PetroChina (Halfaya)

Health, Safety & Environmental Management System

Confined Spaces

HSE Guidance No. 3.11.5

Energize Harmonize Realize

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The following is a brief summary of the four most recent revisions to this document. Details of all revisions prior to these are held on file by the Document Owner.

Version No.	Date	Scope/Remarks

The use of this Guidance is mandatory and any changes must be controlled as detailed in the Quality Procedure relating to Document Control.

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1.0 INTRODUCTION

The purpose of this Guidance is to reduce the risks associated with confined space entry to an acceptable level.

Entry into a confined space, for whatever purpose, shall only be contemplated after all practicable steps have failed to deal with the problem in a less hazardous way.

2.0 SCOPE

This Guidance applies to onshore operations and shall be applicable to:

- PetroChina (Halfaya) employees while carrying out PetroChina (Halfaya) duties at any locations.
- Contractor/sub-contractor employees performing his/her duties in PetroChina (Halfaya) controlled premises.
- Contractor/sub-contractor employees performing his/her duties in a premise under PetroChina (Halfaya) prevailing influences.
- Contractor/sub-contractor operations at a place under PetroChina (Halfaya) prevailing influences.

Confined space means any enclosed or partially enclosed space, either above or below ground or deck level, where there is a specified risk of serious injury from hazardous substances or conditions within, or nearby, the space. A specified risk means one or more of the following:

- Serious injury due to a fire or explosion where escape route is restricted due to the enclosed nature of the space.
- Loss of consciousness due to increased body temperature.
- Loss of consciousness or asphyxiation due to gas, fume, vapour or the lack of oxygen.
- Drowning due to an increase in the level of liquid.
- Asphyxiation in a free flowing solid, or the inability to reach a respirable environment, due to entrapment by a free flowing solid.

Examples of confined spaces are:

- Process vessels and related equipment (vessel tower skirts and flare stacks), boilers, water storage tanks, other tanks including pontoons on floating roof tanks, tank cars and trucks.
- Spaces located below ground or deck level, such as drain pits, sewage pits and associated tunnels, ducts, trenches, wells, shafts, cellars, vaults and unventilated rooms which may be considered confined spaces under specific circumstances.

- The cargo, ballast or void spaces onboard ships.
- The support columns/legs/pontoons of fixed or mobile off-shore installations.

Entry refers not only to complete body entry, but also to partial entry when only the head is inserted, e.g. into manhole openings, hatches, pipe ends, void space above floating roofs, etc. The same risk may exist in close proximity to equipment which has been opened up; in which case some of the precautions which apply to entry would also apply.

3.0 RESPONSIBILITIES

3.1 Field Manager

The Field Manager will hold the ultimate responsibility for ensuring procedures are developed, effectively implemented, and regularly updated and maintained, to ensure safety in all confined space entry activities performed.

3.2 Line Managers

Specific responsibilities of the Line Managers include, but are not limited to, the following:

- Ensuring that risk assessments have been carried out for all confined space activities.
- Reviewing risk assessments to ensure that the hazards and risks associated with all non-routine, high risk and hazardous activities have been identified (**Note**: Line Managers shall request a higher level of risk assessment should they consider that risks have not been fully addressed).
- Ensuring that all Employees and Subcontractor employees are trained in the requirements of this Guidance.
- Ensuring that all potential hazards and risks identified are effectively communicated to those involved in the work, and that effective control/mitigation measures are implemented during the execution of non-routine, high risk or hazardous activities.
- Ensuring that confined space activities are safe, and operated in accordance with this Guidance.
- Ensuring the safety of all personnel on the site and the safe execution of all work carried out on the site.
- Providing necessary resources to facilitate the effective implementation of this Guidance and any supporting procedures.
- Ensuring that the responsibilities of key participants under this Guidance are communicated to those personnel under his direction.
- Ensuring that the personnel appointed are competent to carry out the tasks for which they are authorized.

- Segregating areas and assigning the responsibility for control in those areas to a Competent Person.

3.3 Field HSSE Manager

The Field HSSE Manager, assisted by Safety Officers, will oversee the development, implementation, update and maintenance of this Guidance.

Specific responsibilities of the Site HSSE Manager include, but are not limited to, the following:

- Providing confined space safety training to Subcontractor employees.
- Reviewing this Guidance through regular audit and inspection, and making recommendations to update or amend it to ensure that it remains current and effective.
- Ensuring that a thorough investigation is carried out for any accidents or incidents that may be attributable to a breakdown in the confined space safety system or associated controls.

3.4 Safety Officer (Competent Person)

Safety Officers will assist the Field HSSE Manager in implementing, updating and maintaining the Confined Spaces Guidance. Responsibilities of Safety Officers will include, but not limited to, the following:

- Ensuring that this Guidance is observed and effectively implemented by all employees and Subcontractor employees.
- Assisting the Field HSSE Manager to conduct training to familiarize employees and Subcontractor employees with this Guidance.
- Assisting the Field HSSE Manager to conduct HSE audits and inspections to ascertain the effectiveness of this Guidance.
- Attending toolbox talks to ensure that supporting risk assessments, job hazard analyses are and method statements are fully disclosed to, and understood by, the workforce.

3.5 Permit Issuing Authority

The Issuing Authority should ensure a risk assessments is carried out and documented to ensure that all hazards are recognized and mitigation measures identified. Specific responsibilities of the Issuing Authority include, but are not limited to, the following:

- Ensuring that all employees and Subcontractor employees assigned to perform non-routine, high risk and hazardous job tasks receive adequate training and instruction to ensure that they understand what is required of them to perform their work safely.
- Ensuring that non-routine, high risk and hazardous construction activities are executed in accordance with developed procedures and/or work method statement submitted.

- The safety of personnel and the safe execution of all activities undertaken within his area of authority.

- Identifying the impact of tasks and precautions on other areas, and informing the Area Authority of the proposed activities. This includes specifying the precautions that may be necessary as a result of activities in another area, and ensuring that these are disseminated to all affected personnel.

- Ensuring that work site inspections are undertaken before, during and after the performance of each task (some of these inspections may be delegated to an appropriately competent person).

- Organizing toolbox meetings with all parties involved.

Note: Issuing Authorities shall attend approved training courses, and will be formally assessed and confirmed competent before being formally appointed to undertake their responsibilities.

3.6 Performing Authority

The Performing Authority is the person who requires the work to be done (or who will do the work) and is the senior person in charge of the work controlled by a permit. Specific responsibilities of the Performing Authority include, but are not limited to, the following:

- Applying for a PTW, and ensuring that it has been endorsed and approved, prior to commencing any non-routine, high risk or hazardous construction activity.

- Taking part in the risk assessment process and disseminating the resulting output to the personnel who will be doing the work.

