the confined space and all appropriate surfaces have been cleaned; and
- c) where fixed fire-extinguishing equipment, either manual or automatic activation controls to protect the confined space, such equipment shall be positively isolated when the confined space is occupied. It shall be noted that the discharge of certain fixed extinguishing systems could rapidly cause the atmosphere in a confined space to become dangerously contaminated. Alternative fire protection shall be provided in the confined space such as by providing adequate numbers of the appropriate size and type of portable fire extinguishers. CO₂ portable fire extinguisher shall not to be used in a confined space.

3. FIRE PREVENTION

The following fire preventive measures shall be taken but not limited to –

- a) all combustibles, including any dry residues, in the vicinity of the hot work shall be removed to a safe place. If they cannot be moved, such items shall be covered by a non-combustible blanket, flame-resistant tarpaulin, or other means to prevent ignition from heat, sparks and slag;
- b) consideration shall be given to the assignment of a fire watch in a confined space while hot work is being performed in the same confined space;

Note: Fire watch means an employee who has attended a training course on basic fire fighting and training course on working in confined space for authorised entrant and stand by person and passed the test or examination, stationed inside a confined space who monitor and observe the dangerous activities done by authorised entrant such as hot work. Additional training on first aid and CPR would be an advantage.

The fire watch should –

- i. know the hazards faced during entry, including mode, signs, symptoms and consequences of exposure;
- ii. ensure that the work area and adjacent areas are maintained in a safe condition;

- iii. warn authorised entrant on site of any fire hazard developing in that area;
 - iv. communicate with stand-by person from time to time regarding status of entrant;
 - v. be prepared to put out any undesired flame that may occur;
 - vi. alert the stand-by person of dangerous situations;
 - vii. give order to exit to all authorised entrants when the situation warrants it, or when directed by stand-by person or entry supervisor; and
 - viii. be stationed outside confined space for a reasonable period after the completion of the work based on the risk assessment, to ensure there is no activity which can result in the release of flammable gases.
- c) when welding or cutting is to be performed on a tank shell or a conductive boundary of a confined space, the same precautions shall be exercised inside and outside the space where the hot work is being performed;
- Note:** Sparks from direct penetration or heat transfer may also create an explosion or fire hazard in the adjacent spaces outside the confined space.
- d) before hot work is carry out on a surface covered with a preservative or other protective coating, the flammability and thermal decomposition products of the coating shall be considered;
- e) where such a coating is flammable, it shall be stripped from the area of hot work to prevent ignition. A pressurised fire hose and a suitable nozzle or other extinguishing equipment, or both, shall be available;
- f) when arc welding is suspended for a substantial period of time, such as during lunch break or overnight, the power source to the equipment shall be de-energised, all electrodes removed from holders, and the holders placed so that accidental contact or arcing cannot occur;

- g) when gas welding or cutting is suspended for a substantial period of time, such as during lunch break or overnight, the torch and cylinder valves shall be closed. The torch and hose shall be removed from and depressurised outside the confined space; and
- h) where practicable, no compressed gas cylinders or associated manifold, other than those used for self-contained breathing apparatus or emergency breathing apparatus, shall be located outside the confined space.

4. CONTROL OF FUMES

Fumes shall be controlled as follows but not limited to –

- a) before hot work is started on a metal surface which is coated, the atmosphere in the confined space shall be tested to ensure that flammable vapours or gas from coatings with flash points below the ambient temperature do not exceed 10% of the LEL;
- b) during such hot work, continuous monitoring shall be conducted to ensure that these limits are not exceeded;
- c) in a confined space, all surfaces covered with coatings that would decompose under hot work into toxic, corrosive, or irritant components shall be stripped and removed from the area of heat application. Coatings shall also be removed for a sufficient distance (determined by the risk assessment) from the area to be heated, in order to minimise the temperature increase of the unstripped metal. Additionally, artificial cooling of the metal surrounding the hot-work area may be necessary to limit the size of the area that needs to be cleaned;

Note : Typical coatings which may pose a hazard include zinc, cadmium, lead paints, certain other paints and plastics.

