As a Home Builder, we do not self-perform any work. This section is a resource guide only and is not intended to put any requirements on the company. All subcontractors, trade partners, suppliers and vendors are required to develop, implement and follow their own safety program, including providing the proper competent person(s) for the specific task they are responsible for.

As a controlling employer onsite, we will identify any permit required confined spaces that exist and communicate those and associated hazards to other employers who may need to enter any permit required confined spaces. We will post a sign on each permit required confined space. It is not anticipated that our employees will ever need to enter a confined space.

PURPOSE

This Confined Space Safety Plan is provided to identify confined spaces our employees or subcontractors may experience on the job and protect authorized employees that will enter confined spaces and may be exposed to hazardous atmospheres, engulfment in materials, conditions which may trap or asphyxiate due to converging or sloping walls, or any other safety or health hazards.

Reference: OSHA-Confined Spaces in Construction (29 CFR 1926.1200-1213)

DEFINITIONS

Competent person means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them.

Confined space is a space that meets all three of these requirements:

1. Is large enough or so configured that an employee can bodily enter and perform work
2. Has limited or restricted means for entry or exit
3. Is not designed for continuous employee occupancy

Permit required confined space is a confined space that has one or more of the following characteristics:

- Contains or has a potential to contain a hazardous atmosphere.
- Contains a material that has the potential for engulfing an entrant.
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly covering walls or by a floor, which slopes downward and tapers to a smaller cross-section.
- Contains any other recognized serious safety or health hazard.

RESPONSIBILITIES

Management

- Identify confined spaces and permit required confined spaces
- Train employees to identify confined spaces and not to enter unless authorized
- Ensure proper training for authorized entrants, attendants and entry supervisors
- Ensure confined space assessments have been conducted
- Ensure all permit required confined spaces are posted
- Evaluate rescue teams/service to ensure they are adequately trained and prepared
- Ensure rescue team at access during entry into spaces with IDLH atmospheres
• Annually review this program, including all entry permits

Employees
• Follow program requirements, including only working to level of training
• Report any previously un-identified hazards associated with confined spaces to management

If a confined space is identified as a permit required space, the following three roles are required:

Entry Supervisor
Entry supervisors are responsible for the overall permit space entry and must coordinate all entry procedures, tests, permits, equipment and other relevant activities. The following entry supervisor duties are required:

• Must be a competent person for confined spaces
• Must determine if a confined space is a permit required space by using the Evaluation Form found in appendix A.
• Know the hazards that may be faced during entry, including information on the sign, symptoms and consequences of the exposure to such hazards
• Verifies, by checking that the appropriate entries have been made on the permit (Appendix B), all test specified by the permit have been conducted and that all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin
• Terminate the entry and cancel the permit when the entry is complete and there is a need for terminating the permit
• Verify that rescue services are available and that the means for summoning them are operable
• Remove unauthorized persons who enter or attempt to enter the space during entry operations
• Determine whenever responsibility for a permit space entry operation is transferred and at intervals dictated by the hazards and operations performed within the space that entry operations remain consistent with the permit terms and that acceptable entry conditions are maintained

The entry supervisor may also act as the attendant if the employee is trained properly.

Attendants
At least one attendant is required outside the permit space into which entry is authorized for the duration of the entry operation. All attendants must be authorized by the entry supervisor and have received the proper training prior to performing attendant duties. Responsibilities include:

• To know the hazards that may be faced during entry, including information on the signs, symptoms and consequences of the exposure to such hazards
• To be aware of possible behavioral effects of hazard exposure on entrants
• To continuously maintain an accurate count of entrants in the permit space and ensures a means to accurately identify authorized entrants
• To remain outside the permit space during entry operations until relieved by another attendant (once properly relieved, they may participate in other permit space activities, including rescue if they are properly trained and equipped)
To communicate with entrants frequently to monitor entrant status and alert entrants of the need to evacuate
To monitor activities inside and outside the space to determine if it is safe for entrants to remain in the space and orders the entrants to immediately evacuate if: the attendant detects a prohibited condition, detects entrant behavioral effects of hazard exposure, detects a situation outside the space that could endanger the entrants; or if the attendant cannot effectively and safely perform all the attendant duties
To summon rescue and other emergency services as soon as the attendant determines the entrants need assistance to escape the permit space hazards
To perform non-entry rescues as specified by that rescue procedure and entry supervisor
Not to perform duties that might interfere with the attendants' primary duty to monitor and protect the entrants
To take the following action when unauthorized persons approach or enter a permit space while entry is under way:
   1. Warn the unauthorized persons that they must stay away from the permit space,
   2. Advise unauthorized persons that they must exit immediately if they have entered the space, and
   3. Inform the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space.

