Confined Space Manual

Date of last revision: September, 2009
**Purpose**

This manual and its procedures are intended to establish and implement a written comprehensive permit-required confined space safety and health program to ensure Clemson University’s procedures are prudent and that regulatory standards are met. Communicating and documenting of all permit-required confined space work is essential and necessary to prevent serious injury, death, and property damage.

**Policy**

Clemson University will fully comply with all OSHA Standards on Permit-Required Confined Space.

All supervisory personnel will ensure all Clemson University employees will follow all established procedures applicable to their job tasks in relation to our permit-required confined space safety and health program.

Any person, (regardless of agency) working for the University (i.e. outside company or contractor) shall follow an OSHA compliant confined space policy.

Whenever outside companies or contractors are working with university employees, the confined space policy used shall not be less stringent than the university policy.

**Scope**

All exposed employees working in and around identified permit required confined spaces are covered by this manual, and shall be properly informed and trained in all procedures of our permit-required confined space safety and health program.

University Facilities, Planning, Maintenance, Construction Services, Telecommunications and all other involved Clemson University supervisors will properly inform all contractors/visitors on our permit-required confined space safety and health program procedures prior to any work in and around permit-required confined spaces.
Definitions

**Attendant:** The person who is assigned and responsible for monitoring and overseeing a confined space process or operation. The attendant is also required to provide support services for the confined space activity, provided he/she does not leave the site. The attendant must be able to react to any situation, including an emergency, as required. An attendant is required for both permit & non-permit required confined spaces entries.

**Authorized Entrant:** An employee who is authorized by the employer to enter a permit space.

**Blinding/Blanking:** The insertion of a barrier (obstructing device) across the open end of a pipe which enters or exits a confined space, and securing such a barrier so as to prevent leakage of material into the confined space.

**Confined Space:** An area which has the following (3) characteristics:
1. Its primary function is something other than human occupancy;
2. Has restricted entry and exit; and
3. Is large enough and so configured that an employee can bodily enter and perform assigned work.

**Non-Permit Required Confined Space:** A space which by configuration, meets the definition of a confined space but which after evaluation is found to have no potential for creation of a hazardous atmosphere or has had such hazardous conditions eliminated by engineering controls.

**Permit Required Confined Space (PRCS):** A confined space which has been evaluated and found to have actual or potential hazards that pose a threat to the health and safety of the workers and requires a written authorization to enter. A Permit Required Confined Space is one that has one or more of the following characteristics:
- Contains or has a known potential to contain a hazardous atmosphere (gas, heat, toxic vapor, oxygen deficiency or enrichment).
- Contains a material with the potential for engulfment or drowning of an entrant (particulate matter, liquid (including, but not limited to water).
- Has internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or a floor which slopes downward and tapers to a smaller cross section.
- Contains any other recognized serious safety and health hazard, including but not limited to: high water level, steam leak that cannot be isolated from another point.

**Double Block and Bleed:** A means by which a line, duct or pipe is shut down by physically closing two in-line valves on a piping system, and then opening a vent between them to release excess pressure within the closed lines.

**Engulfment:** The capturing and/or drowning of a person in a particulate matter or liquid.

**Entry:** Whenever a person places any portion of their head, face or any portion of the body into the opening of a confined space, it is considered to be entry.

**Hazard Evaluation:** The assessment of a confined space to determine the potential hazards within.

**Hazardous Atmosphere:** An atmosphere, outside or within the confined space that could pose the risk of injury or death to the occupants because of flammability, explosivity, toxicity or oxygen deficiency (<19.5%) or enrichment (>23.5%).

**Hot Work:** The performance of any work that could or will produce arcs, flames, heat, sparks or other sources of ignition (i.e., cutting, brazing, welding, soldering etc.).

**Isolation:** Physically disconnecting or interrupting the flow of service through a confined space. This would include piping for steam, water and gas, lines for telephone, electricity and other energy sources.

**Lock Out/Tag Out (LO/TO):** In accordance with requirements of the OSHA Lock Out/Tag Out Program and the University Policy, lock out/tag out shall mean the placement of a lock and tag on the energy isolating device. The energy isolating device shall not be operated, until all lock out/tag out devices have been removed by installer of said locks or tags.
Energy Isolating Device: Is any device that prevents the transmission or release of energy. For example: A circuit breaker, disconnect switch, a slide gate, a manually operated switch, a line valve, blocks, and other similar devices with a visible indication of the position of the device. Push buttons, selector switches and other circuit controlling type devices are not energy isolating devices.