- d) where such stripping is not practicable, all persons in the confined space shall wear suitable respiratory protective devices and other personal protective equipment, as appropriate; and
- e) means shall be provided to exhaust contaminated air from the confined space. Such exhaust shall be directed to a location where it presents no hazard to any persons or equipment and will not accidentally be recirculated back into the confined space.

APPENDIX D

SAMPLE PERMIT TO WORK FORM FOR CONFINED SPACE ENTRY

1. GENERAL

- (a) Location of Work
- (b) Employees Assigned
- (c) Outside Contractors

2. WORK DESCRIPTION

Description of work to be undertaken –

.....
.....

- (a) Requested Entry Time(hrs) to.....(hrs)
- (b) Requested Entry Date
- (c) RequesterSignature:..... Date :

THE WHOLE OF THE REMAINING DETAIL OF THIS PERMIT SHALL BE AUTHORISED BEFORE WORK IS TO PROCEED AND ONLY WORK LISTED SHALL BE CARRIED OUT

3. ISOLATION OF CONFINED SPACE

The items ticked below have been isolated or made safe:

- (a) Pipelines (Water, Steam, Gas, etc.)
- (b) Mechanical/Electrical drives
- (c) Sludge/Deposits/Waste
- (d) Harmful materials
- (e) Electrical services
- (f) Warning notices, locks or tags have been fixed to means of isolation
- (g) Adjacent areas
- (h) Any others

Verified by Entry SupervisorSignature:.....Date :

4. ATMOSPHERIC TEST REQUIREMENTS

Type of gas detector equipment:

Serial number:.....

The atmosphere has been tested to ensure no oxygen deficiency or excess and for the following contaminants:

(Fill in details and results of tests)

- (a) ($19.5\% \leq O_2 \leq 23.5\%$)
- (b) (Flammable Gas Concentration $\leq 10\%$ LEL)
- (c) ($CO \leq 25$ ppm)
- (d) ($H_2S \leq 10$ ppm)
- (e) Other gases.....

Continuous monitoring of the atmosphere **required/not required***. (* Delete as appropriate)

The conditions are safe for entry under the conditions ticked below:

- (i) With a supplied-air respiratory protective device.
- (ii) With an air purifying (non-air-supplied) respiratory protective device.
- (iii) Without a respiratory protective device.

Testing time : Date : Authorised Gas Tester :

5. PERSONAL PROTECTIVE EQUIPMENT (PPE)

The following PPE ticked below shall be worn:

- (a) Supplied-air respirators.
Monitored by:.....
- (b) Air purifying respiratory protective devices.
- (c) Safety belt, harness and/or safety line or lifeline/rescue line.
- (d) Eye protectors.
- (e) Hand protection.
- (f) Feet protection.
- (g) Protective clothing.
- (h) Hearing protectors.
- (i) Safety helmets.
- (j) Any others.....

Verified by Entry Supervisor Signature:..... Date :

6. USE OF CHEMICAL AGENTS (Details to be completed)

No chemical agents other than those listed below to be taken into the confined space:

- (a)
- (b)
- (c)
- (d)

Verified by Entry SupervisorSignature:..... Date :

7. HOT WORK

The precautions ticked below shall be observed:

- (a) Area clean and free of all readily combustible materials within 15 metres.
- (b) All drains within 15 metres covered with wet fire blanket.
- (c) Appropriate fire extinguishers on site near source of ignition.
- (d) A water hose run to job site and tested/left running.
- (e) All sparks for work more than 2 metres above ground contained completely by use of a suitable enclosure that shall be inspected before commencing work.
- (f) Welding machine/gas cylinders located (not within 8 metres of any drain).
- (g) All welding machines / gas cylinders shall be located outside the confined space.
- (h) Welding machine earthed directly to equipment being welded as close to welding point as possible.
- (i) Power leads not draped across pipelines or access ways.
- (j) Electrical trace on pipes isolated.
- (k) Coatings are removed for a sufficient distance from the area to be heated.
- (l) Any others
- (m) Fire watch
Name :.....

