

California Institute of Technology

CONFINED SPACE PROGRAM



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May, 2014

CONFINED SPACE PROGRAM

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SCOPE

The purpose of the Confined Space Program is to protect workers entering confined spaces to perform maintenance, cleaning, or other types of work. The Program provides information and guidelines for working with all classifications of confined spaces.

PROGRAM ELEMENTS

1. Identifies and classifies the known confined spaces at the Institute and discusses the reclassification of areas.
2. Identifies the necessary components for entry into confined spaces including monitoring and equipment which may be required.
3. Identifies rescue and emergency procedures of confined spaces and the responsibilities of authorized employees in such instances.
4. Identifies the Institute Permit System including preparation, use, and cancellation of permits. The Permit System includes outside contractors.
5. Provides training to employees involved with confined space work and identifies their duties.
6. Provides for a review of individual operations involving confined spaces and an annual program review.

SPACE EVALUATION

IDENTIFICATION AND CLASSIFICATION

The Confined Space evaluation identifies and classifies all spaces assessed at Caltech for confined space hazards. Environment, Health, and Safety Office (EH&S) has the responsibility for identifying and classifying confined spaces on campus. All confined spaces are evaluated using the "Confined Space Survey" form. A discussion of the classification rationale is provided in the survey. ([See Appendix B: Confined Space Survey](#)). EH&S and corresponding departments maintain a log of all surveys.

The classifications of confined spaces ([See Appendix A: Definitions](#)) are:

- NON-PERMIT REQUIRED
- HAZARDOUS ATMOSPHERE ONLY
- PERMIT REQUIRED

POSTING

All Permit Required and Hazardous Atmosphere Only Spaces are posted with identification signs. The signs state "DANGER – PERMIT REQUIRED CONFINED SPACE, DO NOT ENTER" or other similar language to prevent unauthorized entry.

RECLASSIFICATION OF PERMIT SPACE

Permit Required and Hazardous Atmosphere Only Spaces may be reclassified as Non-Permit spaces. Reclassification occurs when all hazards and potential hazards are removed. Neutralization of dangerous moving parts, by lockout for example, may allow reclassification to Non-Permit status.

ENTRY WITHOUT PERMIT

Confined spaces that do not contain known hazards have reduced requirements for entry. Spaces classified as Non-Permit do not involve hazards considered serious ([See Appendix A: Definitions](#)). Non-Permit spaces do not require a written permit or attendant for entry. Non-Permit spaces do not require any special testing or training.

PERMIT REQUIRED ENTRY

Confined Spaces that contain known or potential safety and health hazards to entrants require a permit and an entry procedure or space review prior to entry. These areas are PERMIT REQUIRED SPACES ([See Appendix A: Definitions](#)). Entry is allowed to trained and authorized individuals only. If the space contains only atmospheric hazards correctable through ventilation, the permit area is a HAZARDOUS ATMOSPHERE ONLY SPACE

ACCEPTABLE ENTRY CONDITIONS

Because of the dangers that exist within Permit Required areas, there are conditions that must be eliminated before entry (See Appendices [D](#) and [E](#): Permit Systems). Precautionary steps such as source isolation, ventilation, and atmospheric level testing are required prior to entry. Acceptable entry conditions for specific areas are contained in Entry Permits.

ISOLATION

Lockout of mechanical hazards follows the requirements identified in the Institute [Lockout / Tagout Program](#).

PURGING AND FLUSHING

If a confined space contains an atmosphere that is flammable or considered immediately dangerous to life or health (IDLH), the area will require purging before employees can enter ([See Appendix A: Definitions](#)). Continual forced ventilation is necessary to keep some areas safe during entry.

VERIFICATION MONITORING

Requirements of entry are listed on Entry Permits. Monitoring of hazardous conditions is required prior to receiving entry authorization. Conditions include atmospheric, mechanical, and physical hazards. Ongoing monitoring may be periodic or continuous as required by the permit. Only personnel trained in the proper use of the equipment are authorized to perform required air monitoring.

BARRIERS

Barriers must be placed around Permit Required Spaces when conditions may cause injury. Conditions include:

- Unauthorized entry.
- Objects falling into the space.
- Vehicular hazards around the space.