Qualified Person: A person who has appropriate education, training and experience to work in and around confined spaces, and is experienced and knowledgeable in the various operations of confined space work. This includes the ability to properly evaluate the hazards that may or may not be involved, and the ability to act/rectify any problem/hazard found.

Toxic Atmosphere: An atmosphere (in or around) a confined space that contains a concentration of a substance (solid, liquid, or gas) above the published or otherwise known safe levels.
Identification/Recognition

All campus locations which are considered to be permit-required confined spaces shall be identified as specifically as possible, including area or room, the building and its specific address.

Entry into these spaces (including, but not limited to placing of head or face into the opening of a confined space) shall be subject to the provisions of this program.

Signage shall be posted near each permit required confined space. The signs shall read:

DANGER
Confined Space
DO NOT ENTER
without a permit

Permit-Required Confined Spaces that cannot be labeled because of adverse area or weather conditions shall be identified in this manual.

Known permit-required confined spaces at Clemson University:
- Manholes
- Tunnels
- Steam Plant: boilers, smoke stacks, bag house, coal elevators
- Amphitheater—under floor
- HVAC ducts
- Water cooling towers
- Tanks
- Silos
- Waste Treatment Plant: bar screen pits, raw sewage sump pumps, clarifiers (open top or closed top tanks), digester tanks, belt press sump pumps

All sewers shall be considered as permit-required confined spaces as they cannot be completely isolated, and the atmosphere can suddenly change, without adequate warning, placing all Entrants in danger.

A sewer can be entered if all requirements of this Confined Space Manual are followed, and:
- The atmosphere is not hazardous before entry and is not expected to become hazardous.
- There is a retrieval system set up.
- The atmosphere is verified and monitored and a gas sensor is worn by the entrant.
- Some kind of emergency air supply, such as an escape bottle, is utilized by the entrant.

Underground vaults – including, but not limited to, telecommunications vaults – shall be considered as permit-required confined spaces, unless all internal hazards can be eliminated and appropriate ventilation maintained before entry.

Electrical Pits shall be considered as permit-required confined spaces, unless all internal hazards can be eliminated before entry.

Steam Pits shall be considered permit-required confined spaces, unless all internal hazards can be eliminated, before entry.
If entrance into an identified permit-required confined space would never be necessary, access to the space will be prohibited. Appropriate warning signage shall be posted, or some other means to prevent access shall be provided.
Confined Space Survey

Each confined space shall be surveyed for hazards or potential hazards within. The survey shall be done by a team of qualified individuals from University Facilities, EHS, and the affected department who shall decide which spaces are to be designated Permit-Required Confined Space or Non-Permit Required Confined Space.

If identified as a Permit-Required Confined Space the confined space shall be labeled with appropriate signage, or shall be otherwise indicated as referenced above.

Hazard Identification: Hazards shall be identified and documented for each confined space. The identification shall include:

1. Location (exact) of confined space.
2. Past or current uses of the confined space which may adversely affect the atmosphere of the confined space.
3. Physical characteristics.

Existing or potential hazards in the confined space:

1. Oxygen deficiency or enrichment.
2. Flammable or explosive atmosphere.
3. Toxic Atmosphere.
4. Biological hazards within the confined space.
5. Mechanical hazards (i.e., augers, ribbon blenders, and piping hazards).
6. Other health and safety related concerns

Hazard Re-Evaluation: In certain circumstances (i.e., downgrading from a permit-required to a non-permit required confined space) a hazard re-evaluation will be performed. Depending on the work being performed within a non-permit required confined space (i.e., welding/cutting) a confined space will need to be re-evaluated.

When the need for such re-evaluation is determined, a team of qualified individuals from University Facilities, EHS, and the affected department shall conduct the hazard evaluation and hazard identification process.

When evaluating or re-evaluating a confined space atmosphere, the following shall be incorporated:

1. All sources of ignition shall be kept to a minimum of twenty-five (25) feet away from the opening, until the space has been tested and found to be free of explosive/flammable gases.
2. Any manufacturer’s recommendations regarding pre-testing and calibration of the equipment to be used shall be followed.
3. Testing shall be done at the opening or cover, first, prior to opening. If no dangerous condition is identified or detected, the cover or door can be partially opened (use caution to avoid sparks).
4. Testing/continuous evaluation shall be performed, first just inside the opening and then into other areas of the confined space, unless a dangerous condition has been identified.

Responsibilities

Department’s Responsibilities

The department performing confined space entry operations shall designate persons who are to have active roles such as Entry Supervisor, Attendant and Entrant.
Each person shall be provided the training required to perform the roles he is designated to perform.

The Department shall certify that the required training has been accomplished. The certification shall contain each employee’s name, the signatures of the trainers and the dates of training. The certification shall be available for inspection.