Entrants
All entrants must be authorized by the entry supervisor to enter permit spaces, have received the required training, used the proper equipment, and observes the entry procedures and permit. The following entrant duties are required:

- Know the hazards that may be faced during entry, including information on the signs, symptoms and consequences of the exposure to such hazard
- Properly use the equipment required for safe entry
- Communicate with the attendant as necessary to enable the attendant to monitor the status of the entrants and to enable the attendant to alert the entrants of the need to evacuate the space if necessary
- Alert the attendant whenever; the entrant recognizes any warning signs or symptoms of exposure to a dangerous situation, or any prohibited condition is detected
- Exit the permit space as quickly as possible whenever; the attendant or entry supervisor gives an order to evacuate the permit space, the entrant recognized any warning signs or symptoms of exposure to a dangerous situation, the entrant detects a prohibited condition, or an evacuation alarm activated

HAZARDS
Confined spaces can present many unique hazards. The list below are some that could be experienced in the construction environment:

- Oxygen Deficient or Oxygen Enriched Environments
- Flammable / Explosive Atmospheres
- Toxic Atmospheres
- Irritant (Corrosive) Atmospheres
- Asphyxiating Atmospheres
• Engulfment
• Entrapment
• Falls
• Mechanical
• Electrical
• Thermal Effects
• Noise & Vibration

Further explanation of these hazards can be found later in this plan in the section titled: Confined Space Hazard Details.

HAZARD CONTROL

Engineering Controls

Engineering controls eliminate or reduce exposure to a chemical or physical hazard through the use or substitution of engineered machinery or equipment. Engineering controls are the preferred method to control hazards. Engineering controls include, but are not limited to:

• Lock Out / Tag Out
• Temporary ventilation
• Temporary Lighting

Administrative Controls

Administrative controls are changes in work procedures such as written safety policies, rules, supervision, schedules, and training with the goal of reducing the duration, frequency, and severity of exposure to hazardous chemicals or situations. Administrative controls will be used whenever feasible in addition to engineering controls.

• Signs
• Employee training
• Entry procedures
• Atmospheric Monitoring
• Rescue procedures
• Use of prescribed PPE

Personal Protective Equipment

Personal protective equipment (PPE) will be used when engineering controls and administrative controls are not sufficient to control the hazard. Some PPE that may be used include:

• Respirators
• Fire Resistant Clothing
• Gloves and Protective Clothing

EVALUATION OF CONFINED SPACES

All confined spaces on the job shall be evaluated to determine if they are Non Permit Required or Permit Required Confined Spaces. This shall be done prior to entry and completed by a competent person. The evaluation form, found in Appendix A of this plan must be completed. The following steps should be followed:
• Identify the confined space that needs to be entered
• Determine if any of these conditions exist:
  o Contains or has a potential to contain a hazardous atmosphere
  o All spaces shall be monitored during the evaluation period. The space should be evaluated without entry and at varying locations
    o Contains a material that has the potential for engulfing an entrant
    o Has an internal configuration that could entrap the entrant
    o Contains any other recognized serious safety or health hazard
• If none of these issues are found, the space can be classified as “Non Permit” and the procedures for Non Permit Entry of Confined Spaces can be followed.
• If there is a serious safety hazard found that would classify the confined space as a Permit-Required Confined Space, and the hazard can be completely eliminated without entry into the space, the space may be reclassified as shown below in Reclassification of Confined Spaces.
• If the only hazard of the confined space is atmospheric and this hazard can be completely eliminated through the use of continuous ventilation, the “Alternative Entry Procedures” can be followed.
• If the space is found contains the conditions above and the space cannot be reclassified or the alternative procedures are not appropriate, the following shall be followed:
  o The competent person must immediately place a sign at the space: “Danger Confined Space – Entry Permit Required. Please see example sign in Appendix C.
  o Follow the procedures below “Entry of a Permit Required Confined Space”
  o Use the permit that is found in Appendix B.
• A decision flow chart to assist the competent person in classifying each space is found in Appendix D.

ATMOSPHERIC MONITORING / TESTING

It is impossible to detect a hazardous atmosphere without instruments designed for that purpose. It should never be assumed that a confined space is safe or that an employee will be fine if they don’t remain in a confined space or perform dangerous work there. A person can be overcome in a hazardous atmosphere in a matter of moments. Even quick and simple work in an area not recognized as a confined space can result in injuries or death by asphyxiation or as a result of an explosion.

