

Confined Spaces



IOWA STATE UNIVERSITY
Environmental Health and Safety

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IOWA STATE UNIVERSITY OF SCIENCE AND TECHNOLOGY

Protecting the Safety, Health, and Environment of the Iowa State Community

Iowa State University strives to be a model for safety, health, and environmental excellence in teaching, research, extension, and the management of its facilities. In pursuit of this goal, appropriate policies and procedures have been developed and must be followed to ensure the Iowa State community operates in an environment free from recognized hazards. Faculty, staff, and students are responsible for following established policies and are encouraged to adopt practices that ensure safety, protect health, and minimize the institution's impact on the environment.

As an institution of higher learning, Iowa State University

- fosters an understanding of and a responsibility for the environment,
- encourages individuals to be knowledgeable about safety, health and environmental issues that affect their discipline, and
- shares examples of superior safety, health and environmental performance with peer institutions, the State of Iowa and the local community.

As a responsible steward of facilities and the environment, Iowa State University

- strives to provide and maintain safe working environments that minimize the risk of injury or illness to faculty, staff, students, and the public,
- continuously improves operations, with the goal of meeting or exceeding safety, health and environmental regulations, rules, policies, or consensus standards, and
- employs innovative strategies of waste minimization and pollution prevention to reduce the use of toxic substances, promote reuse, and encourage the purchase of renewable, recyclable and recycled materials.

The intent of this statement is to promote environmental stewardship, protect health, and encourage safe work practices within the Iowa State University community. The cooperative efforts of the campus community will ensure that Iowa State University continues to be a great place to live, work, and learn.



Wendy Wintersteen
President

Directory of Service and Emergency Providers**Services****Environmental Health and Safety**

2408 Wanda Daley Drive | (515) 294-5359

Iowa State University Occupational Medicine Department

G11 Technical and Administrative Services Facility (TASF), 2408 Pammel Drive | (515) 294-2056

McFarland Clinic PC, Occupational Medicine

1018 Duff Avenue | (515) 239-4496

Thielen Student Health Center

2647 Union Drive | (515) 294-5801

Emergency**Emergency - Ambulance, Fire, Police**

911

Department of Public Safety/ Iowa State University Police

Armory, 2519 Osborn Drive | (515) 294-4428

Mary Greeley Medical Center

1111 Duff Avenue | (515) 239-2011

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A. Introduction

Each year, many people are injured or die as a result of entering confined spaces that contain hazards. Most of these deaths could have been prevented if entrants had been trained to recognize hazards in a confined space, and if employers have a written plan in place for entry into confined spaces. To prevent unnecessary injuries or the loss of life, OSHA enacted the [Permit-Required Confined Spaces Standard](#) (29 CFR 1910.146), effective April 15, 1993. The standard requires that all confined spaces be identified and a written program be generated to outline procedures required for entry into those spaces.

Administrative Responsibilities

Environmental Health and Safety

The specific responsibility for developing and implementing Iowa State University programs for health and safety resides with the Department of Environmental Health and Safety (EH&S). In fulfillment of this responsibility, EH&S has prepared the Iowa State University Confined Spaces Program and assists individual departments in the development and implementation of confined space procedures for their areas.

Departments

Each university department is responsible for evaluating areas under its administrative control and determining whether confined spaces are present. Departments that identify confined spaces in their areas are responsible for the adoption and implementation of the components of this Confined Spaces Program. In addition, departments must submit to EH&S a list of names and locations of confined spaces in their areas and develop department-specific standard operating procedures (SOPs) for confined space entries.

Managers and Supervisors

Managers and supervisors play a key role in the implementation of the Confined Spaces Program. They are responsible for: determining whether personnel need to enter confined spaces; identifying personnel who will be required to participate in confined space entries as part of their duties; ensuring that all personnel required to participate in confined space entries are properly trained prior to assignment; ensuring that proper safety equipment required for entry is made available to personnel; and ensuring that all provisions of the program are followed.

Personnel

Personnel are responsible for observing all practices and procedures contained in the Confined Spaces Program, other general safety practices, attending designated training sessions, and reporting hazardous or unsafe conditions to their supervisor, the entry supervisor or EH&S. Employees designated as Authorized Entrants, Entry Supervisors, and/or Attendants are responsible for additional duties as outlined in Section Duties of Designated Employees.

