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The Four Elements to Successfully Plan and Manage Your Confined Spaces

Introduction

Confined spaces can be complicated and anyone, in any industry, can be exposed to working in and around them. Confined spaces come in different sizes, in different locations of a facility or job site, some may be obvious and others less so, and there may be different hazards in each one. There are also many different standards, regulations and company policies that may apply. While complicated, it may be helpful for you to walk through each of the major elements, which may be categorized as follows:

- **Plan** evaluate, document and plan for confined space entries on your site
- Access what you need to access a specific confined space, including a hazard assessment
- Work inside provide the appropriate personal protection equipment to the worker to provide protection from hazards seen and unseen.
- Rescue / retrieval be prepared



The following document is not intended to replace formal training for entrants, supervisors, management, rescue personnel or anybody involved in planning or undertaking a confined space entry. However, this document is intended to highlight some areas of consideration in the planning and preparation for confined space.

So, let's break these four major elements down a bit more.



1. Planning for Your Confined Spaces

You first need to identify all your potential or known confined spaces. Then you need to evaluate each in turn. This will help you identify the type of training, equipment and people so that you can safely handle all the entries to and exits from confined spaces. When planning for confined space work, it's a good idea to begin by asking yourself:

- What do you know about the undisturbed space? Has there been a recent entry? Have you reviewed the risk assessments for these spaces?
- Do you need to prioritise your confined spaces? Do you a maintenance shut-down planned as some specific confined spaces with tasks scheduled?
- As each confined space is identified, have you conducted a formal hazard assessment? Have you identified what hazards are present, what needs to be done to work in the space safely? Have you checked whether the task can be completed without having to enter the confined space?
- Are you or the person who manages your confined spaces competent to complete a confined space assessment (if training is needed, find a class). You may need a third-party to complete a site assessment to help answer these questions.
- Are there any points you need to lock out, shut down sources of energy or assess what chemicals may be present that are dangerous?
- Do all people involved have a sufficient level of knowledge and experience working in and around confined spaces? If not, what training needs do they have?

- What types of personal protective equipment (PPE) will you need and what inventory do you have available?
- What degree of supervision of the confined space entry will be needed?
- What will happen if something goes wrong? Do you have a trained and competent rescue team on site and available?

By documenting the answers to these and other questions you will be well on the way to creating a Safe System of Work - a step by step guide to safely working within your confined space.



*The degree of supervision needed should be based on the findings of a thorough risk assessment and frequently identifies the need for a competent person who will need to supervise not just the entry, but who may need to remain present while the work is being conducted and completed.

Figure 1 - Planning for Confined Space entries, including development of a safe system of work

2. Accessing Confined Spaces

Hazard Assessment

Confined spaces can be dynamic, unexpected hazards can occur, and a safe system of work developed around the undisturbed space and pre-entry preparation may need further adaption when it comes to the prework inspection.

Therefore, you will need to do a hazard assessment during your prework inspection - every single time someone is going into a confined space. Not only that, you will need to constantly conduct a dynamic hazard assessment based on what is being done at the worksite and what conditions workers are being exposed to that may present a danger. For example, your hazard assessment may identify a variety of issues, such as unsafe levels of gas requiring respiratory protection, the presence of flammable substances, loud noises requiring hearing protection, and control of all energy sources (lockout/tag-out).

Pre-work Briefing

A pre-work (or pre-access) briefing should be given by the supervisor and should cover and review the tasks to be performed, method statements, permits, the time it will take, and emergency protocols so everyone is on the same page.

Air Monitoring

Prior to accessing the confined space, the atmosphere around the entrance and within the confined space must be tested to check for toxic, asphyxiant, and flammable/ explosive atmospheres. Prior knowledge of the configuration, contents and use of confined space should guide you in terms of the likely atmospheric hazards within and around the confined space, as well as appropriate methods of testing the atmosphere throughout the space.