- Signing receipt and on completion, clearance of the permit.

- Ensuring that all potential hazards and risks associated with a specific activity have been identified, mitigated against, and effectively communicated to the workforce involved.

- Ensuring that all control / mitigation measures, required by and indicated in the PTW, are implemented.

- Ensuring that only the intended work, as specified in the PTW, is executed.

- Ensuring that all workers / craftsmen involved in the activity fully understand the limitations, restrictions and hazards involved, as advised and indicated in the PTW.

- Safety at the work site.

- Ensuring that only those activities detailed on the PTW are undertaken.

- Ensuring that an applicable PTW (e.g. Confined Space, Hot Work, Excavation, etc.) has been checked and approved by the relevant authorizing party.

- Ensuring that the work environment is safe and suitable for the performance of non-routine, high risk or hazardous work, before a PTW can be issued.
- Ensuring that the work environment is continuously monitored.
- Immediately informing the Issuing Authority of any event which might impact on the safe performance of a task or on the associated precautions, e.g. changes to working conditions and methods.
- Ensuring that adequate handover takes place at shift change, crew change or other change of Performing Authority.
- Ensuring that the work team is withdrawn, and the work site left in a safe and clean condition, on completion (or suspension).
- Ensuring that the PTW is revalidated should the intended activity require continuation to another shift or day.
- Suspending all works in the event that work conditions or environmental conditions change or differ from those expected when the PTW was issued. Such changes in conditions shall be immediately reported to the Permit Issuing Authority.

3.7 Process Isolators

Process Isolators are responsible for:

- The application, removal and recording of process isolations (appropriate process / mechanical lockout/tag out isolation) in accordance with the permit to work (PTW) Issuing Authority's request on the Isolation Certificate.
- Immediately informing the Issuing Authority of any event which might impact on the security / integrity of the isolations.

3.8 Authorized Gas Tester

After appropriate training, the Authorized Gas Tester is authorized to test for the presence of flammable gas or vapour for PTW compliance purposes.

After appropriate training, the Authorized Gas Tester is authorized to test for the presence of flammable gas or vapour, toxic gas and oxygen, particularly for atmospheres in confined spaces.

3.9 Authorized Entrants

Authorized Entrants will have received adequate training to enable them to perform the following duties:

- Adhere to established safety standards and practices.

- Know and recognizing the hazards that may be faced during confined space entry, including the signs or symptoms and consequences of exposure to hazards.

- Make proper use of equipment and protective devices.

- Maintain communication with the Confined Space Attendant to enable the attendant to monitor the entrant's status, as well as to alert the entrant to the need to exit the confined space if any hazards are identified.

- Alert the Confined Space Attendant if a prohibited condition exists or when symptoms of exposure to confined space hazards are observed.

- Exit from the confined space as soon as possible when:
  - Ordered by the attendant.
  - The entrant recognizes the warning signs or symptoms of exposure.
  - A prohibited condition exists.

3.10 Confined Space Attendant

The Confined Space Attendant will have received adequate training to allow him to carry out his duties responsibly. At all times during a confined space entry operation, he must remain outside the confined space, **in a safe atmosphere**, and perform the assigned duties, including:

- Maintaining an accurate count of all persons in the space by using a tally board on which the name, entry and exit times for all personnel entering or leaving the confined space shall be recorded.

- Ensuring that airlines and/or safety lines are marked so that each individual inside a confined space is clearly identified in the event of a problem.

- Being aware of the hazards that may be faced during entry, including the mode, signs or symptoms, and consequences of any exposure.

- Monitoring conditions and activities inside and outside the confined space to determine if it is safe for entrants.

- Remaining outside the confined space during entry operations until relieved by another attendant.

- Maintaining effective and continuous communication with authorized entrants during entry.

- Ordering authorized entrants to evacuate the confined space immediately if.
  - A condition is observed that is not allowed.
  - Behavioral effects of hazard exposure are detected.
  - A situation occurs outside the confined space that could endanger the health and safety of authorized entrants.
  - An uncontrolled hazard is detected inside the confined space.
  - The attendant must leave his work station.

- Summoning rescue and other emergency services in the event of emergency situations.

Taking necessary actions when unauthorized persons approach or enter a confined space without proper authorization or when entry is already underway.

4.0 CONFINED SPACE HAZARDS

Hazards may exist in a confined space or may be introduced during the work.

Before entering confined spaces, the following particular hazards need to be considered and safeguarded against:

- Oxygen deficiency/enrichment.
- Flammability, fire and explosion.
- Chemical hazards.
- Physical hazards.
- Other hazards

4.1 Oxygen Content

4.1.1 Oxygen Deficiency

Normal air contains about 21% oxygen. A fall to 17% brings on the start of ill effects including loss of co-ordination, concentration and abnormal fatigue. A fall to 10% brings on breathing difficulties, unconsciousness and death.

Atmospheres containing less than 20% vol oxygen are considered to be oxygen-deficient. Under no circumstances should oxygen be used to increase the level of an oxygen deficient atmosphere.

Oxygen deficiency may result from:

- Purging of the confined space with an inert gas to remove flammable or toxic gas.
- Fume, vapor or aerosols.
- The displacement of oxygen by other gases (inerting with nitrogen or CO_2).
- The use of inert gas welding.
- Burning operations and work such as welding and grinding which consume oxygen.
- Combustion or exhaust fumes.
- Inadequate ventilation.

- Naturally occurring biological processes consuming oxygen, which can occur in sewers, storage tanks, storm water drains, wells, etc.
- Displacement of air during pipe freezing, for example, with liquid nitrogen.
- A gradual depletion of oxygen as workers breathe in confined spaces and where provision of replacement air is inadequate.
- Slow oxidation of metals (rusting).

4.1.2 Oxygen Enrichment

Since the rate of combustion is closely dependent upon the concentration of oxygen present, an enriched oxygen atmosphere (greater than 21% vol) becomes a significant fire and explosion hazard.

The main causes which may result in oxygen enrichment:

- Leaks from oxygen containing equipment.
- Inadvertent use of oxygen instead of air or inert gas.
- Deliberate addition of oxygen.
- Use of oxidizing chemicals.

The most common oxygen containing equipment is that used in cutting operations. Storage cylinders, gas hoses, and valves must be handled with care and should be daily inspected for damage.

Gas cylinders must not be taken into confined spaces. Cutting and welding equipment must always be removed from confined spaces during breaks and at the end of the working day.

4.2 Flammability, Fire and Explosion

Fires and explosions can result from accumulations of flammable vapors and/or dust in the presence of a source of ignition.