ATTENDANTS

There must be at least one attendant present outside the space for the duration of the work being performed in Permit Required Spaces ([See Duties](#)). Attendants must not monitor more than one operation at any given time.

CONCLUDING OPERATIONS

When scheduled work operations in a Permit Required Space have concluded:

1. Entrants will exit the space.
2. The area will be closed off.
3. The Permit will be cancelled.

HAZARDOUS ATMOSPHERE ONLY SPACE

Spaces are classified as Hazardous Atmosphere Only if the space contains an actual or potential hazard but still can be controlled by ventilation ([See Definitions](#)).

Hazardous Atmosphere Only spaces require completion of a pre-entry certification prior to entry but do not require an attendant or permit ([See Appendix D](#)).

Atmospheric testing is required prior to entry and periodically as necessary to confirm the elimination of hazardous atmospheres. Continual forced ventilation is required to eliminate hazardous atmospheres.

If circumstances other than a scheduled break require an interruption of work, evacuate the space. A new pre-entry certification, including a re-evaluation, must be completed before resuming work.

Employees working with Hazardous Atmosphere Only spaces must receive training.

EQUIPMENT

- Equipment required during entry operations is listed on the permit and may include:
- Testing and Monitoring Equipment.
- Ventilation Equipment.
- Communications Equipment.
- Personal Protective Equipment.
- Lighting Equipment.
- Barriers and Shields.
- Ingress and Egress Equipment.
- Rescue and Emergency Equipment.
- Any other equipment necessary for safe entry and rescue.

Entry equipment will be maintained by their respective owners. Only trained and authorized employees are to use the equipment.

RESCUE AND EMERGENCY SERVICES PROCEDURES

An emergency is an event in or near the Permit Space that could endanger entrants. Emergency rescue services during entry by Institute employees will be provided by the

Pasadena Fire Department.

EVACUATION AND RESCUE PROCEDURES

1. Attendant will notify all Entrants to evacuate.
2. Attendant will notify x5000 if the emergency involves serious injury or fire.
3. Attendant will execute any "non-entry" rescue procedures appropriate to the situation.
4. Rescue involving space entry will not be performed by Institute employees.
5. The Entry Supervisor will immediately cancel the Entry Permit.

SUPERVISOR AND ATTENDANT RESPONSIBILITIES

- Provide Rescue Services group with information on the work being done.
- Provide the Entry Permit to Rescue Services personnel.
- Provide Rescue Services with any observations or information about the emergency.
- Keep unauthorized personnel out of the area.
- Forward information on any chemicals involved in exposures to the medical facility treating exposed victims.

PERMIT SYSTEM

Entry Permits are kept by supervisors authorized to assign entry.

PREPARATION

Prior to "Permit-Required" or "Hazardous Atmosphere Only" Space entry, an applicable permit or certification must be completed in full. Additional requirements may apply to Permit-Required areas based upon entry testing results ([See Space Evaluation and Monitoring](#)). A final authorization signature is required by the Unit Supervisor for "Permit-Required" spaces. If the area is a "Non-Permit" space, work may proceed without a permit or notification.

ISSUE / USE

Space entry work must not deviate from the requirements of the permit, including the time required to complete the assignment. Permits must be posted during entry. It is the responsibility of the entry supervisor to see that permits are posted.

CONCLUSION OF OPERATIONS / CANCELLATION OF PERMIT

Upon conclusion of the entry operations, the authorized Entry Supervisor is responsible for terminating the entry and canceling the Permit ([See Duties](#)). The Entry Supervisor is also required to terminate entry and cancel the Permit when a condition exists that is not acceptable by the Permit. Entry must not exceed the expiration date and time posted on Entry Permits. Upon conclusion of entry operations, the Entry Supervisor shall cancel the Permit and keep on file for at least one year.

OUTSIDE CONTRACTORS

Outside contractors must be informed of the fact that a space requires a permit, the hazards of the space, the Institute's experience with the space, and precautions and procedures the Institute has implemented for protecting employees in or around the space. If an Institute employee works in or near the space, coordinated entry operations are necessary. A copy of the contractor's permit or a Caltech permit must be obtained before entry. At the conclusion of the contractors work, a debriefing session will be conducted.