Program Review

Each department must review its Confined Spaces Program annually. Canceled permits from the previous year will be used to determine if revisions are needed to ensure employee safety. If revisions are needed, the changes must be made and employees trained on the revisions.

Standard Operating Procedures

Standard operating procedures (SOP) describe the method(s) that will be used to complete a task or operation. Departments with confined spaces must develop SOPs and incorporate them into this manual to complete their Confined Spaces Program. Procedures must be developed by departments for the items outlined below to make the program specific to their areas.

- Training of designated employees.
- Preparation, issuance, use, and cancellation of Entry Permits.
- Conclusion of confined space entries (closing the space, debriefing).
- Communication between the Attendant and the Authorized Entrants and with rescue and emergency personnel.
- Prevention of unauthorized entry into permit-required confined spaces.
- Coordination of confined space entries with contractors.

Recordkeeping

The following confined space records must be maintained by each department or entity using this confined spaces manual.

A listing of confined spaces identified by name, location, description, real or potential hazards, and classification (permit or non-permit required confined space) using the Confined Space Inventory form.

Confined Spaces

- All atmospheric testing results.
- List of employees designated to participate in confined space entries. Refer to Section Training for details.
- Monitoring equipment calibration records.
- Canceled permits for the year.

B. Identification and Evaluation

Each university department must survey their workplace to determine if confined spaces, as defined by OSHA, are present in areas under their administrative control. The confined spaces must be identified by name, location and description, then evaluated by a trained person to determine if the spaces are non-permit or permit-required confined spaces. The [Confined Space Inventory form](#), or equivalent, should be used to document this identification and evaluation process. **A list of all identified confined spaces and their hazards must be sent to EH&S.**

Upon request, EH&S will assist departments in their determination of confined space categorization (permit versus non-permit required) and identification of potential and/or actual hazards present in the spaces.

If entry is required to categorize a confined space, the entry must be conducted by following all requirements of the permit system.



Definition of Confined Spaces

Confined Space means a space which:

- Is large enough and configured for a person to bodily enter and perform work.
- Has limited or restricted means for entry and exit.
- Is not designed for continuous worker occupancy.

Examples of confined spaces include:

Sanitary sewers	Well pits	Boilers	Coal bunkers
Sewer lift stations	Tanks	Silos	Vessels
Grain bins	Grain dryers	Storage hoppers	Vaults

Permit-Required Confined Space

A permit-required confined space has one or more of the following characteristics:

- Contains or has the potential to contain a hazardous atmosphere.
- Contains a material with the potential for engulfment of an entrant.
- Has an 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 or health hazard, including areas or processes that must be locked out and/or tagged out per the Iowa State University Lockout/Tagout Program.

Refer to Appendix A: Definitions for more information on hazards that may be encountered.

Non-Permit Confined Space

A confined space NOT containing ANY of the characteristics listed under permit-required confined spaces may be considered a non-permit confined space.

Notification

Personnel must be made aware of the existence and location of permit-required confined spaces. This may be accomplished by:

- The posting of danger signs reading, "DANGER - PERMIT REQUIRED CONFINED SPACE - DO NOT ENTER" or other suitable language.
- Employee training on the existence and locations of permit-required spaces.
- Posting or making lists of confined spaces.
- Any other methods deemed effective by EH&S.



C. Non-Permit Required Confined Spaces

General Requirements

All confined spaces must be considered permit-required until pre-entry procedures demonstrate that hazards in the space do not exist or have been eliminated. If hazards do not exist or are eliminated, the space may be reclassified as a non-permit required confined space and entry can proceed without the use of an Entry Permit or an Attendant. Confined Spaces Entry training is required for entering into non-permit spaces.