**Attendant’s Responsibility**

One Attendant shall be stationed outside each Confined Space (permit required). A Qualified Person shall determine the number of attendants that are required for any confined space entry. It shall be the Qualified Person’s responsibility to determine the manpower requirement(s) of the project: for example, more than one attendant may be required if there is more than one entry to the confined space, and the distance between the different entries is greater than 20 feet.

Attendants and the **Entrants** within the confined space shall remain in constant two-way communication (i.e., Person to Person, radio, cellular phone).

Attendants shall also:
- Assist the **Entrants** entering the confined space, but shall not enter the confined space themselves.
- Direct **Entrants** to exit the confined space when any irregularities are observed.
- Initiate evacuation and emergency procedures: communications with University **Fire Department and Emergency Medical Staff** must be **readily available** at all times.
- Set up tripod or **other rescue equipment**.
- Request as needed any appropriate personnel:
  - Fire and Ambulance
  - Environmental Health and Safety
  - Confined Space Emergency Response Team (Clemson University Fire Department—Emergency Medical Services)
  - University Police
- Monitor the confined space for any changes or conditions that could adversely affect the entry; the attendant must know how to use the necessary equipment and how to interpret the information provided.
- Remain at the entry point of the confined space, unless relieved by another attendant.

Should unauthorized person(s) approach or enter a confined space while entry is underway the attendant shall:
- Warn the unauthorized person(s) that they must stay out of the permit space.
- Request unauthorized person(s) who have entered the permit space to exit immediately.
- Inform authorized entrants and supervisors when any unauthorized persons have entered the Confined Space.
- Contact University Police to remove the unauthorized person(s) if the attendant deems it necessary.
- If notified that an unauthorized person(s) have entered a confined space, University Police shall ensure that the Fire Department has been notified and responds to the scene.
- Upon arrival, University Police shall attempt to communicate with the unauthorized person(s) and request that they exit the confined space immediately.
• If the unauthorized person(s) fail to exit as instructed, all confined space exits shall be secured and an Entry Permit obtained (if one is not on the scene) before entry into the confined space.

• Because of the hazards associated with any confined space entry, a Permit-Required Confined Space Entry Permit shall always be used for entry into a permit-required confined space. Obtain a permit number by contacting Environmental Health and Safety at 656-2583. In an emergency, the permit number may be obtained after the emergency has been resolved.

• Since the unauthorized person(s) may or could be injured, the police officer must be accompanied by at least one fireman who has been trained in confined space rescue.

Upon completion of the work, the Attendant must inspect the confined space to ensure that all employees have exited and all equipment has been removed. All members of the Entry team must sign the Signature Form for Entry to prove that they have exited.

Entrant(s) Responsibility
The Entrant who will be entering the confined space shall make sure that the qualified person has evaluated/inspected the confined space, and that it was determined to be safe for entry.

The Entrant shall make sure, before entry that all potential hazards have been identified and that serious hazards have been isolated. Isolation includes: de-energizing and locking/tagging out exposed electrical equipment; locking/tagging out exposed mechanical equipment; blanking, blinding, misaligning or removing sections of pipes, ducts, or a double block and bleed system.

The occupant shall also make sure, before entry, that all appropriate rescue equipment has been made available at the site. Whenever a worker is required to enter a permit-required confined space:
• A full body harness may be required.
• An attached retrieval line, secured outside the confined space should be utilized, but may not be required to be attached to the Entrant, if the attachment may cause additional harm or hazard to the Entrant.
• Retrieval lines must not be secured to any vehicle.
• Mechanical hoisting equipment, i.e., tripod, retrieval line, and full body harness shall be available to provide for emergency retrieval from permit-required confined space such as a pit or manhole. This equipment may be provided by the Rescue Service; if the Rescue Service does not have the equipment necessary, it is the responsibility of the Department/Contractor entering the Space to have the equipment available on site.

The Entrant/Attendant/Qualified Person shall make sure that the appropriate forced air ventilation equipment and tubing has been positioned properly to provide continuous, forced air to the work area, in any confined space.

The Entrant shall make sure they have the necessary communication equipment for the type of work and communicate with the Attendant as necessary.

The Entrant should be familiar with the use and warnings of all monitoring equipment.

The Entrant should alert the Attendant whenever he/she recognized any warning sign or symptom of exposure to a dangerous situation or he/she detects a prohibited condition; and exit the permit space as quickly as possible whenever:

• An order to evacuate is given by the Attendant or the Entry Supervisor,
• The Entrant recognizes any warning sign or symptom of exposure to a dangerous situation,
• The Entrant detects a prohibited condition, or
• An evacuation alarm is activated.