TRAINING

Employees working with "Permit-Required" or "Hazardous Atmosphere Only" Spaces must receive training. Employees working as attendants, authorized entrants, or entry supervisors receive training for safe performance of assigned duties in confined space areas. Training is not required of employees entering Non-Permit areas.

FREQUENCY

Affected employees must receive training before the first assignment of work in confined spaces. Employees receive additional training when there is a change in assignment, operation, or procedures.

DOCUMENTATION

All training pertaining to confined space duties will have a training outline and an attendance sheet containing the date of training and a listing of trainees.

DUTIES

There are three different active roles in the performance of permitted confined space entry operations: Entrants, Attendants, and Entry Supervisors.

ENTRANTS

Entrants are employees authorized to enter a permit space. Entrants shall:

- Know the hazards that they may be faced during entry.
- Properly use equipment mentioned under the "Equipment" section.
- Communicate with the attendant as necessary alerting him/her of hazards.
- Exit from permit space whenever there is an order to evacuate, a hazard is recognized, or an evacuation alarm is activated.

ATTENDANTS

Attendants are employees stationed outside of a permit space to monitor entrant activity and perform duties listed on the permit. Attendants are responsible to:

- Know the hazards that they may be faced during entry.
- Know the behavioral effects of hazard exposure in authorized entrants.

- Keep an accurate count of the number of entrants in the permit space.
- Remain outside the space during operations until relieved.
- Monitor the work area for hazardous conditions.
- Summon rescue and emergency services.
- Communicate with entrants to relay information and monitor the status of the entrants.
- Order the evacuation of the entrants from the space if a hazardous condition is encountered.
- Keep unauthorized employees away from the space.
- Perform no duties that might interfere with the attendant's primary duty to monitor and protect the authorized entrants.
- Perform non-entry rescues.

ENTRY SUPERVISORS

Entry Supervisors authorize and supervise entry operations. An Entry Supervisor that authorizes entry may delegate supervisory responsibilities during entry to another employee authorized as a supervisor. Entry Supervisors are responsible to:

- Recognize the potential hazards during entry, including signs and symptoms of exposure.
- Determine, before entry, that area conditions meet the requirements of the permit.
- Provide necessary equipment, hazardous material information, and assuring rescue services are in place.
- Assure that entrants and attendants are trained prior to entry.
- Determine that entry operations and conditions remain consistent with the terms of the permit.
- Remove unauthorized individuals from the area during entry operations.
- Cancel the permit at the conclusion of the entry.

REVIEWS

POST-ENTRY REVIEW

The Safety Office will immediately review specific entry operations under the following circumstances:

- Unauthorized entry.
- Detection of hazards not addressed on a permit.
- Complaints of the effectiveness of entry procedures.
- Subsequent entries will not be authorized until the review is completed with all necessary revisions made.

PROGRAM REVIEW

The Program is reviewed at least annually by the Environment, Health, and Safety Office.

APPENDICES

APPENDIX A: DEFINITIONS

ACCEPTABLE ENTRY CONDITIONS

The conditions that must exist in a permit space to allow entry so that employees involved with a permit-required confined space entry can safely enter into and work within the space.

ATTENDANT

An individual stationed outside the permit space who monitors the authorized entrants and who performs all attendants' duties assigned in the permit space program.

BLANKING OR BLINDING

The absolute closure of a pipe, line, or duct by the fastening of a solid plate that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate.

CONFINED SPACE

A space that meets the following criteria:

- Is large enough and so configured that an employee can bodily enter and perform assigned work; and
- Has limited or restricted means for entry or exit (for example, tanks, vessels, storage bins, vaults, pits, and excavations are spaces that may have limited means of entry); and
- Is not designed for continuous employee occupancy.

EMERGENCY

Any occurrence (including any failure of hazard control or monitoring equipment) or event, internal or external, to the permit space that could endanger entrants.

ENGULFMENT

The surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

ENTRANT

Employee who is authorized to enter a permit space.

ENTRY

Action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and occurs as soon as any part of the entrant's body breaks the plane of the opening of the space.