Mixtures of flammable vapors and air can only be ignited if the hydrocarbon to air ratio is within the flammable range i.e. between the Lower Explosion Limit (LEL) and the Upper Explosion Limit (UEL). LEL and UEL are identical to the Lower and Upper Flammable Limits (LFL, UFL) used elsewhere.
In general, if the oxygen content in hydrocarbon air mixtures can be maintained below 8% by volume, a fire/explosion cannot occur.

Explosive/flammable mixtures may develop typically during the emptying of vessels or tanks and the opening of confined spaces, due to air entering and mixing with the residual gases.
A source of ignition can be any heat source having enough energy to ignite a flammable gas/air mixture or to raise the temperature above the auto-ignition temperature. In addition to naked flames, other possible sources of ignition include:

- Sparks or arcs produced by electrical equipment, lightning and electrostatic charges.
- Hot surfaces raising the temperature above the auto-ignition temperature (e.g. hot pipes, hot exhausts).
- Thermite reactions from aluminum- or other alloy tools striking against rusted iron or steel.
- Heat of friction during drilling or other non-flame cutting operation.
- Pyrophoric materials (e.g. iron sulfide).

Any other highly reactive material capable of producing sufficient heat for combustion (e.g. strong oxidizing substances such as hydrogen peroxide used in waste treatment facilities, or chemicals undergoing self-accelerating exothermic reactions when a critical temperature is reached, such as ethylene oxide).

Note: On no account should a confined space be entered if the explosimeter reading is equal to or greater than 0% LEL.

Hot work must not be undertaken if the explosimeter reading exceeds 0% LEL.

4.3 Chemical Hazards

Liquids can flow into the confined space and lead to drowning and other serious injury depending on whether they are hazardous to health, e.g. corrosive, toxic, etc.

Chemical substances can be toxic. Toxic substances can cause injury, acute or long-latency illness, or death, depending on the concentration and duration of exposure and the characteristics of the substances.

A toxic substance can cause harm by inhalation, ingestion, skin or eye contact. It can affect the tissue at the point of contact, or organs remote from the point of contact.

Corrosives destroy the tissue and may leave permanent injury or scars.

Sludge deposits in the bottom of tanks and vessels may release toxic or flammable gases/vapors when disturbed.

Typical hazardous substances are CO, H_2S, hydrocarbon gases, lead/anti-knock compounds, benzene, polycyclic aromatics, hydrofluoric acid, sulfuric acid, ammonia, chlorine, hydrazine, biocides, and caustic substances such as sodium hydroxide.

Information about specific substances should be sought from the supplier of materials (e.g. Material Safety Data Sheets), and local, state, and federal governments, and be available on site.

Free flowing solids can submerge a person, preventing breathing. Materials which create this hazard include grain, sugar, flour, sand, coal dust and other substances in granular or powder form.

The hazard of contaminated personal protective equipment should not be neglected.

4.4 Physical Hazards

Physical hazards may exist in confined spaces and include:

- Structural failure, e.g. the internal floating cover or roof may not support a worker's weight.
- Falling tools and materials; e.g. refractory.
- Improper shoring, e.g. cave-ins may occur while personnel are working in trenches or excavated areas.
- Failure to positively isolate confined spaces, e.g. blank off or break pipe connections.
- Failure to disconnect or make inoperative electrical or mechanical equipment.
- Migration of gases from adjacent places, e.g. diesel engines, waste tips.
- Restricted working space and obstructions.
- Slippery surfaces.
- Inadequate lighting.
- Inadequate or faulty personal protective equipment.
- Noise levels in excess of published standards.
- Heat stress.
- Radioactive substances which are used for level gauges or might be present in certain crude oils or condensates.

Excessive heat can lead to a dangerous rise in core body temperature and can be made worse as a result of personal protective equipment being worn. In extreme cases heat stroke and unconsciousness can result. A slower heat build-up in the body can cause heat stress, and if action is not taken to cool the body there is also a risk of heat stroke and unconsciousness.

4.5 Other Hazards

These include:

- Physical dimensions and the layout of the space.
- Poor visibility; e.g. due to misty or dusty conditions.
- Persons being trapped in the event of an accident or loss of consciousness.
- Live electrical contacts (circuits) with the risk of electrocution.

- Pressure.
- Odors.

5.0 PRE-ENTRY REQUIREMENTS

When it is necessary to carry out confined space work the following procedure must be followed:

1. Consider if the entry can be avoided, if not then plan the activity by undertaking a risk assessment considering the hazards involved.
2. Determine control and emergency measures and prepare a method statement.
3. Depressurize, drain, and de-energize the space.
4. Clean the space by steaming, purging, flushing, and/or washing.
5. Isolate power sources by blocking-in, blinding or disconnecting them.
6. Install ventilation and air movers as needed.
7. Disconnect mechanical moving parts.
8. Implement the appropriate lockout/tag out procedures.
9. Post a sign over the opening that reads: ‘Danger Confined Space’.
10. Select and obtain the appropriate rescue equipment and PPE.
11. Carry out atmospheric testing.
12. Prepare a permit to work and communicate the method statement and the permit requirements to everyone involved.

5.1 Confined Space Entry Avoidance and Assessment

Always consider whether confined space entry can be avoided by doing the work by alternative means. If this is not possible then consider whether the entry time can be minimized by changing the method of work, e.g. cleaning a confined space from outside.

Before work in a confined space commences a risk assessment should be undertaken to identify all the hazards, risks and control measures. A confined space permit to work is required for all confined space work.

After the Supervisor has made a risk assessment and established pre-entry safeguards, he must then determine if personnel may enter the confined space and under what conditions. Such conditions should be included on the work permit to ensure a safe system of work exists.

Conditions necessary for safe work in or around a confined space will vary greatly depending on its location, configuration, and use.

If entry is required, the risk assessment should take account of, but not be limited to, the following:

- Ensuring a safe system of work exists.
- Supervision requirements.
- Competence of all involved in confined spaces working.
- Communications to those inside the confined space and to the emergency response team.
- Emergency and rescue plans and equipment.
- Isolation from mechanical and electrical equipment.
- Isolation from gases, liquids and other flowing materials.
- Gas purging.
- Ventilation.
- Cooling.
- Removal of residues.
- Testing/monitoring the atmosphere.
- Access and egress
- Selection and use of suitable equipment
- Ignition sources, e.g. static electricity and smoking personal protective equipment (PPE) and respiratory protective equipment (RPE)
- Fire prevention.
- Lighting.
- Portable gas cylinders and internal combustion engines.
- Gas supplied by pipes and hoses.
- Limiting the working time by adopting work/rest regimes.

5.2 Permit To Work

Entry into confined spaces must be subject to a written permit to work system. A permit to authorize entry should, as a minimum:

- Identify the job site and hazards.
- Indicate the date and duration of the permit.
- Specify isolation and testing requirements and other conditions needed to perform the job safely.
- Bear the appropriate signatures as required in the company's procedures.