Hot work **allowed/not allowed** inside the space. (* Delete as appropriate)

If not allowed (Why).....

Verified by Entry Supervisor Signature:..... Date :

8. STAND-BY PERSONNEL AND RESCUE ARRANGEMENTS

(a) Stand-by persons

Name :.....

(b) Rescue and emergency procedures are understood and have been posted.

(c) Rescue facilities and communication are in place.

(d) Rescue personnel

Name:.....

Name:.....

Verified by Entry Supervisor Signature:..... Date :

9. OTHER PRECAUTIONS

Precautions ticked below have been implemented:

(a) Warning notices/barricades are in position.

(b) Smoking/drinking/eating is prohibited in confined space.

(c) Special precautions (indicate)

Verified by Entry Supervisor Signature:..... Date :

10. AUTHORISATION

Based on my evaluation, the confined space described above is in a safe condition for work to be done, provided that the precautions above are fully observed.

Entry Date.....

Entry Time.....(hrs) to.....(hrs)

Permit Issuer..... Signature..... Date :

11. PERMIT ACCEPTANCE

I understand the procedures required for entry and work in the confined space and the protective measures and equipment to be used.

Entry Supervisor Signature:..... Date :

12. LOG IN AND LOG OUT

We have been briefed and understand the procedures required for entry and work in the confined space and the protective measures and equipment to be used.

Name :..... Time in :.....Time out:..... Signature

Name :..... Time in :.....Time out:..... Signature

13. SIGNING OUT

All persons/equipment* have been withdrawn, the work has been **completed/suspended*** and further entry shall not be permitted unless a new entry permit to work is signed. Plant/machinery* is deemed **fit/not fit*** for use. (* Delete if not appropriate)

Entry Supervisor Signature:..... Date :

Permit IssuerSignature :.....Date :.....

14. DEBRIEFING AND ACCEPTANCE OF COMPLETED JOB

I have been briefed by the Entry Supervisor and accept the work as defined in Section 2 of this Permit to work has been completed.

The following observation(s) of unsatisfactory aspects of the operation in the confined space are noted for attention prior to undertaking similar operations. (Attach separate sheet if necessary)

.....
.....

Employer/Responsible Person.....

Note : Authorised person shall have knowledge and skills for that particular job.

**ADDITIONAL RECOMMENDATIONS FOR
CLEANING TASKS IN CONFINED SPACES**

1. GENERAL

- 1.1 This Appendix lists recommendations for undertaking cleaning tasks in a confined space. The recommendations are additional to the requirements specified in paragraph 8.4.
- 1.2. Procedures and processes to be used to clean the inside of a confined space shall be reviewed and authorised prior to entry. The method to be prescribed will depend upon the material in the confined space and the potential hazards that may be created by the cleaning process itself.
- 1.3 Wherever practicable, initial cleaning shall be performed from outside the confined space. Such initial cleaning, including drainage and scale removal, shall continue until the hazard from atmospheric contaminants has been reduced as low as possible.
- 1.4 Contaminants shall be disposed of in a manner that will not constitute a hazard to any person, equipment or environment.