In order to enter any confined space without the use of special types of PPE, such as a self-contained breathing apparatus (SCBA), atmospheric conditions must have these characteristics:

• Oxygen: 19.5 percent to 23.5 percent
• Flammability: below 10 percent of the lower flammable limit (LFL) for gases, vapors, mists or combustible dust
• Toxic gases: below the permissible exposure limit (PEL)/threshold limit value (TLV) or time-weighted average (TWA) of a substance

A 4-gas monitor that tests for all of these at the same time is the best method to test an atmosphere.

All the operations that will be taking place within the space and any hazardous substances that may result, such as fumes from welding or vapors from solvents or other chemicals, must be considered. The proximity to traffic and automotive vehicles on site should also be noted because this may generate carbon monoxide.
CONFINED SPACE EMPLOYEE REQUIREMENTS

Each employee who enters or is involved in the entry must:

1. Completed training as an entrant, attendant or entry supervisor
2. Understand the procedures for confined space entry
3. Know the hazards of the specific space
4. Review the specific procedures for each entry
5. Understand how to use entry and rescue equipment

ENTRY OF NON-PERMIT CONFINED SPACES

If a confined space does not contain other conditions that would classify it as a permit required confined space, the workers do not need to complete a permit. The evaluation form found in Appendix A, must still be filled out and signed. The following steps should be followed for Non-Permit Confined Spaces:

- Fill out and sign evaluation form
- Takes precautions, as necessary:
  - Install vehicular and pedestrian traffic controls as needed
  - Posts warning signs as necessary at the work location
  - Takes measures to prevent hazards near the confined space
  - Use any required personal protective equipment for task conducted

If a hazards arise at any time during the entry, the following is required:

- Each employee must leave the space immediately.
- The space must be evaluated to determine how the hazards developed.
- A competent person shall re-evaluate the space and classify as required.

RECLASSIFICATION OF CONFINED SPACES

Permit-required confined spaces may be reclassified as non-permit-required confined spaces if certain criteria are met. If these criteria are met, rescue teams, special PPE, etc., are not required. The criteria include the following:

- The space poses no actual or potential hazardous atmospheres.
- All hazards within the space can be eliminated without entry into the space, such as locking and tagging electrical equipment so employees are not exposed to a shock hazard. Please note: Forced-air ventilation to control atmospheric hazards does not constitute elimination of hazards.

The basis for determining that all hazards in the permit space have been eliminated or isolated, must be documented using the evaluation form found in Appendix A.

If a hazards arise at any time during the entry, the following is required:

- Each employee must leave the space immediately.
- The space must be evaluated to determine how the hazards developed.
- The space should be classified as Permit-Required and the Permit found in Appendix B should be used.
ALTERNATIVE ENTRY PROCEDURES

Entry into a permit-required space using alternative entry procedures is allowed under the following conditions:

- The only hazards in the permit space are atmospheric
- Hazards can be controlled by the use of continuous forced-air ventilation
- Atmosphere is tested continually during entry

Using these procedures eliminates the need for a written permit, attendant or rescue team, etc.

It may be necessary, though, to conduct a full permit-required confined-space entry to test the atmosphere if it cannot be tested from outside. Once the atmosphere has been tested and it is determined that the only hazard is an atmospheric hazard that can be controlled through the use of forced-air ventilation, the rest of the requirements are relaxed—the only requirement being that the atmosphere must be tested continually.

If a hazardous atmosphere is detected at any time during the entry, the following are required:

- Each employee must leave the space immediately.
- The space must be evaluated to determine how the hazardous atmosphere developed.
- Steps must be taken to protect the employees from the hazardous atmosphere before a subsequent entry takes place.

The confined space evaluation form found in Appendix A must be completed before anyone enters the confined space using alternative procedures.

ENTRY OF PERMIT REQUIRED CONFINED SPACES

If employees are required to enter permit-required confined space the entry supervisor shall use a permit, as found in Appendix B and follow these procedures:

