Confined Space Program
Hazard Assessments
Permit-Required verses Non-Permit
General Industry vs Construction

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Power Plant Operations
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General Industry
Confined Space Resources

- OSHA Standard 1910.146 – Permit-Required Confined Spaces
- The Preamble To Final Rule of the OSHA Standard 1910.146
- 97 OSHA Letters Of Interpretations (LOI)
- OSHA Compliance Directive Number CPL 02-00-100 for Permit-Required Confined Spaces
- Reviewed FOMIS
- Contacted J.J. Keller (Compliance Safety Assistance Company)
- Discussions with OSHA Area Offices
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 (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.); and
- Is not designed for continuous employee occupancy
Permit-Required Confined Space

- A confined space that has **one** or more of the following characteristics:
  - a. Contains or has a potential to contain a hazardous atmosphere;
  - b. Contains a material that has the potential for engulfing an entrant;
  - c. 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
  - d. Contains any other recognized serious safety or health hazard.
Contains Any Other Recognized Serious Safety or Health Hazard

- What does OSHA mean with this statement?

**Answer:** OSHA makes reference that a serious safety or health hazard exposure within a confined space refers to the employee acquiring an acute illness or immediately disabling injury that could impair his or her ability to escape unaided (self-rescue).

*(See LOI 12-9-03, Compliance Directive Number CPL 02-00-100, and Preamble To Final Rule – Summary And Explanation Of The Standard)*
Categorizing the Work Space

- Space large enough to bodily enter &;
- Limited or Restricted entry or exit &;
- Not designed for continuous employee occupancy.

Not a confined Space

**Confined Space**

- Hazardous Atmosphere
  - Or
  - Engulfment Hazard
    - Or
    - Configuration Hazard
      - Or
      - Any Other Recognized Serious Hazard

**Permit**
- Required
  - Yes
  - No

**Non-Permit**
- Confined Space
  - Yes
  - No
Evaluating Confined Space Hazards

- Employers are required to initially evaluate their workplaces and determine if there are any permit required confined spaces.
- We developed a confined space hazard assessment form that identifies the potential of 14 different types of hazards for confined spaces in meeting the initial evaluation requirement.
- A team of employees were then assigned to evaluate each confined space to determine if these hazards are present or have the potential to be present.
- The same team of employees then determine if the hazards can be “eliminated” or just “controlled”.
## Confined Space Hazard Assessment

<table>
<thead>
<tr>
<th>Confined Space No.:</th>
<th>Confined Space Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location/BlDG:</td>
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</table>

<table>
<thead>
<tr>
<th>Date Inspected:</th>
<th>Hazard Assessment Conducted By:</th>
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<tbody>
<tr>
<td>Date Entered:</td>
<td></td>
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<tr>
<td>Date Revisited:</td>
<td></td>
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</tbody>
</table>

**Typical Entry Purpose:**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>Hazard</th>
<th>Measures to Eliminate or Control</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mechanical</td>
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<td></td>
<td></td>
<td>Engulfment</td>
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<td></td>
<td></td>
<td>Entrapment</td>
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<tr>
<td></td>
<td></td>
<td>Atmospheric</td>
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<tr>
<td></td>
<td></td>
<td>Gas, Caustic Corrosive, Biohazard</td>
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<td></td>
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<td>Dust</td>
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<td></td>
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<td>Temperature Extremes</td>
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<td>Excessive Noise</td>
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<td></td>
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<td>Slick / Wet Surfaces</td>
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<td>Fall Hazards</td>
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<td></td>
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<td>Falling Objects</td>
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<td></td>
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<td>Lack Of Lighting</td>
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<td></td>
<td></td>
<td>Electrical Shock</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Work-Created Hazards</td>
<td></td>
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</tbody>
</table>
Hazards Within Your Confined Space Will Classify Your Type of Confined Space

- If a confined space hazard is “controlled”, the confined space will be classified as Permit-Required.

- If all confined space hazards are “eliminated”, the confined space will be classified as Non-Permit.
Confined Space Hazards

1. Mechanical
2. Engulfment
3. Entrapment
4. Atmospheric Gas, Caustic, Corrosive, Bio-Hazard
5. Dust
6. Temperature Extremes
7. Excessive Noise
8. Slick / Wet Surfaces
9. Fall Hazards
10. Falling Objects
11. Lack of Lighting
12. Electrical Shock
13. Work Created Hazards
Mechanical - Power & equipment with moving parts creating injury.

