

# Confined Spaces

Introduce yourself and the section you represent - give a work history and mention your responsibilities at Fermilab.

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## Learning Objectives

- Define "CONFINED SPACE"
- Recognize hazards associated with confined space entry and how they may change. {Confined Space Database}
- Discuss the abnormal behavior and emergency procedures associated with confined space entries.
- Understand your role and responsibilities as it applies to Fermilab Program

Explain learning objectives.

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## Learning Objectives - Continued

- Know ES&H procedures and requirements found in contract documents and FESHM
- Given a sample entry permit, identify inconsistencies, incomplete and invalid data
- Discuss the proper techniques for monitoring Confined Spaces.
- Know where to go for help and assistance

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## What is a “confined space”?

- 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; and
- Is not designed for continuous employee occupancy.



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Pose question to audience, “What is a confined space?”

"Restricted entry or exit," means physical impediment of the body, e.g., use of the hand or a contortion of the body to enter into, or exit from, the space. Underground beamline enclosures are not usually considered confined spaces. Enclosures that can be accessed by a ladder with no other access/egress points **are** considered confined spaces. The Landlord ES&H Department shall evaluate large-scale excavations on a case-by-case basis.

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## Examples of confined spaces

- Tanks
- Vessels
- Silos
- Storage Bins
- Manholes
- Vaults
- Pits
- Sewers
- Septic
- Pipelines

Examples of confined spaces seen at Fermilab

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## Permit Required Confined Spaces

- Contains or has a potential to contain a hazardous atmosphere;
- Contains a material that has the potential for engulfing an Entrant;
- Has an internal configuration such that an Entrant could be trapped or asphyxiated by inwardly 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.



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Pose question to audience. Are all confined spaces Permit-required confined spaces? No, it's the the hazard that makes a confined space a permit-required confined space. A space therefore, must meet all three criterion plus one of the following to be considered a permit required confined space.

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## What The Statistics Tell Us

- Over 200 confined space fatalities annually
- 60% are would-be rescuers
- Nearly 90% die of suffocation
- More than 95% had no formal training
- **They all could have been prevented!!!!!!**



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Explain that many of the rescuers that die in confined spaces are supervisors and that its not the 95% who had **no** formal training that we are necessarily concerned about at Fermilab, but more the 5% who did have formal training. Also point out that most of the fatalities do deal with atmospheric hazards.

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## Dangers of Confined Spaces

- Personnel did not recognize a permit required confined space
- Personnel trusted their senses
- Personnel underestimated the danger
- Personnel did not stay on guard
- Personnel tried to rescue others

Thus the previous overhead leads use to conclude the following.

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## Hazards in Confined Spaces

- Hazardous Atmospheres
  - Oxygen Deficient and Enrichment
  - Flammable and Combustibles
  - Toxic Gases and Vapors



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- Oxygen - 20.8% in fresh air
  - Less than 19.5%
    - Leading cause of confined space deaths
    - Not always recognizable by entrant
    - Causes confusion and disorientation
    - Below 10% fatal in minutes
  - Greater than 23.0%
    - Promotes combustion
    - Minor physical symptoms
- Greater than 10% of the **Lower Explosive Limit** LEL
- The two toxic gases as measured by the MSA Five-Star Multigas monitor are Carbon Monoxide (alarm point is 25 ppm) and Hydrogen Sulfide (alarm point 5 ppm). Some of the other toxic gases at Fermilab include Acetylene, Carbon Dioxide, Methane, Natural Gas, Nitrogen, and Helium.

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## Other Hazards in Confined Spaces

- Electrical Shock
- Slippery and/or sloped surfaces
- Moving Equipment
- Poor illumination
- Flooding
- Restricted Access/Egress
- Falls
- Temperature Extremes

Are we bringing hazards into the confined space?

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## Signs and Symptoms of an Exposure to a Hazard

- Dizzy, Faint, Lightheaded
- Suddenly Feel Tired
- Nauseous
- Burning Eyes or Skin
- Itching, Sneezing
- Difficult Breathing
- Cool, Clammy Skin
- Face Suddenly Feels Flush
- Having Difficulty Focusing



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Keep in mind that as an entrant, many of the signs and symptoms are similar to that of the common cold. This is critical, because, as we will learn later, being able to recognize the signs and symptoms of overexposure is essential in performing self-rescue.

We have added one more for this year “Claims to understand Fermilab sculptures.”