Non-Permit Entry Procedures

All personnel needing to enter a non-permit confined space must:



- Inform their immediate supervisors of the confined space location and plans for entry.
- Guard or barricade entry opening to protect the safety of personnel, pedestrians and motorists.
- Test the atmosphere prior to entry with a calibrated, direct-reading instrument for a hazardous atmosphere.
- Record monitoring results on a Verification and Monitoring Record (back of [Confined Space Entry Plan](#)).
- If a hazardous atmosphere is detected, the space must not be entered and the immediate supervisor must be informed as soon as possible.
- Use continuous or periodic monitoring to alert the entrant of the unexpected development of hazardous atmospheres.
- Evaluate the space for engulfment, entrapment or any other serious safety or health hazards. If any of these hazards are found, this space must not be entered and a supervisor must be informed as soon as possible.
- Wear all required personal protective equipment (PPE) for the assigned task.
- Be observant of the effects of hazardous contaminants and evacuate if any are detected.
- Have a means to summon assistance (ie., cell phones, two-way radio, etc.)

D. Permit-Required Confined Spaces

Entry into confined spaces with hazardous atmospheres, engulfment, entrapment or other serious hazards must be performed under permit-required confined space entry procedures. Entry must be performed under a permit issued by a designated Entry Supervisor. A minimum of one Attendant must be stationed outside the permit space for the duration of the entry. Before entry, a number of pre-entry procedures must be followed including, but are not limited to, isolation of the permit space, removal or control of atmospheric hazards, barricading space entrances, and verifying that acceptable conditions are maintained throughout the entry.

Space specific entry procedures should be reviewed in a pre-planning meeting. Permit space entry procedures must be conducted as outlined in the departmental SOPs and entry permit and must include a debriefing of personnel involved in the entry when the task has been concluded.

Pre-Planning

A pre-planning meeting must be conducted to ensure that all parties know the work to be done, pre-entry procedures, duties of each team member, hazards that may be encountered, equipment necessary, and emergency plans. Pre-planning must take place between all parties involved in permit-required confined space entries. This meeting serves the purpose of reviewing entry procedures as well as covering specific hazards inherent to the spaces being entered. Work procedures involving any chemicals or work techniques which could create additional hazards within the space should also be covered.

Pre-planning must cover all required engineering controls needed to address the space's hazards, including ventilation, space isolation, lockout/tagout of equipment or processes, and PPE. Finally, emergency response and rescue procedures must be reviewed.

Entry Permit

The Entry Permit is the item that documents program compliance and authorizes entry to a permit-required confined space. The designated Entry Supervisor is responsible for issuing the permit before beginning the entry process. Permits are authorized for the duration of the required task or one day. Entry Permits must be posted at the work site for the duration of entry to allow for the documentation of atmospheric testing results and verification of acceptable conditions. Problems encountered during entry must be noted on the permit so revisions to the entry procedures can be made.

The Entry Supervisor must cancel the permit when pre-entry

CONFINED SPACES ENTRY PLAN	
IDENTIFICATION Name of confined space: _____ Location: _____ Space description: _____ Contents: _____ Initial dimensions: _____ Access type: _____ Access dimensions: _____ <input checked="" type="checkbox"/> Permit required (complete Entry Permit below) <input type="checkbox"/> Non-permit required	
POTENTIAL HAZARDS (Check all that apply) Hazardous atmosphere <input type="checkbox"/> Engulfment <input type="checkbox"/> Entrapment <input type="checkbox"/> Hazardous energies <input type="checkbox"/> Other (specify) <input type="checkbox"/>	
REQUIRED PRECAUTIONS (Circle or specify) Atmos. testing <input type="checkbox"/> periodically / <input type="checkbox"/> continuously Ventilation <input type="checkbox"/> if indicated by monitoring / <input type="checkbox"/> prior to entry Surveillance <input type="checkbox"/> visual / verbal / radio <input type="checkbox"/> continuously Safety harness / lanyard <input type="checkbox"/> yes / no Lockout/tagout <input type="checkbox"/> yes / no Respirator <input type="checkbox"/> Other <input type="checkbox"/>	
ENTRY PERMIT Scope of work authorized: _____ Has entry authorized? <input type="checkbox"/> yes <input type="checkbox"/> no Scope: _____ Date: _____ Entry authorized by: _____ Authorized Entrants and Attendant (may alternate <input type="checkbox"/> yes or <input type="checkbox"/> no) 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ 6. _____ Canceled by: _____	

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operations have not been completed or if conditions arise that prevent entry; conditions outlined in the permit change; conditions not allowed under the Entry Permit occur in or near the permit space; or the work has been completed. Cancelled permits must be retained for a minimum of one year for program review purposes.