A copy of the permit should be available at the work place while the job is in progress.
The qualified person must accept responsibility for ensuring that the conditions of the permit are maintained.

The confined space entry is only allowed for the period stated in the PTW.

5.3 Supervision

The degree of supervision should depend on the findings of the risk assessment. In some cases an employer might simply instruct an employee how to do the work and then from time to time check that all is well, for example, if the work is routine, the precautions straightforward, and all the arrangements for safety can be properly controlled by the person carrying out the work.

It is more likely that the risk assessment will identify a level of risk that requires the appointment of a competent person to supervise the work and who may need to remain present while the work is being undertaken. It will be the supervisor's role to ensure that the permit-to-work system, where applicable, operates properly, the necessary safety precautions are taken, and that anyone in the vicinity of the confined space is informed of the work being done.

5.4 Competence and Fitness

All persons involved in confined space work, including those assessing the risks, planning and supervising the work, permit issuing and performing authorities, authorized entrants and attendant/stand-by personnel, should be trained and competent in confined space hazards and precautions.

To be competent to work safely in confined spaces, adequate training and experience in the particular work involved is essential. The standards of training must be appropriate to the work, the individual's role and responsibilities, so that the work is carried out safely.

All personnel selected for entering or acting as attendants in confined spaces must be physically and mentally fit. They must have received adequate training, be competent in performing the job and in the use of the equipment involved.

5.5 Pre-Entry Briefings and Checks

Before the entry is permitted, the Performing Authority must brief entrants, attendants and supervisors on their responsibilities and the hazards and controls for safe entry.

Pre-entry briefings may be conducted outside a confined space in the form of a Toolbox Talk/Meeting. Such briefings should include information such as, but not limited to, the following:

- Potential hazards and its associated risks.
- The prevention, control and mitigation measures in preventing the occurrence of an incident.
- Communication, emergency and rescue procedures.
- Checking and use of PPE.
- Reporting of illness and incident.

5.6 Communication

Systems and equipment should be made available for communication:

- Between persons inside the confined space.
- Between those inside the confined space and the attendant/stand-by personnel
- Between the attendant/stand-by personnel and the emergency response team.

Whatever system is used, and it can be based on speech, klaxon, radio, etc., it is important that all messages can be communicated easily, rapidly and between relevant people and is totally understood. Consideration must be given as to whether people wearing breathing apparatus can be understood, or if a process for example grinding metal can cover an oral warning. The communication system should also cover the need for those outside the space to raise the alarm and set in motion emergency rescue procedures.

Note: Telephone and radios and other equipment should be specially protected so that they do not present a source of ignition where there is a risk of flammable or potentially explosive atmospheres.

5.7 Emergency and Rescue Plans and Equipment

The successful rescue of any person from an enclosed space is dependent on a pre-existing plan, trained personnel and good, well maintained equipment.

Worst case scenarios should always be considered and such plans must take into account equipment normally held on site, together with the availability of manpower, especially those trained in the administration of first aid including the use of resuscitation equipment. Drills must be held at regular intervals to prove the feasibility of the plan under different and difficult

conditions. Allocation of personnel to relieve or back-up those first in action must always be anticipated.

Arrangements for emergency rescue will depend on the type of confined space, the risks identified and the likely nature or an emergency rescue. It may be decided to established company or local rescue teams or to rely on external authorities.

The restoration of the casualty's air supply at the earliest possible moment is of paramount importance. Unless the man is gravely injured, e.g. a broken back, any physical injury he has sustained is of secondary importance. The victim must be brought out with the least delay, and then his physical injuries can be attended to.

Consideration must be given not only to accidents arising from specified risks, e.g. toxic gas, but to other risks, e.g. inability to move due to a fall.

When devising the rescue plan, the following requirements should be taken in consideration:

- The number of attendants/stand-by personnel.
- Rescue and resuscitation equipment.
- Raising the alarm and rescue.
- Safeguarding the rescuers.
- Fire safety.
- Control of plant.
- First aid.
- External/Public emergency services.
- Training.

The rescue plan should be formulated to include as a minimum:

- An assessment of the hazards associated with the confined space.
- Required gas testing / monitoring equipment.
- Personnel required to perform the rescue.
- All precautions to be taken while in the confined space.
- Required personnel protective equipment.
- Required rescue equipment.
- Required tools and any other special equipment.

5.7.1 Rescue and Resuscitation Equipment

Rescue equipment should be appropriate to any likely emergencies identified in the risk assessments, some of the items of equipment may be:

- Self-rescue breathing apparatus.
- Resuscitation equipment.
- Man riding winch or retrieval system.
- Harnesses.
- Lifelines (ropes, karabiners).
- Intrinsically safe lighting.
- Communication equipment.
- Working breathing apparatus.

Note: Resuscitation equipment may be mouth pieces on special tubes to avoid contact with the mouth during oral resuscitation procedures, however if it is likely that toxic gases may be encountered and oral resuscitation procedures could put rescuers at risk then artificial resuscitation equipment may be required.

5.7.2 Raising the Alarm and Rescue

Adequate and effective communications must exist between those inside and those outside the confined space, so that, in the event of an incident, a warning can be given and the space evacuated or those inside rescued. The system needs to be 'fail safe', ensuring that if a reply is not received or a scheduled exit cannot be made, the procedure for rescue starts immediately. The system must be practiced regularly to ensure its reliability.

The Rescue Team should respond immediately to rescue calls from the Attendant or any other person recognizing the need for rescue from the confined space.

The Rescue Team must be qualified and trained to perform the assigned rescue functions. In particular, rescue team members must be trained in the proper use of PPE and rescue equipment, including breathing apparatus. Also, at least one Rescue Team member shall be certified in first aid and in cardiopulmonary resuscitation (CPR).

5.7.3 Safe Guarding Rescuers

Many people have been overcome and died when they attempted to rescue others. This is generally because they have not been equipped or trained in rescue procedures. To prevent this any person given a rescue role are themselves protected against the cause of the emergency. Persons should be fully equipped and trained for the hazards identified during risk assessment.

5.7.4 Fire Safety

Where there is a risk of fire the appropriate type of extinguisher may be needed to be kept near the entry point. Care must be taken with inert gas systems, which should not operate whilst persons are in the space. Ventilation systems may affect the fire as forced air may affect the flames.

5.7.5 Control of Plant

Before an emergency attempt can take place, nearby or adjacent plant may have to be shut down as they may have contributed to the emergency or safe entry cannot be gained to a confined space whilst they are still working.

5.7.6 First Aid

Appropriate first aid equipment should be provided and available for emergencies and provide first aid until professional help arrives. First aiders should be trained to deal with the foreseeable injuries.

