Confined Space
(OSHA 29CFR 1910.146)

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Agricultural Confined Spaces
“any space having a limited means of egress, which is subject to the accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere. Confined or enclosed spaces include, but are not limited to, storage to, storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels, pipelines, and open top spaces more than 4 feet deep such as pits, tubs, vaults, and vessels."
What is a “confined space”?

• Space large enough and so configured that a person can bodily enter and perform assigned task.
• A space that has limited or restricted means of entry or exit.
• It is not intended for continuous human occupancy.
What is a “permit required confined space”? 

- A confined space plus one or more of the following:
  - Contains or has potential to contain a hazardous material (atmosphere).
  - Contains a material that has the potential for engulfing or entrapment.
  - Has internal configuration with inwardly converging walls or floor which slopes downward to a smaller cross section.
  - Contains any other recognized serious safety or health hazard.
Entry into Confined Spaces may be necessary to periodically perform the following functions:

- Construction
- Maintenance
- Removal
- Inspection
- Cleaning
- Repairing
Examples of Confined Spaces Are:

- Vessels
- Tanks (septic, etc.)
- Pipes (sewer, drain, utility, etc.)
- Vaults
- Pits
- Silo’s
- Trenches
- Tunnels
- Storage Bins
- Manholes
- Bore holes
What is an “agricultural confined space”?

• Any space found in an agricultural workplace that:
  – was not designated or intended as a regular workstation
  – has limited or restricted means of entry or exit
  – associated with potential physical and/or toxic hazards to workers who intentionally or unintentionally enter the space.
Confined Spaces in Agriculture:

• Grain and Feed Storage Facilities
  – Corrugated steel bins
  – Steel Tanks or silos
  – Concrete silos
  – Flat grain storage buildings
  – Wooden feed storage structures
  – Sumps / tunnels under storage facilities
  – Grain Driers
Confined Spaces in Agriculture:

• Forage Storage Structures
  – Concrete stave and poured silos
    • (including oxygen limiting)
  – Wooden silos
  – Steel / ceramic – oxygen limiting silos (Harvestore®)
  – Horizontal or bulk silo
Confined Spaces in Agriculture:

• Manure Storage Structures
  – Below floor storage pits
  – Sump pits
  – Above ground storage tanks (Slurrystore®)
  – Ponds, Lagoons, and open pits
  – Manure digesters
Confined Spaces in Agriculture:

- Agricultural Transport Vehicles
  - Grain Transport
    - trucks, gravity bed wagons, auger cart
  - Manure transport vehicles
    - tanks and applicators
  - Sprayer and chemical transport vehicles
  - Food grade bulk transport vehicles
Confined Spaces in Agriculture:

• **Agricultural Equipment**
  – Combine separation area
  – Bale chamber in hay packaging equipment
  – Forage and silage dump wagons
  – Feed grinder / mixers
  – Feed mixer wagons, mixer machines, tub grinders
  – Cabs / operator enclosures
    • used to protect operators from toxic chemicals
Confined Spaces in Agriculture:

- Food Processing and Storage Equipment
  - Storage tanks, bins, and silos
  - Fermentation vessels (pickling or wine vats)
  - Environmentally controlled fruit and vegetable storage units
  - Bulk liquid storage (milk, juice)
Confined Spaces in Agriculture:

- Other
  - Trenching and other on-farm excavations
  - Wells, cisterns, septic tanks
  - Culverts / Drainage
  - Fuel Storage tanks
  - Fertilizer storage tanks
  - Conveyor enclosures
Confined Space Hazards

Atmospheric

• **Oxygen Deficiency or Surplus** – Either too much oxygen or too little
  – Oxygen deficiency (19.5% or less)
  – Oxygen enrichment (23.5% or higher)

• **Toxic Gases, Vapors or Fumes** – Hydrogen Sulfide, Carbon Monoxide, etc...