Each department must establish procedures for the preparation, issuance, use and cancellation of Entry Permits. Departments should use the [Confined Spaces Entry Plan](#), developed by EH&S. .

Permit-Required Entry Procedures

All personnel needing to enter a permit-required confined space must:



- Obtain or prepare an Entry Permit.
- Gather necessary tools and equipment to complete the required task.
- Conduct pre-planning meeting.
- Guard or barricade the entry opening.
- Isolate the permit space.
- Test the atmospheric conditions in the space at multiple levels, note results on the Verification and Monitoring Record on the back of the [Confined Spaces Entry Plan](#).
- Ventilate if indicated by monitoring. Ensure that a minimum seven air changes are achieved, then re-test atmospheric conditions. STOP the entry and notify your supervisor if hazardous atmospheres are not brought within acceptable conditions by ventilation.
- Evaluate the space for engulfment, entrapment or any other serious safety or health hazards. If any of these hazards are found, attempt to control them using lockout/tagout or other suitable control measures. STOP the entry and notify your supervisor if the hazards can not be controlled.
- Verify that acceptable conditions have been achieved on the Verification and Monitoring Record side of the Confined Spaces Entry Plan.
- Begin the permit entry and perform necessary work.
- Maintain contact between entrants and Attendant at all times during the entry to ensure safety.
- Use continuous atmospheric testing and/or continuous ventilation with periodic atmospheric testing to guard against

the development of hazardous atmospheres.

- Evacuate the space and take corrective measures if any prohibited condition develops during entry (i.e., monitor alarm, hazards in or out of the space develop, symptoms of exposure experienced by entrant or observed by Attendant, etc.). STOP the entry and notify your supervisor if acceptable conditions cannot be reestablished.
- Conclude work in the space by removing tools and restoring function to all systems in the space.
- Evacuate the space, close all entrances and remove barricade equipment.
- Conduct a post entry debriefing with all personnel involved in the entry.
- Return Entry Permit to the Entry Supervisor for cancellation and retain documents for a minimum of one year.

E. Contractors

Contractors working at Iowa State University in or near permit-required confined spaces must be informed of and follow the contractor-specific items listed below:

- Contractors must be told about the Iowa State University Confined Spaces Program and its requirements; known hazards or potential hazards present in the space; recommended safety precautions needed for the space; coordination needed for entry operations; and times when Iowa State University personnel will enter or work near the confined space.
- Contractors must be debriefed upon exit.
- Contractors entering confined spaces must inform Iowa State University of the confined space procedures used during entry and hazards encountered or created in the confined space.

F. Duties of Designated Employees

The training and assigning of Entry Supervisors, Authorized Entrants, and Attendants (and each role subsequent responsibilities) must be included in the department's SOPs for confined space entry.

Entry Supervisor

Entry Supervisors are primarily responsible for ordering entries into permit-required spaces and ensuring all proper procedures contained in this manual are followed. Entry Supervisors are specifically responsible for:

- Knowing the hazards that may be faced during entry, including signs, symptoms, and consequences of exposure.
- Conducting pre-planning meetings with designated personnel involved in permit-required confined space entries.
- Filling out the Entry Permit Form.
- Verifying that all Entry Permit requirements have been properly addressed before entry.
- Authorizing entry by signing Entry Permit.
- Verifying that rescue services are available and can be summoned.
- Removing unauthorized individuals from the entry area.
- Canceling the permit if unacceptable conditions arise during entry or if assigned work has been completed.
- Ensuring that the terms of the Entry Permit are followed and that acceptable entry conditions are maintained.



Authorized Entrant

Authorized Entrants are those actually entering the permit-required spaces and performing necessary duties. Authorized Entrants are responsible for:

- Knowing the hazards that may be encountered during entry, including information on the signs, symptoms or consequences of exposure.
- Knowing the proper use of equipment required for entry, including; monitoring, ventilation, PPE and lighting equipment, barriers/shields, safety equipment for entry and egress, and rescue and emergency equipment.