## Hazard Control

- Isolation procedures

- Blanking/blinding

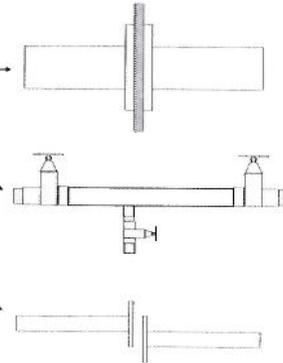
- Double block and bleed

- Line breaking

- Energy control

- LOTO (ZMS)

- Ventilation



Explain these hazard control methods. ZMS-Zero Mechanical State.  
Remember guarding and barriers.

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## Roles and Responsibilities

- The main players:
  - **Entry Supervisor**
  - **Authorized Attendant**
  - **Authorized Entrant**
  - **Fermilab Fire Dept.**
- The secondary players:
  - Subcontractors
  - Task Manager
  - Construction Coordinator
  - ES&H Section
  - Divisions/Sections and ES&H Groups

We break up the roles and responsibility into two separate groups the main players and the secondary players.

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## Entry Supervisor

- Definition
  - The person (such as the employer, foreman or Task Manager) responsible for determining if acceptable entry conditions are present where entry into a confined space is planned, for authorizing and overseeing entry operations, and for terminating entry.



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May serve as an Attendant or as an Authorized Entrant as long as they have been trained and equipped as required-----Duties may be passed.

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## Entry Supervisor - Continued

- Responsibilities
  - Determines whether a confined space is involved for each task under his/her supervision and complete any required permits.
  - Ensures the entry permit contains the required information before authorizing or allowing entry.
  - Ensures that the procedures, practices and equipment necessary for safe entry are in effect before allowing entry.

Other permits that may be necessary are an electrical permit, burn permit, etc.

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## Entry Supervisor - Continued

- Responsibilities
  - Ensures that employees who work as authorized Entrants and Attendants are trained.
  - Informs authorized Entrants of the required personal protective equipment (PPE) and informs on the proper use of the PPE.
  - Ensures at specified intervals throughout the access, that entry operations and conditions remain consistent with the terms of the entry permit.



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If you are unsure about the training credentials of anyone on the confined space entry team check the TRAIN database.

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## Entry Supervisor - Continued

- Responsibilities
  - Cancels the entry authorization and terminates entry when acceptable conditions are not present. Notifies Landlord and Functional Landlord.
  - Takes the necessary measures for concluding an entry operation and canceling the permit once the work authorized by the permit has been completed.
  - Notifies other affected personnel such as the local building/area manager, Fire Department, Landlord and Functional Landlord prior to entry.
  - May serve as attendant or entrant.



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Can the Entry Supervisor be the attendant? If so, can he also sign the permit?

The entry supervisor may also serve as the attendant or entrant, provided that they have received the necessary training and can adequately fulfill the duties and responsibilities of each position.

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## Authorized Attendant

- Definition
  - Any *trained* employee, subcontractor, or user who is stationed and remains outside of the confined space for the purpose of monitoring the Entrants and who performs all Attendant's duties.

The key words are that the attendant be **trained** and remains outside.

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## Authorized Attendant - Continued

- Responsibilities
  - Maintains an accurate count of all Entrants
  - Can recognize potential confined space hazards
  - Can recognize signs and symptoms of a hazardous exposure
  - Performs continuous air monitoring of space
  - Performs non-entry retrievals if trained on equipment



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### Testing Procedures

- Attempt to monitor without entry
- If entry is necessary to monitor use SCBA
- Test slowly
- Use the shortest sampling hose possible
- Beware of energized equipment
- **Test the entire space**

We will talk more about testing the air in confined spaces later in the program.

Performs non-entry retrievals if trained on equipment.

--From FESHM and OSHA Confined Space Standard 1910.146

To facilitate entry and non-entry rescues, retrieval systems or methods shall be used whenever an authorized entrant enters a permit space. This equipment typically includes a full body harness attached by a retrieval line to a mechanical retrieval device. All entrants are required to wear a full body harness, even if it is not attached to a retrieval line. Exceptions exist to this requirement if the use of retrieval equipment presents a greater hazard or would not contribute to the rescue of the entrant. Retrieval systems must be specified for each entry on the permit.