• **Flammable/Explosives Hazards** – This can include gases and vapors but may also include dust and particulates when they are in concentration large enough to ignite
Hazardous levels

Oxygen levels and Concentration levels of typical gases potentially present in a confined space

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Alarm Concentrations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>&lt;19.5% or &gt;23%</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>35 ppm</td>
</tr>
<tr>
<td>Carbon Dioxide</td>
<td>5000 ppm</td>
</tr>
<tr>
<td>H₂S</td>
<td>10 ppm</td>
</tr>
<tr>
<td>Nitrogen Dioxide</td>
<td>3.0 ppm</td>
</tr>
<tr>
<td>Chlorine</td>
<td>0.5 ppm</td>
</tr>
<tr>
<td>Methane</td>
<td>&gt;10% LEL</td>
</tr>
<tr>
<td>Ozone</td>
<td>0.1 ppm</td>
</tr>
<tr>
<td>Combustible Gases</td>
<td>10% LEL</td>
</tr>
<tr>
<td>Particulates</td>
<td>&gt;10% LEL</td>
</tr>
</tbody>
</table>
Confined Space Hazards

Physical

- **Engulfment** – Grain, dirt, liquids, etc... that have the potential of burying a person

- **The Nature and configuration of the space** – Sloping walls or floors that may trap someone

- **Moving parts** – shafts, couplings, gears, belts, motors, mixers,
Confined Space Hazards

Physical

- **Energy Hazards** – Heat, Electricity or Stored energy. *Lockout/Tagout is essential for all energy sources.*
- **Noise** – Confined Spaces may amplify noise. Proper hearing protection should be provided.
- **Falling objects** – Especially with an attendant overhead, with other workers possibly working above, Proper PPE should be worn.
- **Thermal Conditions** – Extreme heat or cold
Confined Space Hazards

Other hazards

- **Critters** – Confined spaces can attract snakes, spiders, insects, birds, nocturnal animals, etc...
- **Psychological** – Includes claustrophobia, fear of isolation, fear of the dark, panic disorders, etc...
Management Practices for Confined Spaces

• Identify all confined spaces at all facilities.
• Make sure all employees and personnel know what areas are considered confined spaces.
• Label and mark permit required confined spaces. Prevent unauthorized entry
Management Practices for Confined Spaces

• Identify all personnel who will be authorized to enter the confined spaces and train them in all the procedures inherent in confined space work.

• Make sure that all required Personal Protective Equipment is available for all authorized personnel when they should need it.
Permit Required Confined Spaces
Identify permit required confined spaces

• Confined Space:
  – Space large enough and so configured that a person can bodily enter and perform assigned task.
  – A space that has limited or restricted means of entry or exit.
  – It is not intended for continuous human occupancy.

• Permit Required Confined Space (plus one or more of the following):
  – Contains or has potential to contain a hazardous material (atmosphere).
  – Contains a material that has the potential for engulfing or entrapment.
  – Has internal configuration with inwardly converging walls or floor which slopes downward to a smaller cross section.
  – Contains any other recognized serious safety or health hazard.
OSHA’s Confined Space Decision Tree can help to determine if the space requires a permit before entry.
OSU EHS entry permit

A permit must be filled out and submitted to OSU Environmental Health and Safety prior to entry of a designated “permit required” confined space.

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**CONFINED SPACE ENTRY PERMIT**

(Must be Posted at Entrance to Permit Required Confined Space)

<table>
<thead>
<tr>
<th>GENERAL INFORMATION</th>
<th>PERSONNEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>Entry Supervisor Attendant(s)</td>
</tr>
<tr>
<td>Entry Purpose</td>
<td>Entrant(s)</td>
</tr>
</tbody>
</table>

**ADDITIONAL PERMITS REQUIRED**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot Work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lockout / Tagout</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line Breaking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (Explain)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**COMMUNICATIONS**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portable Radio / Phone</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand Signals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unaided Voice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (Explain)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EMERGENCY SERVICES**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Name</th>
<th>Telephone / Radio</th>
</tr>
</thead>
</table>

**HAZARD EXPECTED**

<table>
<thead>
<tr>
<th>Hazard Type</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engulfment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Configuration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ignition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oxygen Deficiency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explosive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CONTROL MEASURES**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isolation (Chemical, Utility, Outlets, etc.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lockout / Tagout / Tryout</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line Disconnected</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line Blanked / Capped</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PROTECTIVE EQUIPMENT**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal Protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Safety Shoes / Boots</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fire Extinguisher</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Sparking Tools</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explosion-Proof Lighting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other (Explain)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ear Muffs / Plugs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respirators</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Face / Eyes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Head</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tripod Mechanical Winch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GFCI (Ground Fault)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**ATMOSPHERIC TESTING**

<table>
<thead>
<tr>
<th>Contaminant</th>
<th>Acceptable Level</th>
<th>Time(s):</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>19.5-23.5%</td>
<td></td>
</tr>
<tr>
<td>Explosive (Gas / Vapor)</td>
<td>&lt;10% LEL</td>
<td></td>
</tr>
<tr>
<td>Hydrogen Sulfide</td>
<td>&lt;10 ppm</td>
<td></td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>&lt;35 ppm</td>
<td></td>
</tr>
</tbody>
</table>