- Communicating with the attendant.
- Alerting Attendant if warning signs or symptoms of exposure are detected, or if a prohibited condition occurs.
- Exiting the space if the Attendant orders evacuation, warning signs or symptoms of exposure are detected, a prohibited condition occurs, or if an evacuation alarm is activated.

Attendant

Attendants are individuals who are stationed outside permit-required confined spaces to monitor Authorized Entrants, as well as perform required duties. Specifically, Attendants are responsible for:

- Knowing the hazards that may be encountered during entry, including information on the signs, symptoms or consequences of exposure.
- Knowing behavioral effects of hazard exposure, such as those from heat or chemical exposure. Example effects include slurred speech and/or physical impairment.
- Maintaining an accurate count of Entrants and ensuring permit correctly identifies exactly who is in the space.
- Remaining outside the permit space during entry until relieved by another Attendant.
- Communicating with Entrants to monitor status and alert them of the need to evacuate the space.
- Monitoring activities inside and outside the space to identify potential hazards to the Entrants and call for evacuation if conditions are unsafe. (i.e., prohibited condition is detected, behavioral effects of hazard exposures to Authorized Entrants are detected, conditions outside the confined space change such that Authorized Entrants are endangered, or the Attendant cannot perform all duties required).
- Monitoring multiple confined space entries and performing other duties as long as the spaces are in close proximity and other duties performed are in the immediate vicinity of the spaces (Authorized Entrant safety must be the first priority).
- Summoning rescue and other emergency services as soon as it is determined that the Entrants may need assistance to escape.
- Removing or preventing unauthorized personnel from entering the permitted space.
- Performing non-entry rescues.

Confined Spaces

The Attendant must not enter the confined space. Even if the Attendant is trained in rescue, it must not be attempted until another Attendant can provide relief.

G. Training



Iowa State University provides training so all personnel whose work involves confined space entries become proficient in the requirements of this program. All personnel must gain the understanding, knowledge and skills necessary for the safe performance of their assigned duties. Confined Space Entry training is required for all personnel prior to participating in any confined space entries. Training is provided by EH&S several times a year. Register online at Learn@ISU.

Retraining must be provided:

- Before there is a change in assigned duties.
- Whenever there has been a change in permit space operations that presents a hazard previous training did not cover.
- Whenever there are deviations from the permit space entry procedures required by the Entry Permit.
- When there are inadequacies in personnel knowledge or use of required procedures.

H. Required Equipment

Many different safety equipment items are required to assist safe entries into and rescues from permit-required confined spaces. These items must be supplied, at no charge, to employees engaged in permit space entries. The extent of actual equipment required will depend on hazards present and the category of the confined space being entered. Training must include hands-on usage of all required equipment to such an extent that personnel become proficient in their understanding and use of the equipment.

Possible equipment includes:

- ventilation fan(s)
- life lines
- retrieval equipment
- [PPE](#)
- monitoring equipment (See Section I. Atmospheric Testing below)
- lighting equipment
- communication equipment
- [Lockout/Tagout](#) devices
- barricade equipment
- other safety equipment required to complete the job

Retrieval systems or methods must meet the following requirements:

- Authorized Entrants entering permit-required confined spaces must wear a safety harness attached to retrieval equipment located outside the permit space by way of a retrieval line. Wristlets may only be used in lieu of chest or full body harnesses if it can be demonstrated that the harness usage creates a greater hazard and wristlets are the safest and most effective alternative.
- Retrieval lines must be attached to a mechanical device or fixed point outside the permit space in such a manner that rescue can begin as soon as it becomes necessary.
- A retrieval hoist must be available to retrieve personnel working in vertical-type confined spaces deeper than 5 feet.

When respirators or lockout/tagout procedures are required to enter a confined space, training must be provided to all affected personnel within the requirements of each specific regulation.

I. Atmospheric Testing



Atmospheric testing is required for the evaluation of hazards during initial classification and upon each subsequent entry into a confined space. At a minimum, the space must be tested for oxygen, combustible gases and vapors, and toxic gases and vapors. These items can be tested individually (oxygen first, combustibles, then toxics) or they can be tested simultaneously. All testing must be recorded on either the [Confined Spaces Inventory](#) or on the Verification and Monitoring Record on the back of the [Confined Spaces Entry Plan](#).