<table>
<thead>
<tr>
<th>STEP</th>
<th>RESPONSIBLE PARTY</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Entry Supervisor</td>
<td>Determines if non-entry rescue can be performed. If it cannot, entry must be arranged in advance.</td>
</tr>
<tr>
<td>2.</td>
<td>Entry Supervisor</td>
<td>Determines control measures for hazards associated with the confined space entry</td>
</tr>
<tr>
<td>3.</td>
<td>Entry Supervisor</td>
<td>Verifies that all required equipment, attendants, and entrants are available</td>
</tr>
<tr>
<td>Pre-entry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Entry Supervisor</td>
<td>Documents the pre-entry process with the permit-required confined space procedure and entry permit</td>
</tr>
<tr>
<td>Step</td>
<td>Role</td>
<td>Task</td>
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<tr>
<td>------</td>
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</tbody>
</table>
| 5.   | Entry Supervisor | Ensures that the confined space’s atmosphere is ventilated as necessary and tested prior to entry using properly calibrated monitoring equipment. Results for the following must be recorded on the permit:  
- Oxygen  
- Flammability (percent of lower explosive limit)  
- Hydrogen sulfide  
- Carbon monoxide  
- Any other suspected or known atmospheric hazard  
If at any time the oxygen concentration or other monitored components in the atmosphere fall out of their designated ranges, the cause must be determined and controls must be in place before entry is allowed. If entry is necessary to correct the deficiency, self-contained breathing apparatus or a supplied air respirator must be worn. Note: The entrant has the right to witness atmospheric testing. |
| 6.   | Entry Supervisor | Secures the work site as appropriate  
- Installs barriers and/or controls vehicular and pedestrian traffic as needed  
- Posts warning signs and any required permit(s) at the work location  
- Takes measures to prevent hazards near the confined space |
| 7.   | Entry Supervisor | Conducts pre-entry briefing for all personnel involved in the entry that includes at minimum these topics  
- Work to be performed  
- Anticipated hazards, including signs, symptoms and consequences of exposure  
- Hazard control measures  
- Prohibited conditions (specified in the permit)  
- Non-entry rescue procedures; generally these involve using a full-body harness with a retrieval line attached to a mechanical device or fixed point. |
| 8.   | Entry Supervisor | Verifies that  
- All control measures, procedures, and equipment specified by the permit are in place  
- Entry conditions are acceptable |
| 9.   | Entry Supervisor | Signs the pre-entry certification section of the permit |
| **Confined space entry** |  |  |
| 10.  | Entrant | Entrant must get permission of attendant prior to entry  
Put on any required personal protective equipment  
Enters the permit-required confined space only if  
- Name is listed on the permit  
- Entry conditions are acceptable  
- All control measures and specified non-entry rescue provisions are implemented |
| 11.  | Entry Supervisor | Verifies that acceptable entry conditions are maintained and that entry operations remain consistent with terms of the permit and the hazards associated with the planned work |
### Host Employer / Controlling Employer Duties

The host employer on the site must work with the controlling employer to identify and communicate all confined spaces and their associated hazards to any other employer performing entry on the site. The host employer and controlling employer could be the same company.

### Sub-Contractor Entry

All work by non-company employees that involves the entry into confined spaces will follow the procedures of this program. The only exception is if the sub-contractor has their own confined space program that is equivalent to this program. The information of this program and specific hazards of the confined spaces to be entered will be provided to sub-contractors prior to commencing entry or work.
RESCUE
Non-entry rescue is the preferred method of rescue for any confined space entry. The entry supervisor must also ensure that rescue services are available in case non-entry rescue is not available during a permit-required confined space entry. The rescue services must be provided in accordance with 1926.1211.

TRAINING
Training for Confined Space Entry includes:

1. Duties of Entry Supervisor, Entrant and Attendants
2. Confined Space Entry permits
3. Hazards of Confined Spaces
4. Use of Air Monitoring Equipment
5. First Aid and CPR Training
6. Emergency Action & Rescue Procedures
7. Confined Space Entry & Rescue Equipment
8. Rescue training, including entry and removal from representative spaces

All training must be documented and occur prior to employee working in any function related to confined spaces.

CONFINED SPACE HAZARDS DETAILS

Flammable / Explosive Atmospheres
A flammable atmosphere generally arises from enriched oxygen atmospheres, vaporization of flammable liquids, byproducts of work, chemical reactions, concentrations of combustible dusts, and desorption of chemical from inner surfaces of the confined space.

An atmosphere becomes flammable when the ratio of oxygen to combustible material in the air is neither too rich nor too lean for combustion to occur. Combustible gases or vapors will accumulate when there is inadequate ventilation in areas such as a confined space. Flammable gases such as acetylene, butane, propane, hydrogen, methane, natural or manufactured gases or vapors from liquid hydrocarbons can be trapped in confined spaces, and since many gases are heavier than air, they will seek lower levels as in pits, sewers, and various types of storage tanks and vessels. In a closed top areas, it should also be noted that lighter than air gases may rise and develop a flammable concentration if trapped above the opening.

The byproducts of work procedures can generate flammable or explosive conditions within a confined space. Specific kinds of work such as spraying paint or other chemicals can result in the release of explosive gases or vapors. Welding in a confined space is a major cause of explosions in areas that contain combustible gas.