**Site Supervisor/Project Manager(s) Responsibility:**
The Supervisor/Project Manager for any confined space work shall ensure that the following criteria have been satisfied before work in the confined space is started:

• Make sure that all shops involved or who have responsibility for the confined space being worked on have been notified at least 24 hours in advance.
  - This allows the specific shop(s) to identify any possible hazards that they may be aware of (i.e., asbestos, leaks etc.) before work is initiated.

• Ensure that the necessary equipment has been made available and placed on site before work has begun.

• Ensure that each confined space to be entered shall have been properly assessed by a Qualified Person before entry is permitted.
  - If the Qualified Person finds the confined space unacceptable, the Supervisor/Project Manager shall make sure that no one enters the confined space until corrective measures have been made, and the Qualified Person has then permitted entry.

• Make sure that the Attendants and Entrants have monitoring equipment in the confined space at all times, when necessary and that the Entrant know what to do in case of alarm(s).

• Make sure that the appropriate two-way communication equipment has been made available to the occupant/entrants at all times. The Attendant shall be equipped with communication equipment, in case of emergency.

• Make sure the University Fire and Emergency Medical Staff is made aware of any confined space work so that they are prepared to specifically listen for emergency requests.

• Ensure that the Entrant/Attendant shall have plenty of water and cups at the site should heat and weather conditions warrant.

• Make sure that proper ACGIH work/rest ratio has been implemented for working in a confined space. The ACGIH manual is available through EHS.

• Ensure that all persons who will be working in any confined space shall have adequate safety conditions for confined space entry.

• Ensure that personal protective equipment (PPE) is worn by all personnel when working in and around all confined spaces.

• Not allow entry operations to continue unless EMS is available to respond in the event of an emergency.

• Enforce all appropriate provisions of this program with the assistance of University Facilities, EHS, Fire Department and Emergency Medical Staff, and their respective department heads. Safety Officers from EHS and University Facilities will be monitoring work sites for compliance.
Management (Vice Presidents, Deans, Directors, and Department Heads)
Ensure that procedures and protocol established in this chapter and their specific
departments are followed at all times. Specify departmental procedures where
necessary.

Provide all their affected personnel an opportunity for annual training and review
classes.

Provide required equipment for employee protection, hazardous material detection,
communication, and rescue programs to maintain for constant use.

Ensure the Permit-Required Confined Space Program Annual review is conducted.
This review shall be done annually in August. The review may be conducted by using
the cancelled permits from the preceding 12 months. Revise the program as necessary,
to ensure that employees participating in entry operations are protected from permit
space hazards.

Designate a technical supervisor on staff to thoroughly review the OSHA Standard CFR
1910.146, Permit-Required Confined Space, with all affected employees, contractors,
and vendors.

The designated technical supervisor will assist all affected employees in the following
categories: authorized entrants, attendants, entry supervisors, and rescue and
emergency service personnel.

Coordinate rescue operation functions through our Fire Chief to include practical
exercises in communication and training activities.

Ensure proper communication measures such as two-way radios, telephones, and
posting of emergency numbers, are available and accessible.

Off-campus Directors and supervisory staff will review their possible confined spaces
with Jim Clark (864.656.0792) to determine if they have areas that must comply with the
Permit-Required Confined Space Standard. If they have these areas, they must follow
procedures in this manual, (see CFR 1910.146 - Permit-Required Confined Space
Standard for additional details) and develop their specific procedures in relation to
their community emergency medical services.

Ensure proper completion, documentation, and maintenance of the listed forms.
Fire Chief (Fire Department and Emergency Medical Services)

Main Campus/City of Clemson
Provide emergency response and rescue services to all affected groups involved in work in and around permit-required confined spaces on the Clemson University main campus.

Provide annual training to all Fire Department personnel/ Emergency Medical Technicians on rescue operations for a permit-required confined space program.

Provide training when requested from affected departments involved in working in and around permit-required confined spaces.

Off Campus
It is the responsibility of the Department/Contractor performing the entry to verify that there is a local Rescue Service with confined space rescue capability, and that the Rescue Service is trained and equipped to perform such a rescue.

In the event that the local Rescue Service is incapable or ill equipped to perform a confined space rescue, the Department/Contractor performing the entry must develop and maintain such capability.
Chief Environmental Health and Safety Officer

Develop and implement a comprehensive Permit-Required Confined Space Safety and Health Program.

Serve in a liaison capacity in providing continuous services when requested by affected departments. Services may include training, consultation, supplying vendor lists, audits, surveys, etc.

