



Confined Space – Grain Bins

Modified from Main Campus Confined Space Manual originally created September 2011

PURPOSE

This procedure is intended to establish and implement a written non-permit required confined space safety program to ensure Clemson University's Pee Dee Research and Education Center (PDREC) meets regulatory standards. Communicating and documenting all confined space work is essential and necessary to prevent serious injury, death, and property damage.

POLICY

PDREC will fully comply with all OSHA Standards on Confined Spaces.

All supervisory personnel will ensure all PDREC employees follow the established procedures applicable to their job tasks in relation to our confined space safety program.

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

No PDREC employee is ever permitted to enter a permit-required confined space. All entry to permit-required confined spaces shall be entered by hired contractors.

SCOPE

All exposed employees working in and around identified confined spaces are covered by this procedure and shall be properly informed and trained in all procedures of our confined space safety program.

Clemson's Pee Dee Research and Education Center will properly inform all contractors/visitors on our confined space safety program procedures prior to any work in and around 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 space entries.

Authorized Entrant: An employee who is authorized by the employer to enter a permit space. Entrants are involved in both permit and non-permit required confined space entries.

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 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:

- a. Contains or has a known potential to contain a hazardous atmosphere (gas, heat, toxic vapor, oxygen deficiency or enrichment).
- b. Contains a material with the potential for engulfment or drowning of an entrant (particulate matter, liquid (including, but not limited to water).
- c. 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.
- d. 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 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.

CONFINED SPACE SURVEY

A survey of all confined spaces for Pee Dee was conducted 6/15/2023. There were 4 spaces identified which are:

- 1) Grain bin #1
- 2) Grain bin #2
- 3) Grain bin #3
- 4) Fertilizer tank #4.



Hazard Identification: Hazard were identified and documented for each confined space. The identification showed:

1. Location (exact) of confined space. Each of the grains bins and the fertilizer tank are located at Pee Dee Research and Education Center at 2200 Pocket Rd, Florence, SC 29506. A labeled map is attached in the appendix of this procedure.
 - Grain bin #1: Located beside the front compound and field 23 at coordinates 34°17'34.7136" N, 79°44'22.3224" W.
 - Grain bin #2: Located beside the front compound and field 23 at coordinates 34°17'35.0628" N, 79°44'22.7868" W.
 - Grain bin #3: Located beside the front compound and field 23 at coordinates 34°17'35.286" N, 79°44'22.992" W.
 - Fertilizer tank #4: Located in the front compound at coordinates 34°17'37.9032" N, 79°44'15.1008" W.
2. Grain storage may result in fermentation which may remove oxygen from the atmosphere.
3. Physical characteristics include electric auger at floor.
4. Electrical dryer with gas heater at outside base.

Hazard Re-Evaluation: 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. If re-evaluation determines a non-permit required confined space becomes a permit required confined space, entry will be prohibited by employees at PDREC.

When the need for such re-evaluation is determined, the PDREC Environmental Health Manager and 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.

The Department performing confined space entry shall notify the Environmental Health Manager of entry plans at least 5 business days beforehand.

Attendant's Responsibility

One Attendant shall be stationed outside each Confined Space. 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.

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 local 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:
 - a. Fire and Ambulance – Palmetto Rural Fire Department
 - b. Environmental Health Manager
 - c. Confined Space Emergency Response Team (Palmetto Rural Fire Department)
 - d. Police – Darlington County Sheriff's Office



- 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.

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 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 recognizes any warning signs or symptoms 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.

Entry Supervisor Responsibility:

The Entry Supervisor 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 departments 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 department(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 Entrants 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 local 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.
- 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 the Environmental Health Manager, Fire Department and Emergency Medical Services,



and their respective department heads. The Environmental Health Manager will be monitoring work sites for compliance.

Management (Directors and Department Heads)

Ensure that procedures and protocols established in this document and their specific departments are always followed. Specify departmental procedures where necessary.

Provide all their affected personnel with 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 Confined Space Program Annual review is conducted. This review shall be done annually. 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 the Environmental Health Manager to thoroughly review the OSHA Standard CFR 1910.146 with all affected employees, contractors, and vendors.

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

Ensure proper completion, documentation, and maintenance of the listed forms.

Fire Department and Emergency Medical Services

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.

Environmental Health Manager

Develop and implement a comprehensive Confined Space Safety Program.

Assist all affected employees in the following categories: authorized entrants, attendants, entry supervisors, and rescue and emergency service personnel.

Provide training to employees on the role they have been designated to perform when entering confined spaces.

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 and should be kept on record by the Department and the Environmental Health Manager.



The certification shall be available for inspection.

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

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 Confined Space Program.

Organize respirator fit testing with Clemson University's Occupational and Environmental Safety for affected employees in accordance with Clemson University's Respiratory Protection Program and OSHA Standard 29 CFR 1910.134.