Chemical reactions forming flammable atmospheres occur when surfaces are initially exposed to the atmosphere, or when chemicals combine to form flammable gases. This condition arises when dilute sulfuric acid reacts with iron to form hydrogen or when calcium carbide makes contact with water to form acetylene. Other examples of spontaneous chemical reactions that may produce explosions from small amounts of unstable compounds are acetylene-metal compounds, peroxides, and nitrates. In a dry state, these compounds have the potential to explode upon percussion or exposure to increased temperature. Another class of chemical reactions that form flammable atmospheres arise from
deposits of pyrophoric substances (carbon, ferrous oxide, ferrous sulfate, iron, etc.) that can be found in tanks used by the chemical and petroleum industry. These tanks containing flammable deposits will spontaneously ignite upon exposure to air.

Combustible dust concentrations are usually found during the process of loading, unloading, and conveying grain products, nitrated fertilizers, finely ground chemical products, and any other combustible material. High charges of static electricity, which rapidly accumulate during periods of relatively low humidity (below 50%), can cause certain substances to accumulate electrostatic charges of sufficient energy to produce sparks and ignite a flammable atmosphere. These sparks may also cause explosions when the right air or oxygen to dust or gas mixture is present.

Toxic Atmospheres

The substances to be regarded as toxic in a confined space can cover the entire spectrum of gases, vapors, and finely divided airborne dust in industry. The sources of toxic atmospheres encountered may arise from the following:

1. The manufacturing process (for example, in producing polyvinyl chloride, hydrogen chloride is used as well as vinyl chloride monomer, which is carcinogenic).
2. The product stored [removing decomposed organic material from a tank can liberate toxic substances, such as hydrogen sulfide (H₂S)].
3. The operation performed in the confined space (for example, welding or brazing with metals capable of producing toxic fumes).

During loading, unloading, formulation, and production, mechanical and/or human error may also produce toxic gases, which are not part of the planned operation.

Carbon monoxide (CO) is a hazardous gas that may build up in a confined space. This odorless, colorless gas that has approximately the same density as air is formed from incomplete combustion of organic materials such as wood, coal, gas, oil, and gasoline; it can be formed from microbial decomposition of organic matter in sewers, silos, and fermentation tanks. Carbon monoxide is an insidious toxic gas because of its poor warning properties. Early stages of CO intoxication are nausea and headache. Carbon monoxide may be fatal at 1000 ppm in air, and is considered dangerous at 200 ppm, because it forms carboxyhemoglobin in the blood, which prevents the distribution of oxygen in the body.

Carbon monoxide is a relatively abundant colorless, odorless gas; therefore, any untested atmosphere must be suspect. It must also be noted that a safe reading on a combustible gas indicator does not ensure that CO is not present. Carbon monoxide must be tested for specifically. The formation of CO may result from chemical reactions or work activities, therefore fatalities due to CO poisoning are not confined to any particular industry. There have been fatal accidents in sewage treatment plants due to decomposition products and lack of ventilation in confined spaces. Another area where CO results as a product of decomposition is in the formation of silo gas in grain storage elevators. In another area, the paint industry, varnish is manufactured by introducing the various ingredients into a kettle, and heating them in an inert atmosphere, usually town gas, which is a mixture of carbon dioxide and nitrogen.

In welding operations, oxides of nitrogen and ozone are gases of major toxicological importance, and incomplete oxidation may occur and carbon monoxide can form as a byproduct.

Another poor work practice, which has led to fatalities, is the recirculation of diesel exhaust emissions. Increased CO levels can be prevented by strict control of the ventilation and the use of catalytic converters.
Irritant (Corrosive) Atmospheres

Irritant or corrosive atmospheres can be divided into primary and secondary groups. The primary irritants exert no systemic toxic effects (effects on the entire body). Examples of primary irritants are chlorine, ozone, hydrochloric acid, hydrofluoric acid, sulfuric acid, nitrogen dioxide, ammonia, and sulfur dioxide. A secondary irritant is one that may produce systemic toxic effects in addition to surface irritation. Examples of secondary irritants include benzene, carbon tetrachloride, ethyl chloride, trichloroethane, trichloroethylene, and chloropropene.

Irritant gases vary widely among all areas of industrial activity. They can be found in plastics plants, chemical plants, the petroleum industry, tanneries, refrigeration industries, paint manufacturing, and mining operations.

Prolonged exposure at irritant or corrosive concentrations in a confined space may produce little or no evidence of irritation. This may result in a general weakening of the defense reflexes from changes in sensitivity. The danger in this situation is that the worker is usually not aware of any increase in his/her exposure to toxic substances.

Asphyxiating Atmospheres

The normal atmosphere is composed approximately of 20.9% oxygen and 78.1% nitrogen, and 1% argon with small amounts of various other gases. Reduction of oxygen in a confined space may be the result of either consumption or displacement.