5.7.7 External/Public Emergency Services

In all cases there must be in place procedures for notifying external emergency services quickly should there be an accident. On their arrival someone should be able to give them information about the conditions and risks to be encountered before they enter the space.

It may be very helpful to co-operate with the external emergency service authorities in a planned emergency to highlight any problems but mainly encourage the working together.

5.7.8 Training

Any persons who may be likely to be involved in an emergency rescue should be trained for that purpose. The type of training for each person will vary according to the role they have. It is important that refresher training takes place regularly (at least annually).

Training may include the following:

- The likely causes of an emergency.
- Use of rescue equipment, e.g. breathing apparatus, lifelines, and where necessary a knowledge of its construction and working.
- The check procedures to be followed when donning and using apparatus.

- Checking of correct functioning and/or testing of emergency equipment (for immediate use and to enable specific periodic maintenance checks).
- Identifying defects and dealing with malfunctions and failures of equipment during use.
- Works, site or other local emergency procedures including the initiation of an emergency response.
- Instruction on how to shut down relevant process plant as appropriate (this knowledge would be required by anyone likely to perform a rescue).
- Resuscitation procedures and, where appropriate, the correct use of relevant ancillary equipment and any resuscitation equipment provided (if intended to be operated by those receiving emergency rescue training).
- Emergency first aid and the use of the first aid equipment provided.
- Use of fire-fighting equipment.
- Liaison with external/public emergency services in the event of an incident, providing relevant information about conditions and risks, and providing appropriate space and facilities to enable the emergency services to carry out their tasks.
- Rescue techniques including regular and periodic rehearsals/exercises. This could include the use of a full-weight dummy. Training should be realistic and not just drill based, and should relate to practice and familiarity with equipment.

5.7.9 Maintenance of Equipment

All breathing apparatus, safety harnesses, lifelines and resuscitation equipment provided for use in, or in connection with, entry into enclosed spaces and particularly for use in emergencies must be properly maintained, for example all items of breathing apparatus should be should be inspected each time prior to use, and as soon as possible after every occasion on which the apparatus.

Equipment maintenance schedules must include periodic examination and testing as necessary.

Manufacturers and suppliers information will often provide advice on frequency and type of examination, of all types of equipment.

5.8 Isolation

There could be a risk of substances (gases, liquids, water, steam, raw materials) from services or process entering the confined space. This may be caused by the inadvertent operation of machinery.
There may also be a risk of gases being present in the exhaust of combustion engines that may be used in the confined space.

The confined space shall be isolated from potential dangers by blinding, disconnecting and blanking of all lines connected to the space, or by other approved means.

Pressure equipment must be depressurized. Electrical, mechanical and pressure equipment in the confined space must be isolated and 'locked-out' and 'tagged-out'.

Normally the power to such equipment should be disconnected and measures taken to ensure it cannot be reconnected until it is safe to do so. Care must be taken not to isolate vital services such as sprinkler systems, communication or inert gas flooding systems.

5.9 Gas Purging

Where there may be or even the possibility of toxic or flammable gases or vapors there may be a need to purge the gas or vapour from the space. If toxic gases are present air or inert gases may be used, however flammable gases are present only inert gases may be used (the use of air with a flammable gas will increase the risk or explosion) after purging has been completed, retesting of the atmosphere is required to check purging has been successful and that the air is safe to breathe.

When air purging is taking place, the flow of air should be of a sufficient volume and velocity to ensure that no pockets or layers of gas remain undisturbed.

If the safest method or removing a flammable or explosive hazard is by purging with inert gas, and the work cannot be carried out from a safe position outside the confined space, there will be need to put in place a permit-to-work system that identifies the standard of protection of all exposed persons. This would include use of full breathing apparatus.

Care should be taken to ensure that exposure to vented gases does not affect employees and non-employees as a result of purging, and to protect those outside the space from toxic flammable and irritating gases and vapors.

5.10 Ventilation

Ventilation of almost all confined spaces is required. This may be by natural ventilation for example the opening of as many manholes or covers to allow fresh air to circulate, or by the introduction of compressed air via an airline. Higher rates of air exchange can be achieved by the use of air movers, induction fans or extractor fans, along with trunking, (provided that there is an adequate supply of fresh air to replace the used air). Fresh air should be drawn from a point where it is not contaminated either by used air or other pollutants.

Oxygen should never be introduced into a space to 'cleanse' the air as this can lead to oxygen enrichment and therefore increase combustibility with some materials and some substances like grease liable to spontaneous combustion.

Care must be taken when deciding the ventilation method to take account of the layout of the space, the position of openings, etc. and the properties of the pollutants, so that circulation of air for ventilation is effective. Pockets of gas or vapors may collect in complicated spaces so more complex ventilation systems may be required.

Appropriate and continuous ventilation of the confined space must be provided to displace flammable or toxic gases. The possible presence of pyrophoric materials should be considered and appropriate measures taken to avoid ignition, e.g. wetting. Oxygen must never be used in an attempt to correct oxygen deficiency in a confined space.

Ventilation of confined spaces may be achieved by:

- Natural ventilation.
- Mechanical ventilation – Forced or Suction.
- High Pressure Purging.
- Compressed Air.

All confined spaces where there is a presence of authorized entrants will be continuously ventilated until the work cease.

5.10.1 Clean-out Doors

Where confined spaces are provided with clean-out doors, these doors shall be opened after purging, and the confined space thoroughly ventilated.

5.10.2 Use of Ventilation Equipment

Ventilation shall preferably be accomplished using a positive method of mechanical ventilation that is arranged to introduce sufficient fresh air and remove contaminants from all pockets or corners of the confined space, and avoid re-circulating contaminated air.

Even after the confined space has been cleaned and ventilated, the mechanical ventilation equipment must be kept operating to provide secondary protection in case of accidental introduction of harmful substances, and to remove contamination or heat that may be produced by the work (e.g. welding and cutting, painting, coating).

5.10.3 Ventilation Air Source

The ventilation air used will be from either an electrical blower approved for a Zone 1 hazardous area, or an air driven blower. The air intakes for these devices shall be located where no contaminants may enter the stream.

5.10.4 Disposal of Confined Space Atmosphere

Outlets for power driven blowers, pneumatic air eductors, or air/steam eductors used to draw vapors out of a confined space must be directed to a safe place far from possible sources of ignition.

5.11 Cooling

Confined spaces should be sufficiently cool prior to entry. Cooling is normally achieved by allowing the space to naturally cool down whilst being ventilated.

5.12 Cleaning and Removal of Residues

Before entering a confined space, e.g. the interior of any vessel or tank, depending on the nature of its contents, it must be emptied of residual material or potentially hazardous substances.

There are a variety of methods that can be used for cleaning a confined space to remove hazardous solids, liquids or gas, including draining, pumping out, washing, hot or cold water flushing, steaming, chemical neutralization, and inert gas or air purge.