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## Authorized Attendant - Continued

- Responsibilities - Continued
  - Maintains effective and continuous contact with authorized Entrants
  - Ensures Entrant is protected from external hazards
  - Notifies the Fermilab Fire department in case of emergency
  - Performs no duties that might interfere with the Attendant's primary responsibility of monitoring the Entrants



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Contact with entrants may be with a phone, cell phone, radio, voice, hand signals, etc.

Examples of external hazards may include, equipment exhaust, etc.

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## **Authorized Attendant - Continued**

- **Responsibilities - Continued**
  - Orders Entrant(s) to evacuate the confined space immediately upon observing any of the following:
    - conditions which are not authorized by permit
    - detects signs/symptoms of hazard exposure
    - detects hazardous situation outside
    - the Attendant cannot effectively and safely perform all duties required
    - Serves as Bouncer in case of entry by unauthorized persons and notifies entrants and entry supervisor



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Takes corrective actions when unauthorized persons approach or enter a permit space while entry is underway.

- Warn unauthorized persons to stay away
- Communicate that they are to leave immediately if they have entered
- Inform entrants and entry supervisor of unauthorized persons

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## Authorized Entrant

- Definition
  - Any *trained* employee, subcontractor, or experimenter who enters a confined space.

An employee is considered **entered** when any part of the entrants body breaks the plane of the opening of the confined space. Again the key word is **trained**.

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## Authorized Entrant - Continued

- Responsibilities
  - Knows the hazards that may be encountered
  - Use safety equipment properly, this may include monitoring equipment
  - Maintain communication with Attendant
  - Alert Attendant whenever:
    - recognizes any warning sign and/or symptom of exposure to a dangerous situation
    - detection of a prohibited condition

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## Authorized Entrant - Continued

- Responsibilities - Continued
  - Exit from a confined space as quickly as possible whenever:
    - an order to evacuate is given by the Attendant
    - recognizes any warning sign and/or symptom of exposure to a dangerous situation
    - detection of a prohibited condition
    - an evacuation alarm is activated

If the attendant tells the entrant to evacuate, do so immediately and without delay.

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## Fermilab Fire Department

- Performs entry required rescues from confined spaces
- Annually practices making confined space rescues



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## Subcontractors

- The subcontractor shall provide the Fermilab Construction Coordinator/Task Manager (FCC/TM) with the following:
  - Written copy of their confined space program.
  - Training records for potential Entrants, Attendants, and Entry Supervisors.
  - Evidence that all air monitoring equipment is properly calibrated.
- Subcontractor shall follow all Fermilab safety policies.



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See contract documents for further information.

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## Subcontractors - Continued

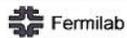
- Subcontractor shall provide their own PPE, such as lifelines, harnesses, respirators, tripods, ventilators.
- If the subcontractor can demonstrate that continuous forced air ventilation alone is sufficient to maintain safe entry conditions, then the job specific confined space entry procedures can be modified by the Landlord ES&H Department.

Unless specified in contract documents the subcontractor shall provide their own PPE, such as lifelines, harnesses, respirators, tripods and ventilators.

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## Subcontractors - Continued

- Each subcontractor who is retained to perform permit space entry operations shall:
  - Obtain available information regarding permit space hazards and entry operations from the FCC/TM.
  - Coordinate entry operations with FCC/TM when working along side Fermilab employees.
  - Prior to entry, inform FCC/TM of the specific permit space procedures the subcontractor will follow.



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Communication is the key!

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## Subcontractors - Continued

Subcontractor must also:

- Inform FCC/TM prior to entering the space
- Inform FCC/TM of any unanticipated hazards confronted during the confined space entry.
- Provide copy of permit, reclassification form or written certification once the work has been completed.



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May provide additional information to the landlord division/section for future confined space entries.

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## **Task Manager/ Construction Coordinator**

- Informs subcontractors of the confined space and that a permit system is required
- Appraise subcontractors of hazards
- Appraise subcontractors of any precautions or procedures
- Ensures that activities are completed in accordance with subcontractor's confined space entry program.



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The Task Manager/ Fermilab Construction Coordinator is to ask the subcontractor to provide:

- Written Program
- Training Records
- Calibration Record of Air monitoring equipment

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## **Task Manager/ Construction Coordinator - Continued**

- Coordinate entry operations
- Notifies Fire Department, Landlord and Functional Landlord ES&H Departments prior to entry.
- Debrief the subcontractor at the conclusion

Debriefing the subcontractor at the conclusion of the confined space entry also helps to gain additional insight into the confined space hazards and potential changes within the space. Aids in maintaining an accurate confined space database.

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## ES&H Section

- Provides a uniform confined space training program
- Provide expertise to Divisions/Sections
- Provides a supply of signs to denote confined spaces
- Maintains lab-wide confined space database on the [ES&H Web-page](#)



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As mentioned earlier, the MSA 5-Star monitors for LEL, CO, H<sub>2</sub>S, and O<sub>2</sub>. The instruments are calibrated prior to each use by the user or an ES&H representative.

Show confined space database on ES&H web-page link (if possible).

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## Divisions/Sections and ES&H Group

- Implements Confined Space Entry program.
- Develops confined space entry notification methods and documents Landlord ES&H Department's signature approval requirements.
- Maintain inventory of confined spaces for which they are landlord on the **ES&H Web-page**.
- Provide Fermilab specific training (i.e., radiation)



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Other training may also include controlled access, ODH, etc.

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## **Divisions/Sections and ES&H Group - Continued**

- Provide all available information on confined space to be entered to the Confined Space Entry Team, Task Manager and Construction Coordinator
- Ensure that the confined spaces are labeled
- Annual review of confined space program and permits
- Maintains and calibrates monitoring equipment

## Entry Permits

- Entry Supervisor/Task Manager shall ensure the completion of the entry permit. Complete as team.
- The duration of permit is for the length of the job, so long as the conditions remain the same
- In the event that unacceptable conditions arise, the Attendant will order an evacuation and inform the Entry Supervisor. The permit will be void and a re-evaluation will be required by the division/section senior safety officer or designee



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Click on the Entry Permit link and show and review permit.

The key is to think of the permit as a tool. I strongly encourage the permit be completed by the confined space entry team.

If the job is anticipated to last longer than one day be sure to indicate that on the permit.

Other Permit Thoughts:

- How to summon rescue and emergency services - Communication Equipment
- Test Radio
- Expiration date of permit
- Permit cancellation signature
- ID numbers, Entry Supervisor and Details

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## Entry Permits - Continued

- All significant identifiable hazards shall be listed
- If there is a shift change or multiple day jobs or change in Entrants/Attendants, a roster of Entrants/Attendants should be attached to the permit
- Air monitoring records must be recorded on the permit
- All canceled confined space permits shall be retained for one year by the D/S making the entry



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Show and review proper procedures for filling out permit.

Show the attached forms for additional Entrants and Attendants and monitoring records.

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## Reclassification Form

- A Permit-Required Confined Space may be reclassified as a Non-Permit Confined Space by an individual trained in confined space entry after the following provisions have been met:
  - No actual or potential atmospheric hazard exists (determined following initial atmospheric testing).
  - All other recognized serious safety or health hazards must be eliminated without entry into the space.

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## Reclassification Form - Continued

- The basis for determining that all hazards have been eliminated must be documented using the Confined Space Reclassification Form from the ES&H Website.
- All completed confined space reclassification forms shall be retained by the division/section making the entry for a minimum of one (1) year.
- The Landlord and Functional Landlord ES&H Departments and Fire Department shall be notified prior to entry.

Show and review proper procedures for filling out Reclassification form.

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## Key Program Requirements

- Use the permit and reclassification forms as planning tools
- Identify and evaluate potential hazards
- Manage the hazards
- Use only trained personnel
- Always utilize an attendant under permit entries
- Establish communications with entrants

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## Key Program Requirements

- Continuously monitor the atmosphere
- Record monitor readings
- Observe for changing conditions
- Develop an emergency plan
- Post the permit
- Review program on an annual basis

Remember to record the readings at least once an hour.

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## Help/Assistance

- Contract
- Hazard Analysis Form
- Division/Section ES&H Groups
- ES&H Section Web-Page: [www-esh.fnal.gov](http://www-esh.fnal.gov)
  - FESHM Chapter 5063
  - Confined Space Flowchart
- ES&H Section

If the confined space entry encompasses the entire job than a Hazard Analysis would not be necessary. If however, the confined space job is part of a much larger project, the projects hazard analysis should merely reference the permit.

Show chapter and flowchart by pointing and clicking on links.

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## Summary

- We defined confined spaces
- Hazards make the confined spaces a permit required
- Discussed Roles and Responsibilities
- The importance of a fully completed Entry Permit or Reclassification Form
- Where to turn for help and assistance

Are there any additional questions?