Portable four-gas detectors, portable area monitoring instruments, as well as fixed area monitoring are commonly used., It is critical to understand the limitations of your air monitoring equipment and check that your device can detect the likely atmospheric hazards or if there is a need for gas-specific monitor to determine lower-level concentrations that may be present. Testing should be repeated prior to every entry, and continuously monitored during an entry.

Atmospheric testing must be conducted by a competent person, using appropriate gas detection instruments which are within calibration, and that have been bump tested regularly - ideally daily.

What is the difference between a Risk Assessment and a Hazard Assessment?

Risk Assessment - This involves identifying and understanding the environment in and around the confined space, including entry location and size of the entry as well as if there are any lockout points and possible sources of energy or chemicals. These things are consistent and very rarely change. This assessment will help you determine if a competent person is needed and if this person needs to remain present for the duration of the work.

Typically conducted upon an undisturbed confined space during the Planning phase.

Hazard Assessment – This is conducted to assess conditions workers are being exposed to that may present a danger, such as unsafe levels of gas requiring respiratory protection or loud noises requiring hearing protection. The conditions often change and therefore, this assessment should be constantly updated.

Typically conducted as part of the pre-entry preparation and prework inspection tasks and throughout the confined space entry.

Ventilation

Confined spaces typically have limited ventilation and air exchange, and within a relatively small volume, dangerous levels of atmospheric hazards can build up. Ventilation (ideally mechanical / forced) prior to and during entry is commonly needed to ensure that atmospheric hazards are reduced and potentially reducing the need to wear specialist respiratory protection. Gas purging may also be needed if there is a risk of an explosive atmosphere. When conducting ventilation and/or gas purging, proper procedures should be followed to eliminate the hazard and the atmosphere tested again to ensure the process was effective. It is also likely that further ventilation will continue while workers are in the space. The proper air changes per hour (ACH) should be calculated and maintained.

Equipment Needed for Access

Confined spaces can be difficult to work around and gain safe access to. Without the proper equipment and training, safety and efficiency may be compromised and rescuing someone may be delayed if a problem does arise. Consideration needs to be made for:

- Access for the entrant
 - Safety can the access equipment enable safe horizontal and particularly vertical access or where there is a risk of falling
 - Efficiency/ time can the access equipment make the process physically easier or quicker for the entrant?

• Rescue of the entrant

- Safety can the access equipment enable a rescue to be performed without a rescuer having to enter the space
- Efficiency/time can the access equipment enable an immediate extraction rescue by attendant, and/or provide mechanical advantage to make the process physically easier or quicker?

The diversity of confined spaces, access points, vertical or horizontal entries will require different access equipment. Examples include a tripod, davit, pole hoist, winch, and SRL retrieval. Having the right equipment in good working order, and proper training for involved can help prevent injuries, risk and in some instances, even prevent the need for anyone else to enter if a rescue does become necessary.



Additional Tips for Accessing a Confined Space

Here are some additional steps you should keep in mind when planning access to a confined space:

- All confined space entrants should wear a full body harness. The harness should be designed for the intended use in the space.
- For medium or high risk confined spaces, and whenever possible, the authorised entrant should have a retrieval line attached to appropriate connection on their harness.
- Fall protection for entrants may be required if there is a risk falling whilst gaining access to or working within the confined space.
- National regulations may require a pre-rigged retrieval system with mechanical advantage for entry into confined spaces larger/deeper than 1.5m. Mechanical advantage is always best practise, regardless of the depth/size of the confined space.
- The attendant outside of the confined space must maintain constant communication with the entrants, when visual contact cannot be maintained, other means of communication must be considered.

Once the work is completed, everyone should review what worked well, inspect all the equipment used to see what needs repairs or should be replaced. You should also update the risk assessment with your findings for future workers who may need to access the space.

3. Work Inside Confined Spaces

When working in the confined space, communication and monitoring should be a constant. Environmental elements can change unexpectedly, plus communicating with workers outside the confined space may become difficult.