ENTRY PERMIT

The written or printed document provided by Caltech allowing and controlling entry into a permit space.

ENTRY SUPERVISOR

The person (such as the supervisor, foreman, or crew chief) responsible for determining if acceptable entry conditions are present at a permit space where

entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required by this section.

HAZARDOUS ATMOSPHERE

An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue, injury, or acute illness from one or more of the following causes:

- Flammable gas, vapor, or mist in excess of 10 percent of its lower explosive limit (LEL);
- Airborne combustible dust at a concentration that meets or exceeds its LEL;
- Atmospheric oxygen concentration below 20.0 percent or above 23.5 percent;
- Atmospheric concentration of any substance for which a dose or a published exposure guideline is available and which could result in employee exposure in excess of its dose or permissible exposure limit.

HAZARDOUS ATMOSPHERE ONLY SPACE

A confined space in which the only hazard posed is an actual or potential hazardous atmosphere which can be controlled by continuous forced ventilation.

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH (IDLH)

Any condition that poses an immediately or delayed threat to life or what would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

ISOLATION

The process by which a permit space is removed from service and completely protected against the release of energy and material into the space by such means as: blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; a double block and bleed system; lockout or tagout of all sources of energy, including hydraulic or electric; blocking or disconnecting all mechanical linkages; or physically restraining moving parts.

NON-PERMIT CONFINED SPACE

A confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

PERMIT REQUIRED CONFINED SPACE (PCs)

- A confined space that has one or more of the following characteristics:
- Contains or has the potential to contain a hazardous atmosphere;
- Contains a material that has the potential for engulfing an entrant;
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
- Contains any other recognized serious safety or health hazard.

RETRIEVAL SYSTEM

Equipment (including a retrieval line, chest or full-body harness, wristlets, if appropriate, and a lifting device or anchor) used for non-entry rescue of a person from a permit space.

APPENDIX B: CONFINED SPACE SURVEY

LOCATION _____ DATE OF SURVEY _____

General Description _____

CLASSIFICATION

____ Permit-Required Space

____ Hazardous Atmosphere Only Space

____ Non-Permitted Space

____ Not a confined space

Can be bodily entered?	Yes	No	Hazardous atmosphere?	Yes	No
Limited or restricted entry?	Yes	No	Potential for engulfment?	Yes	No
Not designed for continuous human occupancy?	Yes	No	Internal configuration hazard?	Yes	No
Other serious safety hazard?	Yes	No			

HAZARDS

Possible atmospheric hazards _____

Possible content hazards _____

Configuration of space _____

Unusual hazards _____

ENTRY

Who usually enters the space? _____

Frequency of entry _____

Number of entry points _____

Reasons for entering space & typical activities _____

Warning signs posted	Yes	No	
Has the space been sealed or locked?	Sealed	Locked	No Action Taken
Has atmospheric testing been performed on or in the space? (If yes, attach copy)	Yes	No	

OTHER PERTINENT INFORMATION

Prepared By: _____ Signature: _____

APPENDIX C: NON-PERMIT CONFINED SPACE RECLASSIFICATION SAFETY CERTIFICATION

LOCATION: _____

DESCRIPTION: _____

HAZARDS ORIGINALLY EXISTING IN THE SPACE	HOW ELIMINATED	INITIAL
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

TESTS PERFORMED FOR ATMOSPHERIC HAZARDS

	RESULTS	INITIAL
Oxygen content (greater than 20.0% and less than 23.5%)	_____	_____
Flammable gas/vapor levels (not exceeding permissible levels)	_____	_____
Toxic air contaminant levels (not exceeding permissible levels)	_____	_____

CERTIFICATION

The following Confined Space is reclassified as a "Non-Permit Confined Space." All hazards within the space are eliminated.