Conduct an annual review and evaluation of the Permit-Required Confined Space Safety and Health Program.

Conduct respirator fit testing for affected employees in accordance with Clemson University’s Respiratory Protection Program and OSHA Standard 29 CFR 1910.134.
Chief Human Resources Officer
Inform management/supervisory staff of any employees’ special requirements for personal protective equipment, such as disabilities and/or handicaps in relation to our Permit-Required Confined Space Safety and Health Program.

Assist management/supervisory staff in utilizing progressive discipline policies and measures on any employees who fail to comply with Clemson University’s Permit-Required Confined Space Safety and Health Program.
Procedures

Notification
When it has been determined that entry into a permit-required confined space on the main campus will be necessary, the following groups shall be notified:

• University Facilities–Supervisor of the shop doing work.
• Environmental Health and Safety–Colleen Caracciolo at 864.656.2583.
• Boilers (if work is to be performed in the Boilers)–Tony Putnam at 864.656.7300.
• Outside contractor shall notify University Facilities–Supervisor of the shop responsible for the space involved.

A verbal notification of permit-required confined space entry can be made. However, the notification shall be made no less than 24 hours prior to the start of work. A copy of the actual entry permits must then be sent to the appropriate departments for record keeping purposes.

Exception: Emergency evaluations /repairs are acceptable. However, University Facilities must be notified before entering a permit-required confined space, and all entry permit conditions met.

Outside contractors must notify University Facilities before entering a permit-required confined space. This notification allows University Facilities to notify the other necessary shops that may have knowledge of unsafe conditions within the permit-required confined space.

These shop(s) include, but are not limited to:
1. Asbestos
2. Electrical
3. Steam Fitters/Plumbing Shop

Pre-Entry Briefing

Before anyone enters or works in any confined space, attendance at a Pre-Entry Briefing will be documented on a Pre-Job Entry Form. All involved employees must be thoroughly briefed on specific entry including:

• Names and signatures of employees and contractors
• Confined Space Permit number
• Date of the meeting
• Written Entry Plan
• Confined Space Rescue Plan, i.e. description of space and techniques to rescue
• Time frame for the completion of work
• Methods for ventilation, e.g. blowers, fans, act.
• Type of lighting, e.g. low voltage
• Methods for accountability for Entrants, e.g., log sheet
• Methods for isolation, e.g., double-block bleed, removal of spool piece, blind flange
• PPE Requirements, e.g. clothing, respiratory protection, body harness, wristlets
• Review of Confined Space entry Permit and other work permits
• Method of entry and exit of the confined space
• Posting of signs at entrance
• Sounding of alarm, bullhorn, air horn
• Methods of communication, radio, verbal, non-verbal
• Names of personnel to be contacted in the event of an emergency
• Methods for barricading entrances when confined spaces are vacant
• Entry Permit conditions
Atmospheric test results, temperature shall be considered
Safe work procedures
Using the MSDS, and other documents, review, the hazards associated with the substances, and consequences of exposure

Permitting
A Permit-Required Confined Space Entry Permit and a Signature Form for Entry shall always be used for entry into a permit-required confined space. They must be completed prior to any entry into a permit-required confined space, and all entry conditions met. Obtain a permit number by contacting Environmental Health and Safety, 864.656.2583.

The permit specifies certain safety measures and checks which workers must complete before and during entry. It designates the person or persons responsible for the safety measures for confined space work. The permit is an authorization and approval, in writing. It states the location and type of work to be done, certifies that all existing hazards have been evaluated and that necessary protective measures have been taken to ensure the safety of personnel.

The entry supervisor will issue copies of the Permit as described on the Permit and send a copy to the following:
- Department Head (if applicable)
- Environmental Health and Safety
- University Facilities

The Permit must also be posted on the job (in a clear plastic sleeve), and returned to the operating supervisor when the job is completed.

If the Permit remains in effect at the end of the shift or change of work force, the oncoming supervisor must: check the precautions listed, review the activities, and sign the Permit.

The oncoming work force or another entry team and their supervisor must sign the Permit. A testing representative must review and sign the Permit and conduct additional atmospheric testing. The testing representative must sign the Permit each time atmospheric tests are made.

The entry team leader must notify the operating supervisor upon arriving at the area. If the job is delayed for other than normal break or lunch periods, the team leader must notify the operating supervisor of the team’s return to the work area.
Atmospheric Testing

Some gases or vapors are heavier than air and will settle to the bottom of a confined space, while some gases are lighter than air and will rise to the top of a confined space. All areas of a confined space (bottom, middle, and top) must be tested with a calibrated direct-reading instrument to determine what is present.