PROCEDURES FOR NON-PERMIT REQUIRED CONFINED SPACE

At the Pee Dee Research and Education Center grain bin entry when they are empty is considered a non-permit required confined space because the engulfment hazard and atmospheric hazards are diminished. Entry into a grain bin, even when empty, is only done when necessary.

Notification

When it is determined that entry to the confined space is necessary, the Environmental Health Manager should be notified.

Verbal notification should be given at least 24 hours before the work begins if the Environmental Health Manager is not needed to assist. If the Environmental Health Manager needs to act as an Attendant, then written or verbal notification is needed at least 5 business days prior to entry.

Atmospheric Testing

Testing of the air inside the confined space must be done before entry to ensure there are no atmospheric hazards.

If testing reveals an oxygen deficiency or the presence of toxic or hazardous gases or vapors, entry into the space will be considered a permit-required confined space. At Pee Dee REC, no employee shall entry a permit-required confined space.

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.

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.

Lock Out/Tag Out

LO/TO procedures must be incorporated at all times to ensure the health and safety of all personnel.

When entering the grain bins for cleaning purposes at PDREC, the main electric box that provides power to all three grain bins will be locked out and tagged out to ensure the augers do not turn on while there are Entrants inside. This box is labeled.

After locking or tagging out energy sources, the Entry Supervisor or Entrant (whoever locks or tags out an energy source) shall make sure that all potential stored energy has been relieved and if necessary, blocked or otherwise secured for additional safety.

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. The Pre-Job Entry Form is attached to this manual in the appendix.

All involved employees must be thoroughly briefed on specific entry including:

- Names and signatures of employees
- Date of the meeting
- Written Entry Plan
- Time frame for the completion of work
- Methods for ventilation, e.g. blowers, fans
- 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



- Method of entry and exit of the confined space
- 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
- Atmospheric test results, temperature shall be considered
- Safe work procedures

Procedures

All employees should be wearing a dust mask to protect from residual grain dust before entering the space.

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

When entering the grain bins for cleaning, entry should only be made through the ground level hatch.

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.

There must be a designated Attendant outside all confined spaces where employees enter the areas.

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 the 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.



PROCEDURES FOR PERMIT-REQUIRED CONFINED SPACE

Pee Dee REC employees are never permitted to enter a permit-required confined space. If entry is required, a contractor will be contacted to perform entry. To ensure contractors are entering a permit-required confined space safely and accordance to OSHA standards, the Clemson University Facilities Confined Space/Permit-Required Confined Space Procedure can be used: [Confined Space Permit Required.pdf \(clemson.edu\)](#).

The permit-required confined spaces at Pee Dee REC are:

1. Grain bins 1, 2 and 3 when they contain grain.
2. Fertilizer tank #4.

PERSONAL PROTECTIVE EQUIPMENT

When entering grain bins at Pee Dee REC, dust masks must be worn for PPE, at a minimum. Additional PPE must be decided by a qualified person, when deemed necessary. The Supervisor/Project Manager shall be responsible for compliance.

TRAINING

All authorized Entrants who enter or work in a confined space or serve as Entry Supervisors and Attendants will receive safety training to minimize the occurrence of accidents and adverse health conditions. The Environmental Health Manager will conduct this training on a regular basis. Employees must successfully complete the training before work in confined spaces is allowed.

Training will be given before confined space work begins. Training does not need to be given more than once annually, unless an incident occurs.

RECORDKEEPING

Pee Dee REC will maintain copies of the following records for five (5) years:

- Employee training documentation
- Pre-Entry Form



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SAFETY PROCEDURES

REVIEW OF THE PERMIT SPACE PROGRAM

PDREC shall review its permit space program annually. PDREC may revise the program as necessary, to ensure that employees participating in entry operations are protected from permit space hazards.

NOTE: If no entry is performed during a 12-month period, no review is necessary.