Testing for atmospheric hazards must be conducted prior to entry into all confined spaces to determine if acceptable entry conditions exist. The atmosphere must be tested at various levels in the confined space. Atmospheric hazards may be found at different levels, depending on the contaminants present and the conditions of the space. During entry into the space, monitoring must be conducted either continuously or periodically (at least every 15 minutes) to ensure that acceptable entry conditions are maintained. Continuous atmospheric testing must be used when the risk of the development of hazardous atmospheres is high. If the monitoring instrument goes into alarm or fails to operate at any time during entry, the entry must be stopped and Entrants removed from the space.

Monitoring equipment must be maintained according to manufacturers' specifications to ensure proper operation during confined space testing and entry. Instrument calibration to known gas concentrations must be conducted prior to instrument use in a confined space entry, to ensure equipment operation is within acceptable ranges.

Proper atmospheric testing will be one of the most important subjects covered in employee training. Employees must become familiar with the performance and limitations of their particular monitoring equipment. EH&S can assist departments with the proper selection and usage of personal monitoring equipment for confined spaces testing and entry.

MINIMUM CONDITIONS FOR ENTRY

Oxygen	Between 19.5%-23.5%	Flammable Dusts	Visibility > 5 ft.
Flammable gasses	< 10% of LEL	Engulfment hazards	None present
Hydrogen sulfide (H ₂ S)	< 10 ppm	Hazardous flows	Secured and locked/tagged out
Carbon monoxide (CO)	< 50 ppm	Hazardous energies	Secured and locked/tagged out
Other toxic substances	< PEL for substance	External hazards	Controlled

If conditions are not met, entry is prohibited. If occupied, the space must be immediately evacuated.

J. Emergency Response and Rescue



Iowa State University will rely on rescue personnel from the Ames Fire Department, Iowa State University Police Department and Mary Greeley Medical Center Ambulance Service in the event of an emergency during a confined space entry. The Iowa State University Department of Public Safety (DPS) will assist in crowd and traffic control during an emergency. These emergency services are accessible by dialing 911 from any campus telephone. If calling from a cell phone dial (515) 294-4428 to reach DPS dispatcher.

To facilitate non-entry rescue, rescue retrieval systems (harnesses, ropes, etc.) must be used by Authorized Entrants unless use of those systems would result in an increase of overall risk of entry, or would not contribute to the rescue of Authorized Entrants. External retrieval should be attempted only after emergency rescue personnel have been summoned.

Appendix A - Definitions

Acceptable Entry Conditions

The conditions necessary in a confined space to allow safe entry. Minimum conditions for entry are contained on the entry permit.

Asphyxiation

Suffocation (lack of oxygen) caused by a class of dangerous gases that replace oxygen and result in unconsciousness or death.

Attendant

An individual, stationed outside of a permit space, who monitors the Authorized Entrants, and who performs all duties assigned to the Attendant by the employer's permit program.

Authorized Entrant

Trained employee authorized by the employer to enter a confined space and perform work.

Carbon Monoxide

A colorless, odorless and tasteless gas that is a chemical asphyxiant. Carbon monoxide is formed as an end product of combustion.

Confined Space

A space which is

- large enough and so configured for an employee to bodily enter and perform work
- limited or restricted means for entry and exit
- not designed for continuous worker occupancy

Engulfment

The surrounding or capture of a worker by a liquid or finely divided solid that can be inhaled to plug the respiratory system or cause death by strangulation, constriction or crushing.

Entrapment

The trapping of a worker by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section.

Entry

The action by which a person passes through an opening into confined space. Entry is said to have occurred as soon as any part of the body crosses the plane of the opening.

Entry Permit

An authorization and approval in writing that specifies the location of the confined space and the type of work to be done. It also certifies that all existing hazards have been evaluated by a qualified person and the necessary protective measures have been taken.

Entry Supervisor

The personnel member assigned by the employer to supervise permit space entries. Responsible for

determining if acceptable conditions exist in a permit space prior to entry, for authorizing entry with a permit, overseeing operations, and terminating the entry at the completion of work.