2. HYDROJETTING

2.1 General

The following general precautions shall be observed when hydrojetting is undertaken in a confined space but not limited to –

- a) hydrojetting shall always be carried out by trained personnel;
- b) each person shall be provided with protective suits, waterproof safety footwear, a safety helmet with face shield, protective gloves and, where necessary, an appropriate respiratory protective device;
- c) warning signs indicating that hydrojetting is in progress shall be displayed in conspicuous locations outside the confined space;

- d) the area affected by the hydrojetting shall be barricaded while work is in progress;
- e) where there is a possibility of a flammable environment, the nozzle of the hydrojetting equipment may need to be earthed to eliminate the generation of static electricity;
- f) nozzle operators shall have direct visual or audible communication with the pump operators;
- g) removal of fluid from the confined space shall be continuous during the operation, especially in the case of work in ships' tank, fuel tanks, etc; and
- h) a high pressure/low volume gun shall be used intermittently for cleaning, rather than continuously, thus allowing adequate replacement of air.

2.2 Equipment

All high pressure cleaning equipment shall be fitted with actuating devices that require positive effort by the operator with hand or foot to keep the supply valve open (deadman valve). In addition, the following requirements for hoses shall, where practicable, be observed –

- a) hoses used for high pressure cleaning shall have a bursting pressure of at least twice that of operating pressure;
- b) hose shall be tagged to indicate working pressure and age;
- c) Hoses which are kinked or showing visible external defect such as exposed reinforcing wire shall be disposed off immediately;
- d) care shall be taken when laying out hydrojet hoses on the ground to avoid constant pulsation damage, especially at corners;
- e) coupling shall be of such a design that they are unable to loosen or be accidentally dislodged during operation; and
- f) the maintenance of the hoses as per manufacturer recommendation.

3. STEAM CLEANING

Where a confined space is to be cleaned by steam, the following precautions shall be observed –

- a) where there is a possibility of a flammable environment, the pipe or nozzle of the steam hose shall be bonded to the confined space enclosure to eliminate static electricity;
- b) steam temperatures shall not exceed the auto-ignition temperature of the content of the space; and
- c) the confined space shall be allowed to return to an acceptable thermal environment prior to entry.

4. ABRASIVE BLASTING

Cleaning by abrasive blasting shall only be undertaken where suitable air-supplied respirators are used. Approval from Director General is required if sand is used as abrasive material. Consideration shall also be given to provide the following –

- a) illumination and visibility adequate to allow safe working to continue;
- b) protection of the integrity of breathing airline from damage;
- c) appropriate protective clothing and equipment;
- d) escape equipment; and
- e) actuating devices that require effort by the operator to keep the supply valve open.

5. CHEMICAL CLEANING

In addition to creating hazards to health, chemicals used in cleaning operations may also be capable of producing a flammable atmosphere. Chemical Health Risk Assessment has to be carried out before chemical cleaning process can start. Accordingly, the safety of the atmosphere shall be re-evaluated after cleaning and prior to the commencement of further work.

APPENDIX F

ADDITIONAL RECOMMENDATION FOR ATMOSPHERIC TESTING

(Informative)

1.0 GAS INDICATORS

1.1 Factors to be taken into account include the following –

- a) properties of the gas/vapour;
- b) humidity and temperature in the space;
- c) presence of airborne contaminants that may reduce the accuracy of the reading or (poison) the sensor;
- d) presence of corrosive gases and mists, which may damage the sensor and give misleading results causing a false zero reading;
- e) calibration, adjustment and maintenance requirements;
- f) need for recalibration during testing;
- g) condensation and/or absorption of gas into the walls of sampling lines where these are used;
- h) response of the instrument to high and low concentrations of flammable gas or vapours (for example, false zeros);
- i) oxygen deficiency causing a false flammable gas reading;
- j) oxygen enrichment where the instrument may act as an ignition source causing an explosion;
- k) differences in atmospheric pressure which may cause erroneous readings in some sensors.

1.2 Equipment for monitoring of flammable gases, dusts and vapours should be intrinsically safe. All electronic equipment for monitoring should be equipped with an audible or visual alarm. Instruments used for testing the atmosphere in a confined space should be selected for their functional ability to measure hazardous concentrations.