You should try to ensure that a confined space is safe to work in reducing the need for personal protective equipment (PPE) including respiratory protective equipment (RPE). Reliance on PPE should be a last resort and every effort should be made to create an environment within the space free of hazards. If your risk assessment does identify the need for PPE, it needs to be suitable for the application and should be provided to those trained to use it and properly used by those entering and working in confined spaces. This may include hard hats, safety glasses, clothing that protects against chemicals, flash fires and other hazards, as well as gloves and safety shoes.

It is important to remember that tight-fitting respiratory protective equipment must be fit tested prior to use. And before any RPE is used, it must be inspected every time to make sure that there is no damage such as cracks, holes and no signs of wear or loose connections. Always follow the manufacturer User Instructions.

Hazards of Working Inside of Confined Spaces

In some cases, there may be a need to limit the time period that professionals are allowed to work in a confined space, for example where RPE is used, or under extreme conditions of temperature and humidity. This can also be the case when the confined space is so small that movement is severely restricted. Confined spaces that are classified as medium or high risk, that are physically large, or there are multiple entrants, a log in or tally system may be necessary to check everyone in and out and to control the duration of time they are in the space.

There may be additional risks to consider, such as:

- Corroded structures
- Cold temperatures
- Loss of rigidity when a tank is drained
- Trip hazards
- Noise



All equipment should be carefully selected bearing in mind the conditions and risks where it will be used. Intrinsically safe and ATEX approved equipment may be appropriate if there is a risk of flammable or explosive atmosphere. Electrical grounding should be considered to prevent static charge build-up. In addition to isolation, mechanical equipment may need to be secured against free rotation.

Communication

Adequate communications must be in place between (a) entrants and attendant; (b) attendant and supervisor; and (c) attendant and rescue ream. Whatever systems are used, all messages should be able to be communicated easily, rapidly and unambiguously between relevant people, especially if they may not be able to see one another.

4. Rescue / Retrieval

Death or injury in confined space incidents can and often do occur. Illconceived attempts to save others who have collapsed or ceased to respond usually follows from a lack of proactive planning, appropriate training or identification of a proper rescue plan.

Proactively identifying a proper rescue plan, seeking out appropriate training and identifying the right equipment long before any rescue is ever attempted is crucial. You need to be prepared so that if you are faced with saving someone who is stuck, has collapsed, or has ceased to respond from inside a confined space, you are ready for the situation.

Have a Rescue Plan in Place Before Any Entry Occurs

National regulations typically require that you have a defined, documented and periodically reviewed rescue and retrieval plan specific to your confined space before any entry or work inside these kinds of spaces can even begin to take place. The act of rescue and retrieval will also need to be performed by someone who is competent and has completed proper training. They must also understand how to select, wear and use appropriate personal protective equipment (PPE) and other tools or equipment that will be needed.

Among the many aspects of a robust rescue plan, at a minimum a rescue plan should:

• Describe the location of the confined space and the job being conducted inside

- Identify the rescuer, competent person who will be on hand, emergency contact and the methods of contact that will be used to keep in contact with those in the confined space or by anyone involved should a rescue become necessary
- Layout all pre-work tasks
- Catalogue all the rescue equipment that will be available for use and where they can be located, including a checklist for thorough inspection that evaluates it is in good working order
- List all the critical rescue factors, including any hazards present
- Record the response procedure, including how to notify the emergency contact, how to make a medical assessment of the person stuck inside, and if possible, how to have the trapped employee perform a self-rescue or other next steps if that is not possible



The requirements for an emergency response plan can vary from country to country, but in the absence of any local guidance, the US NFPA 350 best practice guide is a good place to start when creating your plan.

You should speak up and not enter a confined space without ensuring there is a plan in place about how to react should a rescue and retrieval become necessary.

Make Sure You are Properly Trained to Rescue

Before any access is granted to a confined space, you should evaluate the needs of a rescue team and what training is required for the team (or individual) to perform a rescue operation – whether this be selfrescue by the entrants, a non-entry rescue by the attendant or an entry rescue by a rescue team.