The consumption of oxygen takes place during combustion of flammable substances, as in welding, heating, cutting, and brazing. A more subtle consumption of oxygen occurs during bacterial action, as in the fermentation process. Oxygen may also be consumed during chemical reactions as in the formation of rust on the exposed surface of the confined space (iron oxide). The number of people working in a confined space and the amount of their physical activity will also influence the oxygen consumption rate.

A second factor in oxygen deficiency is displacement by another gas. Examples of gases that are used to displace air, and therefore reduce the oxygen level are helium, argon, and nitrogen. Carbon dioxide may also be used to displace air and can occur naturally in sewers, storage bins, wells, tunnels, wine vats, and grain elevators. Aside from the natural development of these gases, or their use in the chemical process, certain gases are also used as inerting agents to displace flammable substances and retard pyrophoric reactions. Gases such as nitrogen, argon, helium, and carbon dioxide, are frequently referred to as non-toxic inert gases but have claimed many lives. The use of nitrogen to inert a confined space has claimed more lives than carbon dioxide. The total displacement of oxygen by nitrogen will cause immediate collapse and death. Carbon dioxide and argon, with specific gravities greater than air, may lie in a tank or manhole for hours or days after opening. Since these gases are colorless and odorless, they pose an immediate hazard to health unless appropriate oxygen measurements and ventilation are adequately carried out.

Oxygen deprivation is one form of asphyxiation. While it is desirable to maintain the atmospheric oxygen level at 21% by volume, the body can tolerate deviation from this ideal. When the oxygen level falls to 17%, the first sign of hypoxia is deterioration to night vision, which is not noticeable until a normal oxygen concentration is restored. Physiologic effects are increased breathing volume and accelerated heartbeat. Between 14-16% physiologic effects are increased breathing volume, accelerated heartbeat, very poor muscular coordination, rapid fatigue, and intermittent respiration. Between 6-10% the effects are nausea, vomiting, inability to perform, and unconsciousness. Less than 6%, spasmodic breathing, convulsive movements, and death in minutes.
Engulfment Hazards
Confined spaces can include engulfment hazards based upon the material that is in a confined space. Engulfment means the surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

Entrapment Hazards
The physical configuration of the confined space could be an entrapment hazard. Entrapment could occur in any space that has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross section.

Fall Hazards
Confined spaces above another work area, such as an attic space could present a fall hazard. In addition to those fall hazards, vertical entry into a confined space could present a fall to the level below, such as entering a manhole.

Fall hazards may also be present outside the confined space when a cover is removed.

Mechanical Hazards
If activation of electrical or mechanical equipment would cause injury, each piece of equipment should be manually isolated to prevent inadvertent activation before workers enter or while they work in a confined space. The interplay of hazards associated with a confined space, such as the potential of flammable vapors or gases being present, and the build-up of static charge due to mechanical cleaning, such as abrasive blasting, all influence the precautions, which must be taken.

To prevent vapor leaks, flashbacks, and other hazards, workers should completely isolate the space. To completely isolate a confined space, the closing of valves is not sufficient. All pipes must be physically disconnected or isolation blanks bolted in place. Other special precautions must be taken in cases where flammable liquids or vapors may re-contaminate the confined space. The pipes blanked or disconnected should be inspected and tested for leakage to check the effectiveness of the procedure. Other areas of concern are steam valves, pressure lines, and chemical transfer pipes. A less apparent hazard is the space referred to as a void, such as double walled vessels, which must be given special consideration in blanking off and inerting.

Electrical Hazards
Electrical hazards in a confined space include existing electrical components, such as electrical wires run through an attic, crawl space, utility room, etc., and those brought in by the workers, such as tools and equipment.

Existing electrical systems in confined spaces should be identified and lock out / tag out should be used to eliminate those hazards. Some of these can be hidden, such as electrical wire run underneath an insulation blanket. It is best to eliminate the hazard by lock out / tag out procedures.

Electrical components brought into any confined space should be inspected prior to entry to make sure they are in good condition. Consideration should also be given to entry into confined spaces with atmospheric hazards. Intrinsically safe tools should be used in these situations.

Thermal Effect Hazards
Four factors influence the interchange of heat between people and their environment. They are: (1) air temperature, (2) air velocity, (3) moisture contained in the air, and (4) radiant heat. Because of the nature and design of most confined spaces, moisture content and radiant heat are difficult to control. As the body temperature rises progressively, workers will continue to function until the body temperature reaches approximately 102°F. When this body temperature is exceeded, the workers are less efficient, and are prone to heat exhaustion, heat cramps, or heat stroke. In a cold environment, certain physiologic mechanisms come into play, which tend to limit heat loss and increase heat production. The most severe strain in cold conditions is chilling of the extremities so that activity is restricted. Special precautions must be taken in cold environments to prevent frostbite, trench foot, and general hypothermia.