Flammable Atmosphere

An atmosphere that poses a hazard because flammable or explosive gases, vapors or dusts are present at a concentration greater than ten percent of their lower flammable limit.

Hazardous Atmosphere

An atmosphere which exposes personnel to the risks of death, incapacitation, injury, or acute illness from one or more of the following causes:

- flammable atmosphere
- airborne combustible dust
- an atmosphere containing oxygen levels below 19.5% or above 23.5%
- an atmosphere where the permissible exposure limit for a certain chemical has been exceeded and could result in exposure
- any other atmospheric condition that is immediately dangerous to life and health

Hot Work

Any work that introduces an ignition source into a work area (welding, cutting, brazing, or soldering).[Hot Work Permit Guidelines](#)

Hydrogen Sulfide

A toxic colorless gas that, at low levels, has the odor of rotten eggs. It is a chemical asphyxiant and its smell cannot be relied upon for adequate warning.

Immediately Dangerous to Life and Health (IDLH)

Any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or would interfere with Authorized Entrants abilities to evacuate the permit space unaided.

Lockout/Tagout

The control of all hazardous energies within a system prior to performing service on the system. The Iowa State University [Lockout/Tagout Manual](#) will assist in complying with OSHA, Control of Hazardous Energies (Lockout/Tagout) Standard (29 CFR 1910.147).

Non-Permit Required Confined Space

A confined space NOT containing ANY of the characteristics listed under permit-required confined spaces may be considered a non-permit confined space.

Oxygen-Deficient Atmosphere

An atmosphere containing less than 19.5% oxygen by volume. Insufficient oxygen is available to sustain life.

Oxygen-Enriched Atmosphere

An atmosphere containing more than 23.5% oxygen by volume, which increases the potential for explosion or ignition of an explosive or flammable substance.

Parts Per Million (PPM)

Volume measurement of a gas concentration (parts of a contaminant per million parts of air).

Permit-Required Confined Space (Permit Space)

A confined space which has one or more of the following characteristics:

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

Personal Protective Equipment (PPE)

Equipment that will help prevent accidents and personal injury. PPE includes hard hats, goggles, face shields, steel-toed shoes, respirators, aprons, gloves, and full body suits.

Prohibited Condition

Any condition during entry into a permit space that is not allowed by the Entry Permit.

Purge

Performing a complete air exchange in a confined space prior to entry in order to remove contaminated air and replace it with fresh air.

Qualified Person

A person designated by the employer, in writing, as capable (by education or training) of anticipating, recognizing and evaluating hazardous substances or other unsafe conditions present in confined spaces.

Retrieval System

The equipment used for non-entry rescue of persons from permit spaces (includes retrieval line, harness and lifting device).

Site Survey

The process in which the workplace is surveyed for confined spaces, identifying permit spaces and determining whether personnel would need to enter the spaces or not.

Stratification

The phenomenon of gases forming layers, or stratifying based on weight, especially without normal ventilation in a confined space. This is the reason why atmospheric testing must be performed at various levels to ensure employee safety.

Ventilator

A machine designed for moving quantities of air. This machine is used to ventilate the confined space prior and during the entry.

Appendix B - Additional Resources

SDSs for common atmospheric hazards

[Carbon Monoxide](#)

[Hydrogen Sulfide](#)

[Methane](#)

[Sewer Gases](#)

Alternate plan for entry into steam tunnels

This [alternate plan](#) developed by the Iowa State University Utilities Department is being included to illustrate how they are addressing the steam distribution tunnel system. Departments with similar situations may be able to use this as a guide to develop alternative procedures for their areas. Alternative procedures must include justification for the plan, entry procedures, emergency procedures, and monitoring and inspection data to support their use. EH&S will assist with the development of alternative procedures as necessary.

Non-Discrimination Statement

"Iowa State University does not discriminate on the basis of race, color, age, ethnicity, religion, national origin, pregnancy, sexual orientation, gender identity, genetic information, sex, marital status, disability, or status as a U.S. veteran. Inquiries regarding non-discrimination policies may be directed to Office of Equal Opportunity, 3350 Beardshear Hall, 515 Morrill Road, Ames, Iowa 50011, Tel. 515 294-7612, email eooffice@iastate.edu"