Types of Rescue/Retrieval

There are different types of rescue/ retrievals that can be conducted, depending on the situation you and your team are facing.





Self-Rescue

Self-rescue is when entrants can rescue themselves and safely leave the confined space by their own means, whenever an emergency or hazardous situation is encountered, for example a potentially hazardous change in atmospheric conditions. Self-rescue may also occur if the entrant realizes that PPE is faulty, communication with the attendant is severed, or some other hazard presents itself that may put the entrant in danger.

Some key items that help facilitate a self-rescue include ensuring all involved know and understand the potential hazards and the signs and symptoms of any hazard. The entrant and attendant must maintain good lines of communication with one another. Gas detection and/or gas monitoring should be provided closest to the hazard, this often implies that the entrant should be provide with personal gas detection. Lastly, the entrant should be provided with an emergency or escape breathing system inside the space to be used if air quality quickly diminishes.

Non-Entry Rescue

Non-entry rescue occurs when a worker (attendant or non-entry rescue team member) outside the space rescues an entrant, but without having to enter the confined space themselves.

Most national regulations require that a non-entry retrieval option available unless the retrieval equipment would increase the risk to the worker or not contribute to the rescue.

The person or people helping the worker out of the confined space will often require the use of a retrieval system comprised of the following components:

- 1. Anchor systems such as a davit, pole hoist or tripod
- 2. Body harness, worn by the entrant
- 3. Connection devices such as a winch or retrieval SRL

This type of rescue is only effective in simple vertical or horizontal spaces. The opening must be able to accommodate the anchor system, and the surface around the opening must support the weight of it in addition to the attached entrant. Non-entry rescues occur when the entrant is injured or incapacitated to the extent that they cannot perform a self-rescue, then a worker outside the confined space can remove the entrant using the retrieval system. This is where a retrieval system with a mechanical advantage becomes very helpful.

Entry Rescue

An entry rescue is when neither self-rescue or non-entry rescue is possible, and a rescue team member is required to enter the space to assist any entrants who cannot exit the space on their own. These teams can be comprised of company personnel, including externally hired services or a local emergency response team. National regulations often stipulate the minimum capabilities of these rescue teams:

- Members of the team must be specially trained in confined space rescue work, including different techniques, methods of access and equipment that may be required.
- The team must have at least one member certified in CPR and first aid
- The members who are going to assist with the rescue should be well-versed in the rescue plan for that confined space and review both the risk and hazard assessments that have been conducted for that specific space

Post-Rescue Review

Once a rescue is complete, it is important to review how the rescue went and what can be learned from the experience. Do changes need to be made to the rescue plan if the confined space is going to be accessed in the future? Does your PPE need to be checked and should any of it be decommissioned and different or should new PPE be ordered?

PPE and Other Products You May Need

When it comes to considering the equipment for a rescue start with understanding the ABC's of confined space:

- Anchorage systems such as davits, pole hoists, tripods
- Body support, which means full body harnesses, and in some cases, boatswain (bosun) chairs
- Connecting devices such as self-retracting lifelines and retrievals
- Detection for air monitoring of gases, vapours, particulates, fumes and other hazardous substances
- Education courses that help teach how to work safely in confined spaces and well as proper use of any equipment used during the confined space entry.
- Full body coverage for employees who should be protected from head to toe based on hazards identified in the risk assessment, including hard hats, safety glasses, hearing protection, advanced communication devices, respiratory protection, clothing that protects the body against chemicals, fires and other hazards such as coveralls, as well as gloves and safety shoes that protect the hands and feet

Make sure everything is available in stock on the premises, the location is known, the equipment is clean and is in good working order before commencing any access work.



Wrap-up

We know there is a lot to consider when it comes to planning for, working in and rescuing someone from inside a confined space.

Along with a diverse range of PPE products and gas detection products that can help keep your workers safe when working in confined spaces (The ABC's of Confined Space), 3M have a range of resources that can help your plan, access, work within and rescue from confined spaces - explore the resources available at: www.3m.co.uk/confinedspace

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