Cold-water washing, hot water washing and steaming will remove many contaminants, while solvents or neutralizing agents may be necessary for others. If hot water or steam is used, with or without a solvent, care must be taken to ensure that adequate ventilation exists and that condensation does not build up to unacceptable levels.

If steam is used or water is boiled in a confined space, account must be taken of the vacuum that can be created on cooling.

When steam or solvents are used, these may in themselves create a toxic, suffocating or flammable hazard, even though a space has been well cleaned, it must not be entered until the atmosphere has been tested.

Note: Atmospheric testing may not reveal unsafe conditions when dealing with sludge or heavy deposits, but these may release hazardous fumes when disturbed.

The following precautionary measures should be followed with respect to chemical cleaning of confined spaces.

- If chemical cleaners are to be used, the MSDS for the chemical should be consulted and a risk assessment conducted prior to use. When introducing a chemical into a confined space, the compatibility of that chemical with the contents of the confined space must be also checked. If any doubts exist regarding the compatibility of a chemical, the Site HSE Manager or Environmental Coordinator shall be consulted.

- Adequate ventilation should be provided following the chemical cleaning of a confined space. Before an entry is permitted, the confined space will be monitored to ascertain the conditions are safe for entry and occupation.

- During rapid cooling of a confined space, a vacuum may be created, which could result in an oxygen deficient environment.

- Sludge deposits in the bottom of tanks and vessels may release toxic or flammable gases/vapors when disturbed.

- Sludge and spent cleaning fluids must be contained and disposed of in a safe and environmentally acceptable manner.

5.13 Gas Testing and Monitoring

The atmosphere within a confined space should be tested by a competent person prior to anyone entering it. Testing should be for hazardous gas fume or vapour and also the concentration of oxygen. Testing should be carried out on each occasion that the confined space is re-entered, even where the atmosphere initially was found to be safe to breathe.

The atmosphere should be monitored at all times persons are in the confined space.

5.13.1 Atmospheric Testing

Confined space atmospheres must be tested by qualified personnel (i.e. an Authorized Gas Tester) before entry is allowed. Tests shall be conducted for:

- Oxygen deficiency or enrichment.
- Flammable gases and vapors.
- Toxic vapors and gases.

5.13.2 Test Requirements

Testing must be carried out in accordance with the following requirements:

- Ventilation equipment must be shut off before the tests commence.
- The atmosphere must be tested at the bottom, top, and the middle of all confined spaces.
- The atmosphere inside must be continuously monitored while work is being conducted in the confined space.
- If the confined space is left for any reason, the atmosphere shall be re-tested before re-entry may be permitted.

5.13.3 Testing from Within a Confined Space

Where practicable, the gas test shall be carried out from outside the confined space, e.g. using extension probes. If it is not possible to perform sufficient testing from the outside of the confined space then, upon initial entry to a confined space to conduct any testing, self-contained or air-supplied breathing apparatus must be worn.

If breathing apparatus has to be worn, the Authorized Gas Tester shall, if practicable, also wear a harness and a lifeline.

5.13.4 Test Equipment

Testing instruments must be calibrated and operationally checked before and after use in accordance with manufacturer specifications.

The following types of gas testing and monitoring equipment are commonly used to assess the atmosphere within a confined space:

- **Detector Tubes and Hand Pump:** Detector tubes are designed to monitor specific gases, depending on the types of tube used. The operation is simple but the interpretation of gas level detected requires a competent person to decipher the results. The used of detector tubes and hand pumps usually requires the Authorized Gas Tester to enter the confined space in order to sample the atmosphere.

- **Portable Gas Detector:** Portable gas detectors may be analogue or digital type. These detectors usually include a hand pump or battery operated pump, chemical resistant tubes in various lengths to allow monitoring deep into the confined space without having to enter, and other accessories such water and dust traps, etc. Portable gas detectors are capable of monitoring several gases simultaneously, depending on the model and type of sensors installed. These gas sensors have a life span dependent on usage and exposure, are very sensitive and require periodic calibration.

- **Personal Gas Detector:** Personal gas detectors are issued to individuals working in a confined space. Single or multiple gases can be monitored continuously throughout the duration that the worker is within the confined space. The sensors have a life span.

5.13.5 Test Records

The results of atmospheric tests and operational checks must be recorded on the Confined Space PTW.

6.0 ENTRY PRECAUTIONS

6.1 Access and Egress

When work inside the confined space requires the erection of platforms and/or access ladders, the anchorage and support must be adequate for the weight of persons and materials involved.

It is safer to enter or leave a confined space if the access openings are big enough to let the person and equipment through easily.

The size of openings to confined spaces and access through all divisions, partitions or obstructions within such spaces needs to be adequate to ensure persons can get in and out easily, work in relative comfort, and be rescued.

Sufficient internal fittings must be removed from inside the confined space to enable:

- Adequate access and egress for the person in relation to the place of work.

- Adequate working space.

- The attendant to keep the person(s) under observation whenever possible. Where this is not possible, reliable and approved communication equipment must be provided to allow continuous verbal contact between the person in the confined space and the attendant.

Practice drills should be held to check that entry and rescue procedures are satisfactory.

Clear and conspicuous safety signs to prohibit an authorized entry should be displayed alongside access openings.

6.2 Selection and Use of Suitable Equipment

If the atmosphere inside a confined space is classified as flammable/combustible, no electrical tools or tools with the potential to produce sparks must be used. Only tools and equipment approved for Zone 1 hazardous areas should be used.

Where the use of the equipment involves a specific risk to the health and safety of employees, the use of the equipment must be restricted to specified workers.

6.2.1 Lighting

The following precautions shall be observed when using temporary lighting:

- Where the confined space has not been declared as gas free, air driven flameproof lights or certified battery powered torches must be used. Lights must be certified for a Zone 1 hazardous area.
- Confined spaces, which have been certified as gas free but where flammable residues could remain, may be illuminated as above or by extra low voltage (25V ac) portable lighting equipment approved for use in a Zone 1 hazardous area.
- Where the confined space has been cleaned of all flammable residues and certified as gas free, or is a confined space by virtue of restricted access alone and there has never been the possibility of it containing a flammable atmosphere, standard low voltage industrial lighting may be used.
- The supply cables to the transformers (approved for use in a Zone 1 hazardous area) for extra low voltage portable lights, must always be supported above ground and the transformers never taken inside the confined space.

6.3 Personal Protective Equipment and Respiratory Protective Equipment

The wearing of PPE, e.g. impervious clothing and respiratory protective equipment (RPE) can contribute to heat stress, disorientation, loss of judgment and physical distress.