Protective insulated clothing for both hot and cold environments will add additional bulk to the worker and must be considered in allowing for movement in the confined space and exit time. Therefore, air temperature of the environment becomes an important consideration when evaluating working conditions in confined spaces.

**Noise & Vibration Hazards**

Noise problems are usually intensified in confined spaces because the interior tends to cause sound to reverberate and thus expose the worker to higher sound levels than those found in an open environment. This intensified noise increases the risk of hearing damage to workers, which could result in temporary or permanent loss of hearing. Noise in a confined space, which may not be intense enough to cause hearing damage, may still disrupt verbal communication with the emergency standby personnel on the exterior of the confined space. If the workers inside are not able to hear commands or danger signals due to excessive noise, the probability of severe accidents can increase.

Whole body vibration may affect multiple body parts and organs depending upon the vibration characteristics. Segmental vibration, unlike whole body vibration, appears to be more localized in creating injury to the fingers and hands of workers using tools, such as pneumatic hammers, rotary grinders or other hand tools which cause vibration.

**Other Hazards**

Some physical hazards cannot be eliminated because of the nature of the confined space or the work to be performed. These hazards include such items as scaffolding, surface residues, and structural hazards. The use of scaffolding in confined spaces has contributed to many accidents caused by workers or materials falling, improper use of guardrails, and lack of maintenance to insure worker safety. The choice of material used for scaffolding depends upon the type of work to be performed, the calculated weight to be supported and the surface on which the scaffolding is placed and the substance previously stored in the confined space.

Surface residues in confined spaces can increase the already hazardous conditions of electrical shock, reaction of incompatible materials, liberation of toxic substances, and bodily injury due to slips and falls. Without protective clothing, additional hazards to health may arise due to surface residues.

Structural hazards within a confined space such as baffles in horizontal tanks, trays in vertical towers, bends in tunnels, overhead structural members or scaffolding installed for maintenance constitute physical hazards, which are exacerbated by the physical surroundings. In dealing with structural hazards, workers must review and enforce safety precautions to assure safety.
APPENDIX A: CONFINED SPACE EVALUATION FORM

This form must be filled out by the competent person for each confined space that workers will enter.

<table>
<thead>
<tr>
<th>Jobsite Location</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confined Space Description</td>
<td>Time</td>
</tr>
</tbody>
</table>

**Atmospheric Monitoring Results**

<table>
<thead>
<tr>
<th>Oxygen %</th>
<th>Explosive / Flammability % LEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxic (Carbon Monoxide) PPM</td>
<td>Toxic (Hydrogen Sulfide) PPM</td>
</tr>
</tbody>
</table>

**Permit Required Hazards**

<table>
<thead>
<tr>
<th>Does this confined space contain any atmospheric hazards?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does this confined space contain any material that could engulf the entrant?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Is this confined space configured in such a manner that could cause entrapment?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Are there any other serious safety or health hazards in the space or potential introduced by the work operations?</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

If yes to any of the questions above, please describe the hazard:

**Classification of Confined Space**

<table>
<thead>
<tr>
<th>Non-Permit Required</th>
<th>Permit Required</th>
</tr>
</thead>
</table>

If non-permit required, please follow procedures for Non Permit Confined Space Entry, If permit required, please continue this evaluation form.

**Reclassification of Permit Required Confined Space**

<table>
<thead>
<tr>
<th>If classified as a permit required space, can all hazards (other than atmospheric) be completely eliminated without entry into the space?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

If the answer is yes, please describe methods of hazard elimination use to reclassify this space as Non-Permit:

**Alternative Confined Space Procedures**

<table>
<thead>
<tr>
<th>If classified as a permit required space, with only atmospheric hazards, can the atmospheric hazards be completely eliminated by use of constant ventilation?</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

If the answer is yes, please follow alternative entry procedures.

**FINAL CLASSIFICATION OF CONFINED SPACE**

<table>
<thead>
<tr>
<th>Non Permit Space</th>
<th>Permit Required Space</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reclassified Space</td>
<td>Alternative Procedures Space</td>
</tr>
</tbody>
</table>

Evaluation completed and authorized by: ___________________________ Date: ___________________________
### APPENDIX B: CONFINED SPACE ENTRY PERMIT

This form must be filled out by the entry supervisor for each permit required confined space prior to worker entry.