- 1.3 After air purging has been completed, forced air ventilation devices, such as inductors or fans should be turned off for a sufficient time to allow for a normal atmospheric condition to exist for the gas testing of the confined space. If an acceptable result cannot be obtained without continuous forced air ventilation, then the forced air ventilation device should be suitably tagged and/or locked to ensure it is not disconnected while the inspection or other work is in progress. The stand-by person is responsible for monitoring the proper operation of the forced air ventilation device.
- 1.4 Testing of the confined space shall be carried out before the entry permit to work is issued. The tests shall be check on the presence of gas or fumes, on chemical deposits, and, where appropriate, on the adequacy of the supply of oxygen. A satisfactory result shall be obtained before proceeding further.

2.0 RETESTING AND CONTINUOUS MONITORING

- 2.1 The employer shall arrange for repeat tests for oxygen and hazardous gases at intervals which take account of the likelihood of a change in conditions. No set time can be applied for all circumstances, but periods between tests should be set conservatively, not more than 8 hours apart. There should not be a significant delay between tests and the first entry to the confined space.
- 2.2 The frequency for retesting should be determined by the employer having knowledge of the equipment and processes. Use of continuous monitors with alarms is the most conservative approach. If there is a significant break in occupancy of a confined space, the atmosphere should be retested before re-entry.

APPENDIX G

<p>HEALTH EXAMINATION CHECKLIST FOR WORKING IN CONFINED SPACE (TO BE FILLED UP BY OCCUPATIONAL HEALTH DOCTOR (OHD))</p> <p>This is to certify that the below statements are true. I give consent to the OHD for medical examination and to communicate with the management regarding my work capability after discussion with me.</p> <p>Worker's signature : _____ Date : _____</p>	
<p>A) Worker</p> <p>Name : _____</p> <p>Address : _____</p> <p>Postcode : _____ District : _____ State : _____</p> <p>Tel No. : _____</p> <p>IC No. : _____</p> <p>Age : _____ years Sex : Male <input type="checkbox"/> Female <input type="checkbox"/></p> <p>Ethnic : Malay <input type="checkbox"/> Chinese <input type="checkbox"/> Indian <input type="checkbox"/> Others <input type="checkbox"/></p> <p>Marital status : Single <input type="checkbox"/> Married <input type="checkbox"/></p> <p>Nationality : Malaysian citizen <input type="checkbox"/> Non citizen (specify) <input type="checkbox"/></p>	
<p>B) Next of kin to be contacted in case of emergency</p> <p>Name : _____</p> <p>Relationship : _____</p> <p>Address : _____</p> <p>Tel No. : _____</p>	
<p>C) Employer</p> <p>Name : _____</p> <p>Address : _____</p> <p>Tel No. : _____ Fax No/E-mail _____</p>	

D) Occupational History

1. Job Title : _____

2. Duration of service : _____

3. Any training received for this job? Yes No

4. Other job (other than this job) : _____

5. H/O using any PPE Yes No

Specify _____

6. H/O allergy or difficulty in using PPE Yes No

Specify _____

E) Do you have any history of or suffering from the following conditions?

1. Smoking :

a) Smoker
 b) Non smoker
 c) Stopped smoking

No of years smoked : years
 No of cigarette/day :

2. Medical condition

Yes	No	Remarks
-----	----	---------

a) Eye problems (including visual acuity, or night blindness)

b) Ear problems (including hearing, inner ear disease or recurrent vertigo)

c) Nose (trouble smelling odours)

d) Central Nervous System :

i) Epilepsy, fits or convulsion of any kind	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
ii) Stroke with residual abnormality	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
iii) Disease affecting co-ordination e.g., Parkinson	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
iv) Serious head injury	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
v) Severe headache, giddiness or migraine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>

e) Cardiovascular System :

i) Uncontrolled hypertension	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
ii) Heart disease (including IHD, Heart Failure or Arrhythmia)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
iii) Congenital heart disease with cardiomegaly, ECG Abnormality or inadequate oxygenation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>

f) Respiratory System :

i) Uncontrolled asthma	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
ii) COAD	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
iii) Acute pulmonary infection (including TB)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>