6.3.1 Personal Protective Equipment (PPE)

So far as is reasonably practicable a confined space should be safe to work in without the need for PPE and RPE, which should be considered as a last resort measure, except for rescue work (including the work of the emergency services), and emergency escape. However, where exposure to hazardous substances, e.g. for H_2S, CO_2, hydrocarbons, is likely, then PPE should be provided as necessary.

The potential for additional hazards through work-related activities (e.g. spray-coating, refractory dismantling, shot-blasting, hydro-jetting, dye penetration, etc.) in the confined space should be taken into consideration when providing PPE.

Note: Some PPE may give a static electrical discharge, so antistatic footwear and clothing should be considered for use in flammable atmospheres.

6.3.2 Respiratory Protective Equipment (RPE)

Respiratory protective equipment that is suitable for atmospheres containing toxic vapors, gases or dusts should be provided as necessary.

Where RPE is provided or used in connection with confined space entry or for emergency or rescue, it should be suitable for the purpose for which it is intended, i.e. correctly selected and matched both to the job and the wearer.

A wide range of types of respiratory protective equipment is available from various manufacturers. The equipment functions on the basis of two distinct principles outlined below:

1. **Respirators:** These purify the air breathed. The air inhaled is drawn through a filter or medium that removes the harmful substance or pollutant. The nature of the filtering agent depends on the type of pollutant to be dealt with.

2. **Breathing apparatus:** These supply clean breathing air. The air can be supplied straight through an airline via a pump or compressor or, alternatively, the person may carry compressed air in cylinders.

Care must be taken to select the correct type of protection for the conditions. Respirators (as opposed to breathing apparatus) do not protect against oxygen deficient atmospheres and should not be used in any atmosphere dangerous to life. RPE should not be used unless all other methods of control or protection have been examined and it is established that the use of RPE is the only reasonably practicable solution.

Where it is the intention to supply emergency-breathing apparatus for safe egress or self-rescue in an emergency, the type commonly called escape sets may be suitable. These types which usually have a breathable supply of air for only a short duration are intended to allow the user time to exit the hazardous area to a place of safety. This type of equipment is not suitable for normal work.

6.4 Ignition Sources

Smoking and naked lights must be strictly prohibited and care must be taken to avoid the generation of static electricity with the consequent risk of sparks.

Earthing (grounding) should be considered to prevent static charge build up.

Before any welding, cutting and grinding may be carried out in a confined space, the space shall be proven completely gas free, and free of all flammable residuals.

Ignition sources must be removed if there are flammables or combustibles in the vicinity of the work area.

6.5 Fire

If there is a risk of flammable or explosive atmospheres the risk should be eliminated by cleaning, good ventilation and ignition source control.

Flammable and combustible materials should not be stored in confined spaces, and they should not be allowed to accumulate as a result of work.

If flammable materials are allowed to be located in a confined space they must be kept in fire resistant containers under strict control.

Appropriate fire protection must be considered not only in the space itself but also in any adjacent spaces that might be affected by the work.

6.6 Portable Gas Cylinders and Internal Combustion Engines

Never use petrol type internal combustion engines in confined spaces. Diesel and gas fuelled internal combustion engines are nearly as dangerous as petrol fuelled and should not be used unless stringent precautions are taken. Very high levels of ventilation are required and no vehicle should be re-fuelled within the space.

Gas cylinders should not normally be used in confined spaces unless special precautions are taken. Gas equipment and pipelines for example welding sets, must be rigorously examined for gas leaks before entry, they should not be left unattended and should be removed when not being used, especially at the end of work periods.

6.7 Gas Supplies by Pipes and Hoses

The use of hoses and pipes to convey flammable gases or oxygen into confined spaces must be severely restricted or controlled to minimize the risks. Supply valves to the hoses and pipes must be shut off before the hoses and pipes are moved. Hoses and pipes should be removed at the end of working periods. Where hoses and pipes cannot be removed, they should be disconnected from the gas supply at a point outside the space and their contents safely vented.

6.8 Radioactivity

Radiation sources must be removed or shielded.

Any confined space that might normally contain naturally occurring radioactive materials (NORMs) shall be checked by a certified Radiological Protection Supervisor.

Where vessels are fitted with nucleonic gauges for measuring levels or product density, the radioactive source must be made safe.

6.9 Limiting the Working Time by Adopting Work/Rest Regimes

Hot, humid, or cold conditions, the wearing of breathing apparatus, PPE or severe restrictions of space may require a limit on the time persons are allowed to work in confined spaces. A logging or tally system to control duration of time may be necessary especially in multiple entry locations.

To guard against on-set of heat stress, the temperature in the confined space should be monitored.

Appropriate work/rest regimes must be adhered to in line with the heat stress threshold limit values.

7.0 TEMPORARY SUSPENSION OF WORK

Whilst work in a confined space is proceeding, it is the responsibility of the supervisor and the attendant to ensure that any outside activities that could possibly affect or endanger the persons in the space, is suspended.

8.0 CONTROL OF UNAUTHORIZED ACCESS

Precautions must be taken to render unauthorized access to the confined space impossible when work is temporarily suspended.

9.0 ENTRY INTO GAS-FREE SPACES

A confined space must be made safe (i.e. non-toxic, non-flammable, non-asphyxiant) for persons to enter and work in.

Entry without using appropriate breathing apparatus should only be permitted subject to the following conditions:

- Oxygen content: minimum 20% vol, maximum 21% vol.
- Explosimeter reading: 0% of LEL.
- Toxic vapors: not greater than 50% of the OEL.

Satisfactory tests must be carried out by a qualified person before entry, to check the oxygen level and the possible presence of flammable and/or toxic gases.

Before entry, and as long as any person is inside the confined space, adequate ventilation must be provided. Wherever possible, additional manhole lids, access covers and outlets should be opened to improve natural ventilation. Continuous forced ventilation is recommended. However, in this case the requirement for hearing protection should also be considered.

The confined space must be cleared of flammable materials, including any deposits which might release or regenerate flammable or other vapors hazardous to health. Particular care is necessary to ventilate dead 'legs' and pockets within the space and to remove any paint blisters which might contain hazardous and/or flammable materials beneath.

Whenever a person is in the confined space, an attendant must always be outside.
A properly completed Work Permit confirming the aforementioned and stating the period of validity must be issued.

10.0 ENTRY INTO NON GAS-FREE SPACES

When every effort has failed to gas-free the confined space, entry may still be permitted subject to very stringent precautions.

Entry to a space with the following oxygen and explosimeter readings is only permitted with an appropriate breathing apparatus:

- Oxygen content: minimum 20% vol, maximum 21% vol.
- Explosimeter reading: no more than 0% of LEL.

Details of these test(s) should be entered on the Work Permit.