- **Note:** Compliance with OSHA's Lockout Tagout Standard is considered to “eliminate” electro-mechanical hazards. *(See LOI 11-15-93 & 12-2-02)*
Engulfment - Covered, buried, or smothered by a liquid or a flowable materials such as fly ash, coal, water, sand, or dirt for example, creating suffocation.

- **CONTROL** – LOTO

- **NOTE:** Compliance with the requirements of the Lockout/Tagout Standard is not considered to eliminate hazards created by flowable materials such as steam, natural gas, water and other substances that can cause hazardous atmospheres or engulfment hazards in a confined space. The confined space will still be considered permit-required with these conditions. If the confined space has the potential to introduce flowable material hazards where the employee could become engulfed, the only way to eliminate these hazards is by the use of the techniques described in the definition of the term "isolation". The definition of the term "isolation" is in paragraph (b) of 29 CFR 1910.146. The techniques listed in the definition are blanking, blinding, misaligning or removing sections of lines or pipes and a double block and bleed system. Simply locking or tagging out a piping system, pursuant to §1910.147 Lockout / Tagout Standard, is not appropriate for fluid isolation purposes. **(See LOI 8-28-95 & 8-6-07)**

- **NOTE:** To drain existing flowable materials (ie: fly ash, coal) eliminates those materials from causing an engulfment hazard.
Engulfment Hazard
**Entrapment** - By converging walls or tapered/sloped floors by slipping or falling into a space too tight to escape

- **CONTROL** - PPE (fall protection)

- **NOTE:** A temporary floor that is installed to carry the anticipated total load of the authorized entrants and would-be rescuers without moving, can be a method of hazard elimination for entrapment which could be employed to meet the requirements of 1910.146(c)(7).

- The use of fall protection (harness and restraint line) in lieu of a temporary floor would not be a basis to reclassify the space because they (harness and restraint line) are a form of hazard control rather than hazard elimination. Engineering controls such as proper hand railings and or properly built scaffolding is considered a form of elimination. *(See LOI 10-27-95)*
Atmospheric –

- Flammable gas, vapor, or mist, levels high enough to cause a fire or explosion.
- Toxic gas, vapor, mist, or steam levels high enough to cause illness, suffocation, or death if inhaled.
- Oxygen levels below what you need to breathe or levels above that create a serious fire or explosion risk

**CONTROL** - purge/clear/ventilate, LOTO, intrinsically safe electrical equipment, GFI’s, testing

**NOTE**: The confined space atmosphere shall be tested by a calibrated direct reading instrument to verify if any of the above atmospheric hazards exist. If there is no presence of the above atmospheric hazards inside the confined space and there is no possible way of introducing these atmospheric hazards inside the confined space, then the atmospheric hazards will be classified as “eliminated”.
Potential Atmospheric Hazards in Confined Spaces

- **Oxygen Deficiency or Enrichment**
  - $<19.5\%$ or $>23.5\%$ oxygen concentration

- **Combustibles**
  - Methane
  - Hydrogen
  - Acetylene
  - Propane
  - Gasoline fumes

- **Toxic Materials**
  - Carbon Monoxide
  - Hydrogen Sulfide
  - Welding fumes
  - Corrosives Fumes
Oxygen Deficient Atmospheres

19.5 %  Minimum acceptable oxygen level.
15 - 19%  Decreased ability to work strenuously. Impair coordination. Early symptoms.
12-14%  Respiration increases. Poor judgment.
10-12%  Respiration increases. Lips blue.
6-8%  8 minutes - fatal, 6 minutes - 50% fatal 4-5 minutes - possible recovery.
4-6%  Coma in 40 seconds. Death!
Oxygen Enriched Atmospheres

- Oxygen level above 23.5%.
- Causes flammable and combustible materials to burn violently when ignited.
- Never use pure oxygen to ventilate.
- Never store or place compressed tanks in a confined space.
Flammability

- Combustibles <10% LFL/LEL
  - Methane
  - Hydrogen
  - Acetylene
  - Propane
  - Gasoline fumes
Flammable Atmosphere

Flammable range

100% air (oxygen) 100% fuel

0% fuel 0% air

LEL UEL

Lean Rich

Flammable range
Flammable Atmosphere

0% fuel

100% air (oxygen)

5% Methane

15%

0% air

100% fuel
Flammable Atmosphere

100% air (oxygen)  100% fuel

2.5%  99%

0% fuel  0% air

Acetylene
Gas, Caustic, Corrosive, Bio-Hazard:

Non-flammable gas, vapors, mists or materials that may cause serious injury or death.

- **CONTROL** - purge/clear/ventilate, LOTO, testing, PPE
- **Remember**: OSHA makes reference that a serious safety or health hazard exposure within a confined space refers to the employee acquiring an acute illness or immediately disabling injury that could impair his or her ability to escape unaided (self-rescue).
Hydrogen Sulfide

- Decomposition of materials. Human waste.
- Rotten egg odor at low concentrations.
- Possibly no warning at high concentrations.

<table>
<thead>
<tr>
<th>PPM</th>
<th>Effect</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 ppm</td>
<td>Permissible Exposure Level</td>
<td>8 Hours</td>
</tr>
<tr>
<td>50 - 100</td>
<td>Irritation - eyes, throat, and respiratory areas</td>
<td>1 Hour</td>
</tr>
<tr>
<td>200 - 300</td>
<td>Significant Irritation</td>
<td>1 Hour</td>
</tr>
<tr>
<td>400 - 600</td>
<td>Unconsciousness, Death</td>
<td>1/2 - 1 Hour</td>
</tr>
<tr>
<td>1000</td>
<td>Unconsciousness, Death</td>
<td>Minutes</td>
</tr>
</tbody>
</table>
Carbon Monoxide

- Odorless, Colorless Gas.
- Combustion By-Product.
- Quickly collapse at high concentrations.

<table>
<thead>
<tr>
<th>PPM</th>
<th>Effect</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>50 ppm</td>
<td>Permissible Exposure Level</td>
<td>8 Hours</td>
</tr>
<tr>
<td>200</td>
<td>Slight headache, discomfort</td>
<td>3 Hours</td>
</tr>
<tr>
<td>600</td>
<td>Headache, discomfort</td>
<td>1 Hour</td>
</tr>
<tr>
<td>1000</td>
<td>Pounding of heart, dizziness</td>
<td>1 Hour</td>
</tr>
<tr>
<td>2000-2500</td>
<td>Unconsciousness, dangerous to life</td>
<td>30 mn</td>
</tr>
</tbody>
</table>
MSA Altair 5X AIR MONITORS

- Bump Test – daily when using
- Calibration - when bump test failed or once per month
- MSA Galaxy Calibration Station
MSA Altair 5X AIR MONITORS

- Air Monitor Pump Rate
- Allow 1 second for every 1 foot of sample tube line for the correct amount of time needed when air monitoring a confine space.
- Example if you had a 10 ft. sample line on the air monitor you need to wait at least 10 seconds for a valid test result.
Testing The Atmosphere

Test all areas of a confined space.

- Top, Middle, Bottom

- Methane is lighter than air.
- Carbon Monoxide is the same as air.
- Hydrogen Sulfide is heavier than air.
- Oxygen Deficiency.
<table>
<thead>
<tr>
<th></th>
<th>OSHA General Industry PEL TWA</th>
<th>Altair 5X Alarm Settings</th>
<th>Altair 5X Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen Minimum</td>
<td>19.5 %</td>
<td>19.5 %</td>
<td>0 %</td>
</tr>
<tr>
<td>Oxygen Maximum</td>
<td>23.5 %</td>
<td>23 %</td>
<td>30 %</td>
</tr>
<tr>
<td>Flammability</td>
<td>&lt; 10 % LEL/LFL</td>
<td>10 % LEL/LFL</td>
<td>0 – 100 %</td>
</tr>
<tr>
<td>Carbon Monoxide (CO)</td>
<td>50 PPM</td>
<td>25 PPM</td>
<td>0 – 2000 PPM</td>
</tr>
<tr>
<td>Hydrogen Sulfide (H2S)</td>
<td>20 PPM</td>
<td>10 PPM</td>
<td>0 – 200 PPM</td>
</tr>
<tr>
<td>Carbon Dioxide (CO2)</td>
<td>0.5 % by volume or 5000 ppm</td>
<td>0.5 % by volume or 5000 ppm</td>
<td>0 – 10 % by volume or 100,000 PPM</td>
</tr>
<tr>
<td>Ammonia (NH3)</td>
<td>50 PPM</td>
<td>25 PPM</td>
<td>0 – 100 PPM</td>
</tr>
</tbody>
</table>
**Dust** - The existence or potential of suspended dust levels high enough to cause explosion, immediate illness, suffocation, or death if inhaled. In addition to this, OSHA is concerned that heavy amounts of dust in the air can create vision impairment affecting your ability to escape unaided.