<table>
<thead>
<tr>
<th>Jobsite Location</th>
<th>Date/Time Issued</th>
</tr>
</thead>
<tbody>
<tr>
<td>Confined Space Description</td>
<td>Date/Time Expires</td>
</tr>
<tr>
<td>Worker to be performed</td>
<td>Entry Supervisor</td>
</tr>
</tbody>
</table>

#### Posting

<table>
<thead>
<tr>
<th>Permit Required Confined Space Sign Posted</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

#### Initial Atmospheric Monitoring Results

<table>
<thead>
<tr>
<th>Oxygen %</th>
<th>Explosive / Flammability % LEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxic (Carbon Monoxide) PPM</td>
<td>Toxic (Hydrogen Sulfide) PPM</td>
</tr>
<tr>
<td>Signature of Tester</td>
<td>Date/Time</td>
</tr>
</tbody>
</table>

#### Isolation/Ventilation

<table>
<thead>
<tr>
<th>Isolation of hazards (source isolation, lock out tag out, disconnection, etc.)</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventilation: Natural Ventilation</td>
<td>Ventilation: Mechanical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
<td></td>
</tr>
</tbody>
</table>

#### Atmospheric Monitoring Results after Isolation/Ventilation

<table>
<thead>
<tr>
<th>Oxygen % (19.5% to 23.5%)</th>
<th>Explosive / Flammability % LEL (less than 10% LEL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxic (Carbon Monoxide) PPM (less than 35)</td>
<td>Toxic (Hydrogen Sulfide) PPM (less than 10)</td>
</tr>
<tr>
<td>Signature of Tester</td>
<td>Date/Time</td>
</tr>
</tbody>
</table>

#### Communication Procedures


#### Emergency Rescue Procedures


#### Equipment

<table>
<thead>
<tr>
<th>4 Gas Monitor (Tested/Calibrated)</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
<th>Ventilation Equipment</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non Entry Rescue Equipment</td>
<td>Powered Communications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCBA’s for Rescue</td>
<td>Thermal Equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protective Clothing</td>
<td>Other:</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Description of Equipment:
Training

Have all workers been trained for their specified task? Is the training current? (Entry is not allowed if the answer is NO)  

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
</table>

Attendant

<table>
<thead>
<tr>
<th>Print Name</th>
<th>Signature</th>
</tr>
</thead>
</table>

Entry Log

The entry supervisor will hold a pre-entry briefing with all attendants and entrants. Upon completion of the pre-entry briefing, each entrant will print and sign their name below. Prior to entry, each entrant will time stamp and initial entry. Upon exit, each entrant will time stamp and initial exit.

<table>
<thead>
<tr>
<th>Print Name</th>
<th>Signature</th>
<th>Time of Entry</th>
<th>Initials</th>
<th>Time of Exit</th>
<th>Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

Continuous Atmospheric Monitoring Results  (Document every 30 minutes, use additional sheets as necessary)

<table>
<thead>
<tr>
<th>Oxygen % (19.5% to 23.5%)</th>
<th>Explosive / Flammability % LEL (less than 10% LEL)</th>
<th>Signature of Tester</th>
<th>Date/Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toxic (Carbon Monoxide) PPM (less than 35)</td>
<td>Toxic (Hydrogen Sulfide) PPM (less than 10)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<td></td>
<td></td>
</tr>
</tbody>
</table>

Permit completed and authorized by: ____________________________ Date/Time: __________________________
(Entry Supervisor/Competent Person)

Permit canceled by: ____________________________ Date/Time: __________________________
(Entry Supervisor/Competent Person)

Once permit is canceled, it must be returned to office and kept on file for 12 months.
APPENDIX C: CONFINED SPACE SIGN

DANGER
PERMIT REQUIRED
CONFINED SPACE
DO NOT ENTER

PELIGRO
PERMISO REQUERIDO
ESPACIO CONFINADO
NO ENTRAR
APPENDIX D: DECISION FLOW CHART

Is the space a confined space?

- **Y**
  - Test the Atmosphere with a 4-gas monitor. Are there any atmospheric hazards?

  - **Y**
    - Can the Atmospheric hazards be eliminated with constant mechanical ventilation?
    - **Y**
      - Follow the Alternative Confined Space Entry Procedures
    - **N**
      - Follow the Permit Required Confined Space Entry Procedures
  - **N**
    - Can these hazards be completely eliminated without entry into the confined space? (For example, LOTO for electrical hazards.)
    - **Y**
      - Follow the Reclassified Confined Space Entry Procedures
    - **N**
      - Follow the Non-Permit Required Confined Space Entry Procedures

- **N**
  - Are there any actual or potential entrapment or engulfment hazards?
    - **N**
      - Are there any electrical, mechanical, heat stress or other serious safety or health hazards associated with working in the space?
        - **N**
          - Follow the Permit Required Confined Space Entry Procedures
        - **Y**
          - Follow the Reclassified Confined Space Entry Procedures
    - **Y**
      - Follow the Permit Required Confined Space Entry Procedures

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