Persons must wear air supplied breathing apparatus (respirators cannot be used) and a lifeline/guideline where practicable. A suitable number of attendants must be on duty, some of whom will have already donned the appropriate equipment and are effectively prepared to undertake an immediate rescue should that be necessary.

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 person(s) from the confined space.

Fire and Safety Departments can advise on all such equipment but such advice should be sought before the work starts.

Continuous gas monitoring should be carried out during the work.

The number of persons permitted to enter a confined space should be limited according to the available space, the number of escape routes and the rescue facilities.

The Work Permit must specify the precautions necessary for the entry, the subsequent work to be carried out, knowledge of emergency procedures and also the period of validity.

Note: Where there is a life threatening situation, or in case of extreme emergency, or to prevent the development of potentially dangerous situation, it may be necessary to permit entry under less stringent conditions. In such circumstances special authorization is required and appropriate breathing apparatus must be worn.

11.0 ENTRY INTO INERTED SPACES

Work being carried out in an inerted space requires special equipment and skilled personnel; e.g. inside reactors, where in order to handle catalyst safely, it has to be both dry and out of contact with air.

Since the breathing apparatus equipment normally available on the site does not provide an adequate safeguard to the risk inherently involved in inert handling, only personnel using specialized equipment for working in inerted atmospheres should be employed.

Entry into inerted confined spaces using conventional self-contained breathing apparatus should be limited to emergency life-saving situations.

Gas testing monitors must be suitable for gas detection in inert atmospheres (normal explosimeters are not suitable).

If work in inerted atmospheres is interrupted, proper safeguards must be taken to secure the area so as to avoid unauthorized entry.
A properly completed Work Permit must be issued, specifying the necessary precautions for the entry and subsequent work, emergency procedures and the period of validity.

11.1 Equipment for Entry into Inerted Confined Spaces

The following lists the minimum requirements:

- A positive pressure air line breathing apparatus with back-up independent air supply for each person to enter the confined space and the attendant.
- Banks of air cylinders manifolded in such a manner that two completely independent air supplies are provided for primary and emergency use. The emergency air supply must be sufficient to allow the personnel to evacuate the confined space.
- A life control support station, set up as close to the entry point(s) as practicable to continuously monitor the supply air pressure for each individual mask. Each breathing apparatus must be provided with an alarm indicating low supply pressure and an automatic actuating valve for the emergency air supply.
- The control station should also be capable of monitoring the atmospheric conditions in the confined space, e.g. oxygen and temperature.
- The monitoring station should be provided with a battery power back up, automatically cutting in on failure of electricity supply. The battery supply should keep communication systems alive as well as providing emergency lighting at least for the time required to evacuate the confined space.
- Open communication links between entry personnel, attendants, supervisors and emergency personnel.
- Reinforced umbilical cords linking each man with the monitoring station and carrying primary and emergency air supplies and communication cables.

- Parachute-type safety harness and lifeline.
- A supply of emergency compressed air cylinders of sufficient capacity for escape purposes.
- A mechanical device capable of assisting in the rescuing of personnel from the confined space.

The use of fixed 'space type' helmets in conjunction with a life support system may be considered.

In the event that the area around open man-ways/entry points cannot be properly restricted, portable oxygen meters/alarms for continuous monitoring of the outside atmosphere should be considered.

The provision of an oxygen resuscitator outside the space should be considered. However, this requires an individual trained in its use and holding a current certificate in cardiopulmonary resuscitation (CPR).

11.2 Inert Supply

Since the oxygen concentration will depend on the inert gas purge rate, number of openings etc., the procedure should clearly define:

- Maximum allowable oxygen content.
- Minimum flow rate of inert gas.
- Total daily consumption of inert gas.
- Number and positions of inert gas injection points.
- Position and responsibility for monitoring inert gas pressure gauges.
- Number and position for instruments measuring oxygen and responsibility for monitoring and calibration.

11.3 Required Manpower for Inert Handling

Both, the worker(s) entering the inerted confined space and the attendant(s) outside, must use breathing apparatus equipment (positive pressure air line supplied).

A rescue assistant and a supervisor should be present.

With catalyst handling at elevated positions, supervision should be split into top and ground levels. For multi-bed vessels, the number of attendants should be increased accordingly.

11.4 Contractors for Inert Handling

The site management must be satisfied that the contractor is qualified to perform inert handling in a safe and skilled way.

As a minimum, contractors should use the equipment specified above and should provide the following information:

- A comprehensive safety and operating manual covering the procedures and instructions required to perform inert handling.
- Training certificates for entry into inert atmospheres showing dates of refresher training and experience of those named persons selected for the job.
- Confirmation that all named personnel undergo regular medical checks and are allowed to perform such work.
- Written reports of similar work undertaken.
- Incident reporting procedures and safety records.

To safeguard against all foreseeable hazards and difficulties, close co-operation by own and contractor staff is required from the pre-planning stage onwards. Areas of responsibilities in the execution of work must be clearly defined, understood and strictly adhered to.

12.0 MONITORING

The Confined Spaces system should be monitored to ensure that control measures remain unaltered, and that the precautions specified within the risk assessment are being complied with.

13.0 TRAINING AND CERTIFICATION

The extent of training required will vary according to types of activity to be performed, as well as the responsibilities of appointment holders, training needs for the following categories of employees will be considered:

- Line manager/Area Authority.
- Permit Issuing Authority
- Performing Authority.
- Authorized Entrants.
- Confined Space Attendants
- Gas testers.
- HSSE/Safety Officers.

14.0 RECORDS

A record of actual Confined Space permits should be maintained to enable auditing of completed permits and supporting certificates and other documents over a specified period.

The period for retention of records is typically 3 years unless local legislation requires retention for a longer period.

15.0 RELATED DOCUMENTS

15.1 PetroChina (Halfaya) Level 3 Guidance Documents

This Guidance is supported by:

- Document 3.6.1: Risk Assessment Guidance.
- Document 3.6.2: Job Hazard Analysis Guidance.
- Document 3.11.1: Permit To Work Guidance.
- Document 3.16.3: Personal Protective Equipment (PPE) Provision Guidance.
- Document 3.19.1: Emergency Preparedness and Response Guidance.

15.2 PetroChina (Halfaya) Level 2 Procedures

This Guidance is related to:

- Document 2.6: Risk Assessment Procedure.
- Document 2.11: Permit To Work Procedure.

15.3 PetroChina (Halfaya) Level 1 HSE-MS

This Guidance supports the ‘Evaluation and Risk Management’ section of the PetroChina (Halfaya) HSE-MS Document.

15.4 External Sources of Information

Further information is available from:

- The U.S. Department of Labor OSHA website (USA) www.osha.gov
- The Health and Safety Executive (UK) www.hse.gov.uk
- The International Association of Oil and Gas Producers (OGP) www.ogp.org.uk