	Yes	No	Remarks
g) Gastrointestinal System :			
i) Peptic ulcer disease			
h) Endocrine System :			
i) Uncontrolled diabetes mellitus			
i) Renal System :			
i) Chronic renal disease e.g., nephritis			
ii) Renal failure			
j) Musculoskeletal System :			
i) Deformity, disability or amputation of the body/limbs			
ii) Chronic or recurrent disease of muscle, bone or joint			
k) Dermatological System :			
i) Acute or chronic inflammatory skin condition			
l) Psychiatric			
i) Mental illness (including depression, psychosis, mania or anxiety)			
ii) Drug and alcohol dependent (current or past)			
iii) Claustrophobia (fear of enclosed spaces)			
m) H/O taking any medications			
i) Cough/cold medication			
ii) Tranquilisers			
iii) Hypnotics			
iv) Other drugs (including cytotoxic agents, Anti-coagulants or immunodepressants)			
n) Any other health problem or injury			
F) Family history			
	Yes	No	Specify (if yes)
1. H/O medical illness :			
2. H/O allergy :			
3. Other illness (specify)			
G) For female only			
Currently Pregnant	Yes	<input type="checkbox"/>	No <input type="checkbox"/>

H) Physical examination

1. Anthropometry

- a) Weight : _____ kg
- b) Height : _____ cm
- c) BMI : _____

2. Vital sign :

- a) Blood pressure _____ mmHg
- b) Pulse rate _____ per minute

3. General condition :

- a) Eye :

Right	Left

 - i) Visual acuity
 - ii) Visual field
 - iii) Colour vision
 - iv) Fundoscopy
- b) Ear :

Right	Left

 - i) External ear
 - ii) Tympanic membrane
 - iii) Air Condition
 - iv) Bone conduction
- c) Nose

Right	Left
- d) Throat _____
- e) Skin _____
- f) Lymph nodes _____

4. Target organ :

	Normal	Abnormal	Specify (if abnormal)
a) Central Nervous System			
b) Cardiovascular System			
c) Respiratory System			
d) Gastrointestinal System			
e) Endocrine System			
f) Renal System			
g) Musculoskeletal System			

I) Investigations

	Date	Normal	Abnormal	Remarks
1. FBC				
2. UFEME				
3. Spirometry :				
FVC				
FEV1				
FEV1 / FVC				
4. Other (specify)				

On the basis of the applicant's personal declaration, my clinical examination and diagnostic test results recorded on the medical examination form, I declare that this workers is **FIT / NOT FIT** * for working in confined space. (*delete if not appropriate)

Doctor's signature : _____

Name of OHD : _____ DOSH RN : _____

Name of clinic : _____ Clinic tel. No : _____

Fax no. : _____ E-mail add : _____

Date : _____

Health Fitness Certificate
for the purposes of permission to work in confined space

Named of Person examined _____

NRIC/Passport No. _____ Date of Birth _____

Name and addressed of employer

I hereby certify that I have examined the above named person on _____.
From the information related to health being declared by the person, my clinical examination and diagnostic tests recorded on medical examination form, I certify that this person is **FIT / NOT FIT** (*delete if not appropriate) for working in confined space.

Doctor's signature : _____

Name of OHD : _____

DOSH RN : _____

Name of clinic : _____

Tel : _____

Fax : _____

APPENDIX I

DECLARATION OF HEALTH STATUS BY AUTHORISED ENTRANT.

Name :

NRIC/ Passport No.

Date of Birth : Sex :

Name and Address and Employer :
.....
.....
.....

I hereby would like to declare that having following sickness
and felt **FIT / NOT FIT** to work in confined space for(Date).

Remarks (if any):

Signature.
.....
Date: