

## Extreme danger lurks in confined spaces

**A**t a sawmill several years ago, the vertical chute of a hog-fuel machine became plugged with waste cedar (log ends, bark, and sawdust). Workers opened the bottom access doors to unplug the machine. One worker went inside the chute and stood on the rotor to clear the plug. Other workers removed waste wood through the doors. The worker inside the chute was later found surrounded by waste wood and could not be revived.

This is just one example of a common and potentially very dangerous place to work: the confined space.

If your workers are required to construct or work in a boiler, cupola, degreaser, furnace, pipeline, pit, pumping station, reaction or process vessel, septic tank, sewage digester, sewer, silo, storage tank, ship's hold, utility vault, vat or similar enclosure, they are working in a confined space.

A confined space is a space that has any one of the following characteristics:

- Limited openings for entry and exit
- Unfavorable natural ventilation
- Not designed for continuous worker occupancy.

Confined space openings are limited primarily by size or location.

Openings are usually small in size, perhaps as small as 18 inches in diameter, and are difficult to move through easily. Small openings may make it very difficult to get needed equipment in or out of the spaces, especially protective equipment, such as respirators, needed for entry into spaces with a hazardous atmosphere, or lifesaving equipment when rescue is needed.

However, in some cases, openings may be very large. For example, open-topped spaces, such as pits, degreasers, excavations and ship's holds, are still considered confined spaces. Access to open-topped spaces may require the use of ladders, hoists or other devices, and escape from such areas may be very difficult in an emergency.

Air may not move in and out of confined spaces freely due to the design, so the atmosphere inside a confined space can be very different from the atmosphere outside. Deadly gases may be trapped inside, particularly if the space is used to store or process chemicals or organic substances that may decompose. There may not be enough oxygen inside the confined space to support life, or the air could be so oxygen

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rich that it is likely to increase the chance of fire or explosion if a source of ignition is present.

Most confined spaces are not designed for workers to enter and work in on a routine basis. They are designed to store a product, enclose materials and processes, or transport products or substances. Therefore, occasional worker entry for inspection, maintenance, repair, cleanup or similar tasks is often difficult and dangerous due to chemical or physical hazards within the space.

A confined space found in the workplace may have a combination of these three characteristics, which can complicate working in and around these spaces as well as rescue operations during emergencies.

The atmosphere in a confined space may be extremely hazardous because of the lack of natural air movement. This characteristic of confined spaces can result in 1) oxygen-deficient atmospheres; 2) flammable atmospheres; and/or 3) toxic atmospheres.

### **Oxygen-deficient atmospheres can be deadly**

An oxygen-deficient atmosphere has less than 19.5 percent available oxygen. Any atmosphere with less than 19.5 percent oxygen should not be entered without an approved self-contained breathing apparatus (SCBA).

The oxygen level in a confined space can decrease because of work being done, such as welding, cutting or brazing; or it can be decreased

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## *Workers exposed to the total displacement of oxygen by another gas, such as carbon dioxide, will lose consciousness and then die.*

by chemical reactions (rusting) or through bacterial action (fermentation).

The oxygen level can also decrease if oxygen is displaced by another gas, such as carbon dioxide or nitrogen. Workers exposed to the total displacement of oxygen by another gas, such as carbon dioxide, will lose consciousness and then die.

### **Beware of flammable atmospheres**

Two things make an atmosphere flammable: the oxygen in air; and a flammable gas, vapor or dust in the proper mixture. Different gases have different flammable ranges. If a source of ignition (e.g., a sparking or electrical tool) is introduced into a space containing a flammable atmosphere, an explosion will result.

An oxygen-enriched atmosphere (above 21 per cent) will cause flammable materials, such as clothing and hair, to burn violently when ignited. Therefore, never use pure oxygen to ventilate a confined space.

### **Atmospheres can become toxic**

Most substances (liquids, vapors, gases, mists, solid materials and dusts) should be considered hazardous in a confined space. Toxic substances can come from the following:

**Product stored in the space** — The product can be absorbed into the walls and give off toxic gases when removed or, when cleaning out the residue of a stored product, toxic gases can be given off.

**Work being performed in the confined space** — Examples include welding, cutting, brazing, painting, scraping, sanding, degreasing, etc. Toxic atmospheres are generated in various processes. For example, solvents are used in many industries for cleaning/degreasing. The vapors from these solvents are very toxic in a confined space.

**Area adjacent to the confined space** — Toxicants produced by work in the area of confined spaces can enter and accumulate in the spaces.

It is important to understand that some gases or vapors are heavier than air and will settle to the bottom of a confined space. Also, some gases are lighter than air and will be found around the top of the confined space. Therefore, it is necessary to test all areas (top, middle, bottom) with properly calibrated testing instruments to determine what gases are present. If testing reveals an oxygen deficiency or the presence of toxic gases or vapors, the space must be ventilated and re-tested before workers enter. If ventilation is not possible and entry is necessary (for emergency rescue, for example), workers must have appropriate respiratory protection.

## **Get with a program**

Confined space hazards are often quite complex. For assistance in preparing a written confined space entry program, consult a qualified occupational health and safety professional.

The Canadian Centre for Occupational Health and Safety suggests that general requirements for confined spaces should include:

**Identify confined spaces** - The employer must identify each confined space in the workplace, and determine whether the spaces will require entry by a worker.

**Prohibit entry** - If a confined space exists at a workplace but no worker entry is required, the employer must ensure that each point of access to the confined space is secured against entry or identified by a sign or other effective means which indicates the nature of the hazard and the prohibition of entry, and that workers are instructed not to enter.

**Control hazards** - Whenever possible engineering solutions should be implemented, such as robotic cameras for the inspection of tanks, to avoid entering confined spaces. Also, measures should be taken to convert spaces containing high or moderate hazard atmospheres to contain low hazard atmospheres. The employer must ensure that all confined space hazards are eliminated or minimized and that work is performed in a safe manner.

Before a worker is required or permitted to enter a confined space, the employer must prepare and implement a written confined space entry program that includes:

- (a) an assignment of responsibilities,
- (b) a list of each confined space or group of similar spaces and a hazard assessment of those spaces, and
- (c) written safe work procedures for entry into and work in the confined space, that address, where applicable:
  - identification and entry permits
  - lockout and isolation
  - verification and testing
  - cleaning, purging, venting or inerting
  - ventilation
  - standby persons
  - rescue
  - lifelines, harnesses and lifting equipment
  - personal protective equipment and other precautions
  - coordination of work activities.

*If someone takes a serious tumble because of something you left on the floor, you were a major cause of the accident, and the injured party may not be very forgiving.*

## Good housekeeping is everyone's task

There's a lot more to good housekeeping in the workplace than sweeping the floors and dusting. Not only does it indicate pride in where a person works and maintain morale among fellow workers who would otherwise have to function in a messy environment, it's an important safety and health issue.

Keeping your workplace clean and tidy starts with you. Here are some of the problems that can result from sloppy housekeeping:

- Unsanitary conditions, leading to the possibility of disease
- Injuries, when employees trip, fall, strike or are struck by out-of-place objects
- Injuries from using improper tools because the correct tool can't be found
- Lowered production because of the time spent maneuvering over and around someone else's mess, and time spent looking for proper tools and materials
- Time spent investigating and reporting accidents that could have been avoided
- Fires due to improper storage and disposal of flammable or combustible materials and wastes
- Substandard quality of finished products because of production schedule delays, damaged or defective finishes, ill-equipped employees, etc.
- Lack of future work due to a reputation for poor quality;

A sanitary work area is a safe work area. This means disposing of trash and other debris promptly and properly. Here are some ways to do that:

- Keep food and drink out of the work area. Such items can attract bugs and/or rodents.
- Help keep break rooms clean. Do not let dirty dishes sit in the sink and do not leave food in the refrigerator for extended periods of time.
- If the microwave or refrigerator needs to be cleaned, do it yourself or report it to the person responsible for the job.
- Do your part to keep restrooms clean. If you spill water, clean it up. If there is a plumbing problem, report it immediately. Bathrooms are a breeding ground for

mold, mildew and germs.

Most slips, trips and falls can be prevented. If someone takes a serious tumble because of something you left on the floor, you were a major cause of the accident, and the injured party may not be very forgiving.

Here are some ways to prevent such an occurrence:

- If you see a spill, clean it up or report it to someone who can. Wet floors are slippery floors, so it is important to clean up spills immediately.
- Do not store items in aisles or walkways. This only creates a tripping hazard.
- Put trash and debris in receptacles, not near or next to them.
- Never use stairwells as storage areas.
- If the lighting is bad in a stairwell, report it immediately.
- If employee entrance areas are slick, report it immediately.



Employees often track in the weather, turning some floor surfaces into skating rinks.

- Do not run cords or wires across walkways.

Proper housekeeping can also protect employees from fires. Allowing trash and debris to accumulate creates a fire hazard. It is important to note that fire needs three

things in order to flourish: fuel, oxygen and an ignition source. Oxygen is always present. Allowing trash and debris to accumulate adds fuel to the mix. This is inviting a fire.

Chemicals are another common source of fire. They must be stored properly at all times. Check chemical labels and material safety data sheets (MSDSs) to determine whether you are storing chemicals in their proper locations. Some chemicals must be stored within a certain temperature range. Others are very reactive and should be stored alone. Every chemical has its own characteristics, especially as they relate to fire.

Remember, good housekeeping is never a job that belongs to somebody else.

## How to improve your delegation skills

If you really want to be an effective supervisor, you can't do it all yourself. You have to be able to delegate tasks to others. However, some methods of delegation are better than others. Here are some tips:

**1. Make the job serious.** Never shrug off the importance of work that you are delegating or the worker won't realize that it's serious. We know one supervisor who frequently made this mistake before a manager explained what was going wrong. The supervisor, who worked in a supermarket, would tell a worker to "just restock the end of aisle nine so it looks neat, but don't worry, it's not a big job and it won't take long at all."

The worker, who normally bagged groceries, might have felt pleased to do something different. But instead, he felt that he was being asked to do something that wasn't even necessary, and so he didn't do it quickly or well. The supervisor got much better results when she started using this kind of wording to delegate: "Aisle nine is looking pretty shabby. If you could restock it for us, the customers would be very appreciative—and so would I!"

**2. Choose the right employee.** Every employee you have may be capable of doing the assignment, but one or two will do it the best. When you delegate, make sure you choose the person who will do the job properly. That way, success will be more likely. Also, the main purpose of delegation — making it possible for you to do other things no one else can do—is served better if you pick the best worker for the job.

**3. Instill confidence.** Supervisors who delegate in a hesitating manner, saying "You don't have to do this if you think it's too much for you" or "Let me know now if you can't do this and I'll get somebody else," are setting themselves up for disappointment. Worse, they are paving the way for the employee to lose confidence. You need to delegate with authority, conveying the impression that you know the worker can handle the job.

**4. Spread the wealth.** Employees like to have

work delegated to them. It makes them feel important. So be sure you don't always delegate to the same few workers. Find different jobs for different employees so that everyone can feel like he or she is pitching in to help.

Remember, the key is to build a stronger team with you as the coach.

### Building better teams

If you want to start your own team-building program, Peter Grazier, of Teambuilding, Inc., recommends that you be on the lookout for questions and that you not answer them.

Here's what he says:

"If someone raises an issue, just say, 'Oh, let's think about this. What would you do?' But don't give the answer yourself."

Don't be surprised, says Grazier, if your comment is met by silence at first. There is a hesitance to contribute, particularly in front of a large group. There are those individuals who are merely waiting to be led, and there are also those people who have a bit of a phobia about speaking up when in a group.

"Sometimes people don't say anything," Grazier says. However, he has a simple solution for this problem. "Neither should you. Just be quiet and listen."

Eventually, your subordinates will realize that they do have something to contribute.

### Be subtle about teams

It's not a good idea to announce that you're going to have a team, says Grazier. The notion of working in a team all too often causes people to have flashbacks to term projects from high school. Because the majority of people subscribe to the philosophy of "If you want something done right, you have to do it yourself," it's difficult to get people organized who believe in the team ethic. Grazier feels it's better to subtly slip into the team project. Otherwise, workers may be spooked.

Finally, Grazier recommends that supervisors write down workers' ideas and hang them up on the wall. It doesn't have to be a big production. "You can just use markers, paper and tape," he says. The point is to get workers used to the concept of coming up with ideas and working with each other. Take your time with this process, as it may be a bit uncomfortable at first. There are many people who need to be convinced that this is the way to solve problems.

For more information, visit [www.teambuildinginc.com](http://www.teambuildinginc.com).

## Accident investigation: Why bother?

Investigation is an essential prevention tool that makes it possible to determine the cause of an accident or incident and minimize risks. Investigation can mean saving lives.

The term "accident" can be defined as an unplanned event that interrupts the completion of an activity, and that may (or may not) include injury or property damage. An incident usually refers to an unexpected event that did not cause injury or damage this time but had the potential. "Near miss" or "dangerous occurrence" are also terms for an event that could have caused harm but did not.

Reasons to investigate a workplace accident include:

- to find out the cause and to prevent similar accidents in the future
- to comply with any legal requirements
- to determine the cost of an accident
- to determine compliance with applicable safety regulations
- to process workers' compensation claims

Incidents that involve no injury or property damage should still be investigated to determine the hazards that should be corrected. The same principles apply to a quick inquiry of a minor incident and to the more formal investigation of a serious event.

When accidents are investigated, the emphasis should be concentrated on finding the root cause rather than the investigation procedure itself so you can prevent it from happening again. The purpose is to find facts that can lead to actions, not to find fault. Always look for deeper causes. Do not simply record the steps of the event.

Ideally, an investigation would be conducted by someone experienced in accident causation, experienced in investigative techniques, fully knowledgeable of the work processes, procedures, persons, and industrial relations environment of a particular situation.

Some jurisdictions provide guidance, such as requiring that it must be conducted jointly, with both management and labour represented, or that the investigators must be knowledgeable about the work processes involved.

In most cases, the supervisor should help investigate the event. Other members of the team can include:

- employees with knowledge of the work
- safety officer
- health and safety committee
- union representative, if applicable
- employees with experience in investigations

- "outside" expert
- representative from local government

An investigator who believes accidents are caused by unsafe conditions will likely try to uncover conditions as causes. On the other hand, one who believes they are caused by unsafe acts will attempt to find the human errors that are causes. Therefore, it is necessary to examine some underlying factors in a chain of events that ends in an accident.

Even in the most seemingly straightforward accidents, seldom, if ever, is there only a single cause. For example, an investigation that concludes an accident was due to worker carelessness, and goes no further fails to seek answers to several important questions such as:

Was the worker distracted? If yes, why was the worker distracted? If not, why not? Were safety devices in order? If not, why not? Was the worker trained? If not, why not?

An inquiry that answers these and related questions will probably reveal conditions that are more open to correction than attempts to prevent "carelessness".

The accident investigation process involves the following steps:

- Provide first aid and medical care to injured person(s) and prevent further injuries or damage
- Report the accident occurrence to a designated person within the organization
- Investigate the accident
- Identify the causes
- Report the findings
- Develop a plan for corrective action
- Implement the plan
- Evaluate the effectiveness of the corrective action

Make changes for continuous improvement

As little time as possible should be lost between the moment of an accident or near miss and the beginning of the investigation. In this way, one is most likely to be able to observe the conditions as they were at the time, prevent disturbance of evidence, and identify witnesses. The tools that members of the investigating team may need (pencil, paper, camera, film, camera flash, tape measure, etc.) should be immediately available so that no time is wasted.



## Some healthy advice on insect repellents

Whether you're on the job or on vacation, insect repellents can be an effective aid in reducing bites from mosquitos and ticks that can cause a range of health problems from itchiness and irritation to potentially serious diseases. Some insect repellents are more effective than others.

In Canada, West Nile virus and Lyme disease are the main health concerns, but there are other diseases that can also be contracted. For most Canadians, the risk of contracting these illnesses is very low and the risk of serious health effects is even lower. Your best protection from them is to take preventive measures, including the use of insect repellents that have been approved by Health Canada. These products have a Pest Control Product (PCP) registration number on the product label. Never use a product labelled as an insecticide on your body.

Choose a product that meets your needs. For example, if you plan to be outdoors for a short period of time, choose a product with a lower concentration of repellent and repeat application only if you need a longer protection time.

Health Canada advises that the following products are not recommended, for a variety of reasons. They may not be very effective or long-lasting, and may have the potential to be harmful to human health.

- Electronic or ultrasonic devices
- Electrocuting devices, such as bug zappers
- Wristbands, neckbands and ankle bands impregnated with repellents
- Odour-baited mosquito traps
- Citrosa houseplants
- Vitamin B1 taken orally
- Skin moisturizers and insect repellent combination products are not approved for use by Health Canada. Use separate products simultaneously when required.