If testing reveals an oxygen deficiency or the presence of toxic or hazardous gases or vapors, the space must be ventilated and retested before workers enter.

Tests shall be conducted for gases, vapors, and oxygen content no more than 30 minutes prior to entry.

There shall be no detectable gases or vapors in the space.

Any deviation from the normal atmospheric content of 21% oxygen must be investigated and the deficiency corrected before workers enter the confined space.

Continuous or periodic atmospheric testing is required if activity in the confined space will deplete the oxygen (welding, cutting, etc.), work will continue for several hours or more, and/or work shift or work crew changes.

Monitoring of a PRCS must continue as long as there is someone in the confined space. If any confined space is vacated for longer than 30 minutes, the atmosphere of the confined space must be re-evaluated before entry is again permitted.

If isolation of the space is not feasible because the space is too large or is part of a continuous system, (such as a steam line) then entry testing or re-testing shall be performed to the extent possible, before entry into the work area is made.

Acceptable Limits

After evaluation by a qualified person, the atmosphere of the confined space shall be considered within the acceptable limits if the following criteria are met:

• Oxygen–levels are between 19.5-23.5%.
• Flammability–is less than 10% of the Lower Explosive Limit.
• Carbon Monoxide–is less than 35 ppm.
• Hydrogen Sulfide–levels are less than 10 ppm.
• Toxicity–is less than the recognized exposure limits.
• Airborne Dusts–levels less than 10% of the Lower Explosive Level-see NFPA Handbook, 14th edition for particular dusts.

Unsafe Atmosphere/Unacceptable Limits

No employee/contractor shall enter any confined space in which a hazardous atmosphere has been detected.

Whenever testing of the atmosphere by a qualified person indicates that levels of oxygen, flammability, or toxicity are not within acceptable limits, entry shall be prohibited until appropriate controls are implemented or appropriate Personal Protective Equipment (PPE) is provided and used, EMS is on site, and training has been provided.

If hazardous gas (toxic/flammable) or oxygen deficiency/enrichment is discovered, the space can be purged or force ventilated using intrinsically safe equipment (explosion resistant) to eliminate or control atmospheric hazards. Then re-monitor the area.
Procedures
All employees not wearing the proper self-contained breathing apparatus must vacate the confined space immediately if the blower or auxiliary air supply stops or is interrupted for any reason.

If an odor is noticed, all employees must vacate the confined space until an inspection and test are made.

An eyebolt (5,000 lb. capacity) should be attached to the manhole flange, grating beams, or other suitable location at or near the confined space opening for support of a pulley. The pulley would be supplied by the response department/contractor to facilitate rescue.

Unless it will increase the hazard to the Entrant, a safety harness or lifeline will be used when working in confined spaces. If a lifeline is used, it must be equipped with a suitable double-locking snap hook, which will be attached to the D-ring of the safety harness (attached at the center of the Entrant’s back near shoulder level) before the person enters the confined space. The other end of the lifeline must be attached to a mechanical device or fixed point outside the permit space.

A ladder shall be used when entering or leaving confined spaces that involve a drop or climb of more than four (4) feet.

All electrical equipment used in confined spaces is subject to Lock Out / Tag Out. Electric lights must have fully guarded bulbs. The guards shall be grounded. Use vapor-proof cord and light sets and use low voltage cord and light sets if 110-volt equipment would pose shock hazards.

No compressed gas cylinders are allowed in a confined space. All torches and hoses shall be removed when not in use.

If the confined space is equipped with an agitator, fan, or other such mechanical device, make the equipment safe prior to any work beginning in the area.

There must be a designated Attendant outside all confined spaces where employees enter the areas. Contractors should have their own Attendant, but in cases where they do not have one available, they must request assistance (an Attendant) from University Facilities.

Medical and first aid kits must be available at the outside site of a confined space where work is being performed.

Quick and accessible means of communication (telephones, radios, etc.) for contacting our Fire Department/Emergency Medical Technicians must be made available at these sites.

Whenever possible, forced ventilation shall be directed to ventilate the immediate areas where an employee is or will be present within the space and shall continue until the employees have left the space.

Ventilation
If forced ventilation is necessary, and is to be used, the initial and subsequent atmospheric tests of the confined space shall be done with all ventilation equipment shut down for a significant period of time. (This is done to show hazardous and potentially hazardous conditions, should the ventilation system fail.)