**ENTRY AUTHORIZATION / CANCELLATION**

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Name</th>
<th>Date</th>
<th>Signature</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authorization</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Send Copies to:**

EHS (Fax 292-6404)
Department File
OSU EHS
Safety Department Responsibilities

• Formulate and manage the confined spaces program
• Maintain a space inventory
• Maintain a list of “Authorized Personnel”
• Maintain copies of space permits
• Direct the confined space training program
• Maintain rescue equipment
• Coordinate contract activities
Entry Team

- Entry supervisor
- Authorized person
- Attendant
- Entrant
- Rescuer
Entry Supervisor Responsibilities

• Conducts pre-entry briefing
  – To discuss the job that needs to be done, and
  – To review the potential hazards
• Ensure that permits are completed, posted and maintained
• Oversee all necessary confined space activity
• Ensure that personnel are evacuated when necessary
• Ensure that all necessary equipment is returned to its proper location after the work is completed
The Authorized Person and the Entry Supervisor is often the same person

- Familiarize themselves with characteristics of spaces
- Verify that all hazards and sources of energy have been controlled in the space
- Ensure that confined space permit is posted
- Rescind any permit for noncompliance with permit requirements
Attendant Responsibilities

- Attend pre-entry briefing
- Know the hazards of the space
- Conducts air quality measurement/records results
- Control access to the space/maintain head count
- Maintain communication with entrants
- Know the personalities of the entrants
- Shall not enter the space for rescue
- Order an evacuation, when required
- Summon emergency services
- Assist rescue efforts from outside the space
Entrant Responsibilities

- Attend the pre-entry meeting
- Know the hazards of the space
- Use appropriate equipment properly

Exit the space if:
- An alarm is activated
- Communication is lost
- Unknown exposures are encountered, or
- Ordered to do so
Rescuer Responsibilities

• Understand the hazards of the space
• Be certified in emergency first aid and CPR
• Understand appropriate entry procedures
• Know how to use rescue equipment
• Practice confined space rescues at least annually
PPE and other equipment for Permit Required Confined Space

- Harnesses
- Retrieval lines
- Chemical protective clothing
- Welding apron/sleeves
- Respirators
- Gloves
- Safety glasses
- Hard hats
- Safety Shoes
Atmospheric Testing

• Hazards must be tested in this order:
  – Oxygen content
  – Combustibility/flammability
  – Toxic atmospheres

• Entrants are allowed to observe the monitoring
Atmospheric Testing

- Oxygen levels can affect the toxic sensors
- Measure around the opening
- Measure at different levels & elevations
  - Chemicals Stratify Based upon their weight
  - Oxygen levels can be displaced by gases & chemicals e.g., carbon monoxide, carbon dioxide, hydrogen sulfide, halon, etc.
Reasons for Space Ventilation

• Maintain oxygen levels above 19.5%
• Reduce toxic gases and vapors at acceptable levels
• Remove excess heat and improve comfort

Two exhaust blowers and one supply air recommended. Vent 10 to 15 minutes and re-monitor before entering

(Keep hoses as straight as possible)
Lockout / Tagout

• Identify, implement and monitor all lockout procedures both inside the confined space as well as those outside the confined space that could potentially have an effect on the conditions inside the confined space and/or on the attendant(s) outside the confined space.
Permit Required Confined Space Entry Step-by-Step

• Determine if planned work will require employees to enter a permit-required or non-permit-required confined space.
  – Consult OSU Confined Space Program for definitions, requirements, and questions about confined space

• Should work require entry into a permit-required confined space, contact EHS and request Confined Space Entry Permit.

• Designate the appropriate trained personnel who will be involved in the work operations. Review entry requirements with entrants and attendants.
Permit Required Confined Space Entry
Step-by-Step (cont.)

• Gather equipment as specified on the permit for the type of work to be performed.

• Ensure that all preparatory measures listed on the permit are completed. These include
  – Safe atmosphere monitoring
  – Lockout / Tagout, and/or Deactivation
  – Hot work permit
  – Explosion proof lighting
  – Communications devices
  – Personal Protective Equipment (PPE)

• Obtain permit authorization from EHS and proceed with entry operations.
Contact Information:

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Columbus, Ohio 43210-1057
Email: mcguire.225@osu.edu
Phone: 614-292-0588
Fax: 614-292-9448

www.agsecurity.osu.edu