## The dangers of diesel exhaust

Diesel exhaust is a pervasive airborne contaminant in workplaces. Due to expanding use of diesel equipment, more workers are exposed to diesel exhaust and face the risk of adverse health effects, ranging from headaches and nausea to cancer and respiratory disease. Such employees include mine workers, bridge

and tunnel workers, railroad workers, loading dock workers, truck drivers, material handling machine operators, farm workers, longshoring employees, and auto, truck and bus maintenance garage workers.

Make sure your warehouse is well ventilated. Diesel exhaust is regarded as "a potential occupational carcinogen," and studies have shown workers exposed to the substance face an increased risk of lung cancer. In addition, the exhaust can cause eye and skin irritation, upper respiratory problems and even death from carbon monoxide poisoning. You can ventilate your workplace by using fans, opening windows and introducing fresh air into the environment through ducts. Also, be sure to tune up your equipment frequently to help reduce the levels of noxious fumes. In addition, stock the appropriate respirator for emergency use.

## Lockout/tagout: A quick review

"Lockout/tagout" refers to specific practices and procedures to safeguard employees from the unexpected energization or startup of machinery and equipment, or the release of hazardous energy during service or maintenance activities.

Before beginning service or maintenance, the following steps must be accomplished in sequence and according to the specific provisions of your company's energy-control procedure:

- Prepare for shutdown.
- Shut down the machine.
- Disconnect or isolate the machine from the energy source(s).
- Apply the lockout or tagout device(s) to the energy-isolating device(s).
- Release, restrain or otherwise render safe all potential hazardous stored or residual energy. If a possibility exists for reaccumulation of hazardous energy, regularly verify during the service and maintenance that such energy has not reaccumulated to hazardous levels.
- Verify the isolation and de-energization of the machine.

Employees who work on de-energized machinery may be seriously injured or killed if someone removes lockout/tagout devices and reenergizes machinery without their knowledge. It is extremely important that all employees respect lockout and tagout devices and that only the individual who applies a device may remove it.

The material contained in this document has been prepared from sources believed to be accurate and reliable. Application of this information to a specific worksite should be reviewed by a safety professional. Anyone making use of the information set forth herein does so at their own risk and assumes any and all liability arising therefrom. Specific medical advice should be obtained through consultation with a physician or other trained health care practitioner.

## There are big risks in small spaces

**T**here are many types of confined spaces — tanks, vats, pits, tunnels, pipes, boilers — and more. All of them can be dangerous.

A confined space has three characteristics: It has limited openings for entry and exit, it is large enough to permit a worker to enter, and it is not designed for continuous worker occupancy.

These characteristics of a confined space cause it to present serious hazards. Here are some of the common ones:

- lack of oxygen, resulting in risk of suffocation
- fire or explosion from an accumulation of flammable vapors
- toxic vapors
- difficulty exiting the space in the event of an emergency
- cramped spaces to work in, resulting in a danger of being caught in equipment
- poor visibility
- high levels of noise
- temperature extremes

Working in a confined space requires special training. For example, it requires a good understanding of gas monitoring, ventilation systems, fire and explosion prevention, equipment lockout, and a thorough knowledge of the worksite's specific hazards.

You must know your company's procedures for safely entering a confined space and working in it. Confined spaces should be identified and classified, and safe entry procedures developed. Some confined spaces require a permit for entry.

Once you have determined if a work space is considered a confined space, be sure the confined space hazard assessment and control program has been followed.

A key question to ask is whether it's absolutely necessary the work be carried out inside the confined space. In many cases where there have been deaths in confined spaces, the work could have been done outside the confined space.

Before entering any confined space, a trained and experienced person should identify and evaluate all the potential hazards.

An important step in determining the hazards in a confined space is air testing. The air within the space should be tested from outside before entry into the confined space. Care should be taken to ensure that air is

tested throughout the confined space — side to side and top to bottom.

A trained worker using detection equipment that has remote probes and sampling lines should do the air quality testing.

Another very important thing to remember is what to do

if someone working in a confined space becomes ill or injured. In the event of such an emergency, you should never enter a confined space to rescue someone without the proper equipment, training, and atmospheric testing. Chances are, whatever caused the illness or injury will claim you as a victim too.



Victims should be rescued from outside the confined space, if possible. More than 60 per cent of deaths in confined spaces are would-be rescuers, who are not fully trained and adequately equipped.