After testing and documenting the results with the ventilation shut down, the ventilation system should then be turned back on. (The above is done to ensure that contaminants are not being drawn in to the confined space by the ventilation system, creating its own hazardous condition(s).)
Exceptions:

- Negative air (already permanently installed) can be used in lieu of forced ventilation provided that it does not draw contaminated air into the confined space.
- Air supply for the forced air ventilation must be from a clean source (i.e., not in close proximity to vehicle exhaust), and shall not increase the hazards within the confined space.
- When Air quality (re-testing), shows that the atmosphere remains unsafe or unacceptably for entry, the entry permit shall be revoked and entry prohibited.

The permit can be revoked by: the Attendant, Supervisor, Qualified Personnel, or any Qualified Person within University Facilities or Environmental Health and Safety.

If hazardous gases or oxygen deficiency/enrichment is not indicated after re-testing, the confined space may be entered. This provides that continuous atmospheric monitoring is conducted and that forced ventilation is continuous throughout the work period. If, during any entry, a hazardous atmosphere is detected:

- All Employees Shall Leave the Confined Space IMMEDIATELY, and then notify University Facilities and Environmental Health and Safety.
- The space shall then be evaluated by a Qualified Person to determine how the hazardous atmosphere developed. All necessary steps, including corrective action, continuous forced ventilation and atmospheric monitoring, shall be taken to protect employees prior to re-entry.
- If the source of the contaminant cannot be determined, precautions shall be adequate to deal with the worst possible condition within the confined space.
Personal Protective Equipment

It is understood that Personal Protective Equipment (PPE) must be required when working in and around all confined spaces. Whenever possible, engineering controls (ventilating and removing the contaminants, etc.) and administrative measures (substituting with less hazardous areas and less hazardous products) may be used in lieu of PPE.

All necessary PPE, including but not limited to hard-hats, hand/foot protection and safety eyewear (including appropriate welder’s glasses for all personnel in pits) shall be used. The Qualified Person shall identify the appropriate PPE needed for the intended work. The Supervisor/Project Manager shall be responsible for compliance.
Special Considerations/Hazards

Asbestos
Any potential asbestos problems (friable, mastic, transite etc.) shall be reported immediately to the University Facilities Asbestos Shop. Precautions must be taken to reduce the risk of exposure to the occupant/entrant(s) and the University community.
Contact: Eddie Gilstrap at 864.656.0242 (shop)

Radiological Hazards
Any Radiological Hazards shall be evaluated by the Department of Environmental Health and Safety before entry.
Contact: Larry Addis at 864.656.7615

Chemical Hazards
Any chemical hazards not previously taken into consideration (i.e., you need not call about cleaning solutions), shall be evaluated by the Department of Environmental Health and Safety before entry.
Contact: Naomi Kelly at 864.656.2583

Electrical/Energy Hazards
All energy sources, (i.e., electric, hydraulic, mechanical and/or pneumatic), which are or could be hazardous to those entering a confined space, shall be secured/disconnected, etc., before personnel enter a confined space.

The University Facilities/Housing Electrical Shop (depending on area of work), must be contacted for assistance prior to starting work.

Lock Out/Tag Out
LO/TO procedures must be incorporated at all times to ensure the health and safety of all personnel. In accordance with the different isolation procedures, a means of reducing hazards for health and safety reasons must be followed.

If complete isolation is not possible, provisions shall be made to reduce any hazard before work in a confined space is initiated. After locking or tagging out energy sources, the Supervisor/Project Manager or Entrant (whoever locks or tags out an energy source) shall make sure that all potential stored energy has been relieved and that if necessary, blocked or otherwise secured for additional safety.

Fire
Open flames, welding, cutting, soldering, brazing, general purpose electrical equipment, light sources, smoking material, or other spark or flame producing agents or devices other than explosive-resistant equipment, shall not be used in any confined space, until it has been demonstrated by approved test that a flammable vapor does not exist.

Appropriate and sufficient portable fire extinguishers shall be readily available, and in good working order at the site.

A FIREWATCH shall be provided as required by the permit, for the safety of the entrants and the University. The person, (i.e., second occupant in the confined space), may be utilized for this purpose, provided their full attention is on the fire and safety issues.

Hot Work
When Hot Work (i.e., welding, cutting, soldering or brazing etc.) is required in a confined space, adequate fresh air ventilation of at least 2,000 cubic feet per minute per welder shall be
provided. A Hot Work Permit must be completed before work in a confined space has begun. Contact the Fire Department at 656-2323 whenever hot work is done in an occupied building.

Outside contractors must obtain the necessary Hot Work Permit from the University’s Fire Marshall or University Facilities.

Environmental Health and Safety shall be contacted if the 2,000-cfm rate per welder can not be obtained or maintained. Local exhaust, airline respirator, or self-contained breathing apparatus (SCBA) may be necessary. Respirators and Self-Contained Breathing Apparatus (SCBA) require special training and other requirements. For assistance and information contact Environmental Health and Safety at 864.656.2583.