Revision History

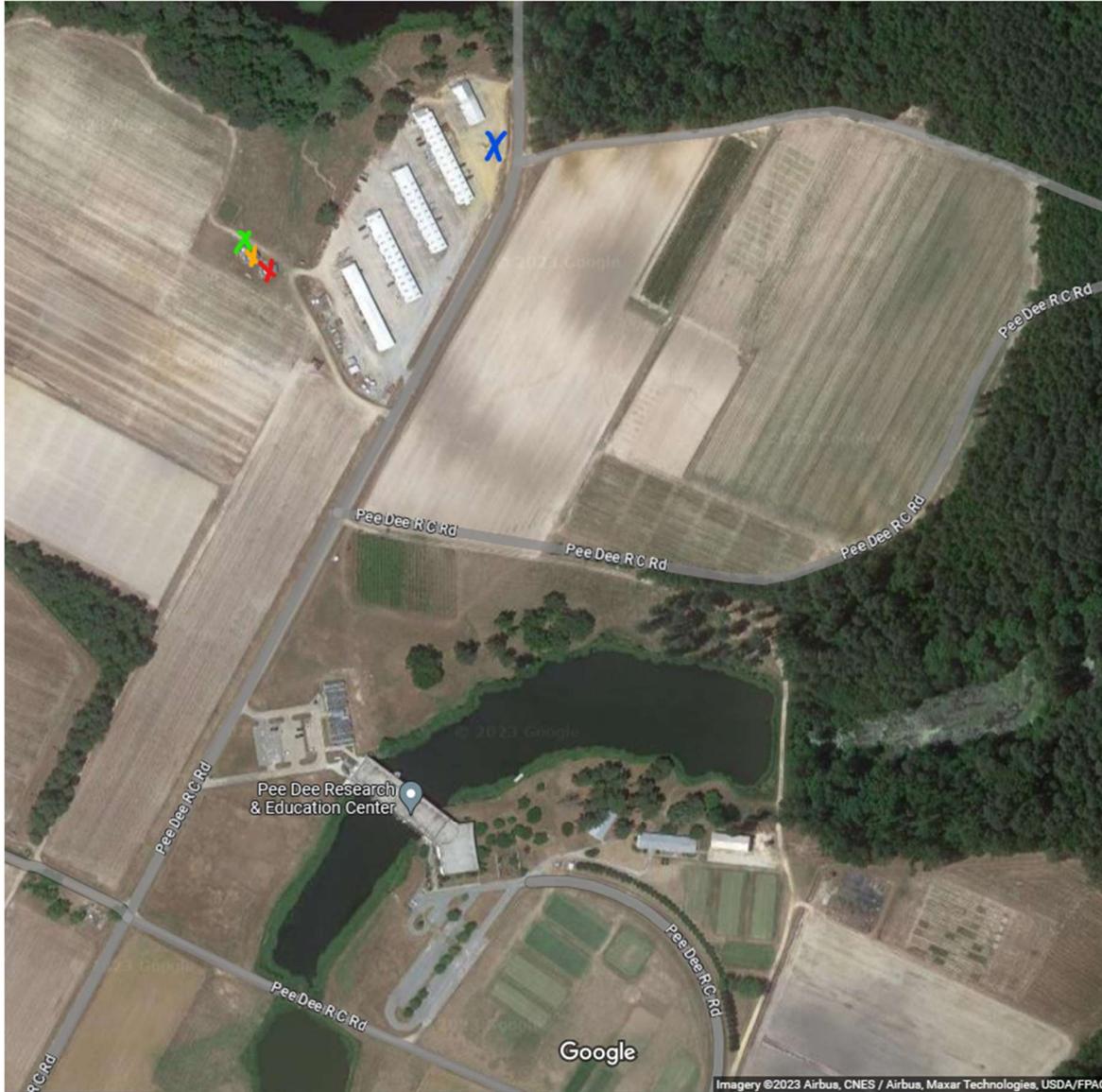
Created July 2023 by Sara Pederson

Modified October 2023 by Sara Pederson



Appendix

Labeled Map of Pee Dee Research and Education Center



Legend:

- Red = Grain bin #1
- Orange = Grain bin #2
- Green = Grain bin #3
- Blue = Fertilizer bin #4



Confined Space Pre-Job Entry Form

Description of Confined Space:					
Date of Entry:		Time of Entry:			
Description of Work to be done:					
Prior to entry call Palmetto Rural Fire Department at 843-393-0996 and notify them that Company is performing confined space work. The Fire Department will put tech rescue team on alert. To mobilize rescue team call 911.					
Atmospheric Monitoring: Allowable Levels per 29 CFR 1910.1000 Table Z					
Gases	Allowable	Time	Time	Time	Time
Oxygen	>19.5%				
Lower Explosive Limit	<10%				
Carbon Monoxide	< 35 ppm				
Hydrogen Sulfide	< 10 ppm				
Ammonia	< 50 ppm				
Other					
Preparation of Confined Space					
Describe Rescue Equipment					
Describe Ventilation					
Evaluate need to lockout sources of air or water flow					
Evaluate need to lockout sources of energy					
Method of Communication	Verbal	Radio	Line of Sight	Other:	
Circle PPE needed	Protective Clothing	Hard hat	Gloves	Goggles	
	Safety Harness	Retrieval System	Hearing Protection	Lighting	
Authorized Entrants			Attendants		



SAFETY PROCEDURES

Entry Supervisor Name	Entry Supervisor Signature	Date and Time Permit Approved	Date and Time of Exit
When clear of confined space call Palmetto Rural Fire Department at 843-393-0996 and notify them that company has completed work.			
Notes:			