Another worker qualified in confined spaces rescue procedures must be present outside the confined space before the first rescuer enters the confined space. Do not use the same air as the confined space workers you are rescuing. Wear SCBA (self-contained breathing apparatus) or supplied air respirator with an escape bottle.

In general, then, these are the things you should be aware of before you work in a confined space:

- how to enter and exit safely
- the atmosphere in the space has been tested and found to be free of dangerous levels of toxic or flammable vapors, and there is sufficient oxygen
- the atmosphere is going to remain safe while you are working
- the rescue plan in the event of an emergency, and that proper rescue equipment is available and in good condition
- another person outside the confined space is keeping an eye on you as you work, and they also know the rescue plan
- other procedures necessary to work safely, such as locking out energy sources

Performing a task safely in a confined space requires careful planning and preparation. Don't be tempted to take shortcuts. Follow all safety precautions and don't hesitate to speak up if you are unsure of the correct procedures.

# Confined Spaces

## The Quiz

These questions are meant to help you remember what was discussed today — not to test your patience or challenge your intelligence. The answers are at the bottom of the page. Complete the quiz as quickly as you can.

- All confined spaces can be dangerous.  
TRUE \_\_\_\_ FALSE \_\_\_\_
- Is special training required to work in a confined space?  
YES \_\_\_\_ NO \_\_\_\_
- Which of the following are characteristics of a confined space:  
A. Lack of oxygen  
B. Poor visibility  
C. High levels of noise  
D. Difficult access and exit  
E. All of the above
- Which of the following is an unlikely example of a confined space hazard:  
A. Toxic vapour  
B. Cramped conditions  
C. Fire or explosion  
D. Avalanche  
E. Electrocution
- Have you been informed of the known confined space hazards at your worksite?  
YES \_\_\_\_ NO \_\_\_\_
- Name one potential confined space at your worksite  
\_\_\_\_\_
- Which of the following is a poor way to avoid confined space risks  
A. Enter only after the atmosphere in the confined space has been properly tested.  
B. Learn the company's procedures for safe entry and exit of a confined space.  
C. Act swiftly to attempt a rescue, even if you are alone.  
D. Work in a confined space only if it's absolutely necessary.
- Does your company have a confined space training program in place?  
YES \_\_\_\_ NO \_\_\_\_ DON'T KNOW \_\_\_\_

**ANSWERS:** 1. True, 2. Yes, 3. E., 4. D., 5. Your answer, 6. Your answer, 7. C., 8. Your answer

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**President:** Chris Skilton  
**Sales:** Art Hamilton • Alan Haycroft • Lisa Adams  
Liz Slobodin • Carol Wilkinson  
**Editor:** Bryden Winsby  
**TOLL FREE:** 1-888-655-4800 • **Fax:** 1-250-487-2104  
**Mailing Address:** #101-196 Wade Avenue W.,  
Penticton, British Columbia V2A 1T6  
www.skilven.com • customerservice@skilven.ca

## Hold These Thoughts

Anyone working in a confined space must be constantly alert for any changing conditions within the confined space. Another worker, the Safety Watch or Standby, is posted outside the confined space and continuously monitors the workers inside the confined space.

If a situation arises where there is a hazardous condition and the worker does not leave or is unable to leave the confined space, rescue procedures should begin immediately.

The Safety Watch is qualified in confined spaces rescue procedures and will be available immediately to provide emergency assistance if needed. The Safety Watch should be familiar with the structural design of the confined space. The Safety Watch is in constant communication with the worker inside the confined space and will:

- Have all required rescue equipment (for example, safety harnesses, lifting equipment, a lifeline) immediately available and be trained in its use.
- Hold a basic first aid certificate.
- Can do Cardiopulmonary Resuscitation (CPR).

The detailed plan for emergency response to an emergency within the confined space should be described in detail in the Confined Space Hazard Assessment and Control Program.

Rescue the victims from outside the confined space, if possible. No other worker should enter a confined space to attempt a rescue unless that worker is fully trained in the rescue procedures and is wearing the appropriate personal protective equipment. More than 60 per cent of deaths in confined spaces are would-be rescuers, who are not fully trained and adequately equipped.

Another worker qualified in confined spaces rescue procedures must be present outside the confined space before the first rescuer enters the confined space. Do not use the same air as the confined space workers you are rescuing. Wear SCBA (self contained breathing apparatus) or supplied air respirator with an escape bottle.