Hot Work can only be performed in a confined space after the Qualified Person has given permission.

Any Hot Work performed in close proximity to other openings or stationary combustible material shall be properly covered with a non-combustible cover, or some other similar, protective means.

A portable Fire Extinguisher (Dry Chemical), with a rating of not less than a 4-A: 60-BC shall be kept at the Hot Work location, and the Entrants and Attendants shall be familiar with its use.

Torch valves shall be closed and fuel-gas and oxygen supply to the torch positively shut-off at a point outside the confined space whenever the torch is not being used for a substantial period of time.

No compressed gas cylinders are allowed in a confined space. All torches and hoses shall be removed when not in use.
General Safety

Ground Fault Circuit Interrupters (GFCI)
All portable electrical devices including, but not limited to, power tools, lightning, generators, etc. shall be properly grounded and protected by approved GFCI’s.

Guarding of Confined Spaces
When covers of manholes, vaults or other confined space accesses are opened, the opening shall be guarded by either or both:
1. A standard railing.
2. A hole cover of standard strength and construction.

The temporary cover shall completely cap the opening and be able to withstand any weight that may be applied to it.

The guarding must also protect the Entrants working in the manhole or other confined space from falling objects that may enter the hole/opening.

Appropriate cones with scotch-lite and other warning devices must also be placed near the work area to warn of the work being done and/or the type of hazard involved.

Signs, barriers or other necessary measures shall be taken to prevent unauthorized access to the confined space work area.

Lighting
Adequate lighting shall be used to safely accomplish the work; as a rule of thumb, a minimum of 60 Lumens is required.

Protection from Vehicular Traffic
In addition and in conjunction with the guarding section, listed above; when work is required within roadways or when employees and/or outside contractors are exposed to vehicular traffic, the University Police Department shall be notified. Proper measures must be taken to divert traffic away from the work area/opening. High visibility and reflective warning vests and garments shall also be used.

Training
All authorized Entrants who enter or work in a confined space or serve as Entry Supervisors, rescue personnel, and Attendants will receive safety and health training to minimize the occurrence of accidents and adverse health conditions. EHS will conduct this training on a regular basis. Employees must successfully complete the training before work in confined spaces is allowed. This training requirement may be fulfilled by successful completion of the EHS World Wide Web based training course.

The training will include at a minimum:
• Clemson University’s Permit-Required Confined Space Safety and Health Program
• Entry and Exit Procedures
• Respirators
• Emergency Procedures
• Lockout Procedures
• Permit Entry System
• Safety and Protective Equipment
• Work Practices in Permit-Required Confined Spaces
• Hazard Recognition
• Atmospheric Sampling and Testing.

Rescue Operations
The Chief of Clemson University Fire Department, or his designee, is the Incident Commander for all confined space rescue operations. The Clemson University Fire Department maintains its own procedures for rescue operations.

Contractors
Contractors, sub-contractors, and all other employers working in a Clemson University confined space are under the control and jurisdiction of the responsible department and University Facilities.

The responsible supervisor must provide the contractor information on:
• Confined Space Hazards
• Clemson University’s Permit-Required Confined Space Program
• Any Other Workplace Hazards
• Safety Rules
Recordkeeping
All Clemson University department managers/supervisors who have employees/contractors entering confined spaces will maintain copies (logs) of the following records for five (5) years:
- Permit-Required Confined Space Entry Permit Forms
- Signature Forms For Entry
- Employee training documentation

Review the Permit Space Program
Each department shall review its permit space program, annually, using the cancelled permits generated in the preceding 12 months. The Department may revise the program as necessary, to ensure that employees participating in entry operations are protected from permit space hazards.

NOTE: All Departments on main campus may perform a single annual review in August of each year covering all confined space entries performed during a 12-month period, if no entry is performed during a 12-month period, no review is necessary.
Forms
Permit forms must be completed before any Permit-Required Confined Space Entry is conducted. Each person who enters or leaves a confined space must sign and record the time on entry form. If a person leaves through an opening other than the one where the Attendant is stationed, that person must immediately report to the Attendant and sign the entry form. Each employee must also initial the entry form to confirm that the Pre-Entry Briefing has been conducted. See sample permit form on the EHS webpage at http://ehs.clemson.edu/.
Signature Form for Entry into a Permit-Required Confined Space

Permit-Required Confined Space Permit #: _________________________________
Date of Entry: __________________________
Qualified Person in charge of entry: _______________________________________

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