Certifying Employee: _____

Signature: _____ Date: _____

APPENDIX D: "HAZARDOUS ATMOSPHERE ONLY" CONFINED SPACE ENTRY PERMIT PRE-ENTRY CERTIFICATION

Location: _____

Description: _____

- | | YES | NO |
|--|-----|----|
| <input type="checkbox"/> Have any entrance cover hazards been eliminated before removal of the cover? | | |
| <input type="checkbox"/> Have guard rails or barriers been installed? | | |
| <input type="checkbox"/> Does your knowledge of industrial or other discharges indicate this area is likely to remain free of dangerous air contaminants while occupied? | | |
| <input type="checkbox"/> Were all atmospheric levels of the confined space tested? | | |
| <input type="checkbox"/> Has a Confined Space Survey been Completed? | | |

Enter Results (if multiple levels present enter highest readings): Time _____

	Date of Last Calibration	
Oxygen	_____	%
Explosive	_____	%LEL
H2S	_____	PPM
Name of tester: _____		
Signature of tester: _____		

Has a continuous forced air ventilation system been installed?

Has the area been purged or flushed?

Will there be periodic monitoring of the atmosphere while the space is occupied? Give Interval: _____

If the answers to any of the above questions are negative, the space cannot be entered. If a hazardous atmosphere is detected during entry, the area must be evacuated. Promptly notify the Environment, Health, and Safety Office of an evacuation.

CERTIFICATION

This space has no hazards other than the existing atmospheric hazards.

A continuous forced air ventilation system is in place to eliminate or control the existing atmospheric hazards.

Supervisor/ Supervisor designee signature _____

APPENDIX E: CONFINED SPACE ENTRY PERMIT

Site Location and Description: _____

Work to be Performed: _____

Job Supervisor: _____

Date and Time Issued: _____

Date and Time of Expiration: _____

Authorized Entrants:

_____	_____
_____	_____
_____	_____

Attendants:

_____	_____
_____	_____

Current Entry Supervisor: _____

Hazards of permit space to be entered:

Limited Exits	Lack of Natural Ventilation
Oxygen Deficient Atmosphere	Oxygen Rich Atmosphere
Airborne Combustible Dust	
Toxic Gas, Vapor or Mist (Explain) _____	

Jobs that may provide a source of heat (i.e., welding, riveting, cutting, turning, and heating)
 Other: (Explain) _____

Source Isolation Requirements:

(Procedures used to eliminate or control permit space hazards)

Requirements		Completed	Date/Time
___ Lockout/De-energize/Try-out	Yes	No	_____
___ Line(s) Broken-Capped-Blanked	Yes	No	_____
___ Purge-Flush and Vent	Yes	No	_____
___ Ventilation	Yes	No	_____
___ Secure Area (Post and Flag)	Yes	No	_____
___ Confined Space Survey Completed	Yes	No	_____
___ Trained on entry procedure or reviewed space prior to entry	Yes	No	_____

NOTE: Enter N/A in the blank for items that do not apply.

Acceptable Entry Conditions _____

Results of Monitoring:

RECORD CONTINUOUS MONITORING RESULTS AND TIME EVERY _____HR/MIN*

Time Test Taken: _____ AM PM

TEST(S) TO BE TAKEN	RESULTS
_____% of Oxygen 20% to 23.5%	_____
____LEL under 10%	_____
____Hydrogen Sulfide <2PPM* <5PPM**	_____
____Other _____	_____

* 8 hr. Time Weighted Average: Employee can work in area 8 hr.

** Short-term exposure limit: Employee can work in area up to 15 minutes.

Signature of Tester: _____

Emergency Rescue Procedures:

ALWAYS DIAL EXTENSION 5000 IN CASE OF EMERGENCIES. Specify resources available to make call in case of emergency:

Communication Processes:

Visual	Voice	Radio
Other (Explain): _____		

Equipment Required:

Direct Reading Gas Monitor – Tested	Communications Equipment
Lifelines	Full Body Harness
Explosion Proof Lighting	Protective Clothing
Respiratory Protection	Hoisting Equipment
Special Tools	Fire Extinguishers

Other Information / Specific Requirements: _____

We have reviewed the work authorized by this permit and the information contained here-in. Written instructions and the safety procedures have been received and are understood. This permit is not valid unless all appropriate items are completed.

Permit and Checklist Prepared By: _____

Approved By (Supervisor/ Supervisor designee): _____

THIS PERMIT MUST BE KEPT POSTED AT THE JOB SITE