- **CONTROL** - purge/clear/ventilate, PPE
**Temperature Extremes** - Heat creating potential for burns, heat exhaustion, heat stroke etc. Cold creating potential for frostbite, hypothermia etc.

- **CONTROL** – purge/clear/ventilate, cool, PPE

- **NOTE:** When work inside a confined space involves heat/cold stress, the confined space will be permit-required. *(See LOI 11-15-99)*
Excessive Noise - Noise that could damage hearing or prevent communication between the entrant and attendant.

- **CONTROL** - PPE

- **NOTE:** Excessive noise inside a confined space requires the confined space to be permit required.

*(See Preamble To Final Rule – Summary And Explanation Of The Standard)*
Slick Wet Surfaces - Slips, trips & falls caused by wet/slippery surfaces.

- **CONTROL** - PPE, clean, drain

- **NOTE** - Proper cleaning (resulting in no slippery surfaces) is considered elimination.
**Fall Hazards** - Personnel exposed to a potential fall hazard of 4 feet (General Industry), 6 feet (Construction) or more.

- **CONTROL** = PPE (fall protection)

- **NOTE:** The use of fall protection equipment is a form of hazard control rather than hazard elimination. Engineering controls such as proper hand railings and or properly built scaffolding is considered a form of elimination. *(See LOI 10-27-95)*
**Falling Objects** - Exposure to material that may fall onto an entrant creating a serious safety / health hazard.

- **CONTROL** – PPE

- **NOTE**: Complete removal (ie: deslag, clean) of potential falling materials is considered elimination.
Lack of Lighting - Inadequate lighting causing poor visibility causing slips, trips and falls.

- **CONTROL** = illuminate

- **NOTE:** Proper illumination of the area is considered elimination.
**Electrical Shock** - Electrical and/or mechanical equipment or processes that may create electrical shock, electrocution or arc flash hazards.

- **CONTROL** = PPE,

- **NOTE** = Compliance with OSHA's Lockout Tagout Standard is considered to “eliminate” electro-mechanical hazards. *(See LOI 11-15-93 & 12-2-02)*
Work Created Hazards - Reference the hazards listed above that may be created while working in the confined space.

- Processes that may cause a fire or explosion resulting in serious safety or health hazard exposure (welding, cutting, grinding etc...)

- **CONTROL** = Hotwork Permit

- **NOTE:** Always consider any processes involving equipment, tools, materials etc. that may cause serious safety / health hazards
Permit-Required Confined Space Program

- Implement necessary measures to prevent unauthorized entry;
- Identify and evaluate permit space hazards before allowing employee entry;
- Test atmospheric conditions in the permit space before entry operations and monitor the space during entry;
- Perform appropriate testing for the following atmospheric hazards in this sequence: oxygen, combustible gases or vapors, and toxic gases or vapors;
- Establish and implement the means, procedures and practices to eliminate or control hazards necessary for safe permit space entry operations;
- Identify employee job duties;
- Provide and maintain, at no cost to the employee, personal protective equipment and any other equipment necessary for safe entry and require employees to use it;
Permit-Required Confined Space Program

- Ensure that at least one attendant is stationed outside the permit space for the duration of entry operations;
- Coordinate entry operations when employees of more than one employer are working in the permit space;
- Implement appropriate procedures for summoning rescue and emergency services, and preventing unauthorized personnel from attempting rescue;
- Establish, in writing, and implement a system for the preparation, issue, use and cancellation of entry permits;
- Review established entry operations annually and revise the permit space entry program as necessary; and
- Implement the procedures that any attendant who is required to monitor multiple spaces will follow during an emergency in one or more of those spaces.
Confined Space Entry Permit Requirements

- Identification of space.
- Purpose of entry.
- Date and duration of permit.
- A list of authorized entrants.
- Names of current attendants and entry supervisor.
- A list of actual or potential hazards in the permit space.
- A list of measures to isolate the permit space and eliminate or control the hazards.
- The acceptable entry conditions.
- The results of initial and periodic air monitoring tests with the person(s) initials or signature performing the tests including date and times.
- The rescue and emergency services available and the means to summon them.
- Communication procedures for attendants and entrants.
- Any special required equipment (such as respirator, communications, alarms, etc.).
- Any other necessary information given the circumstances of the confined space to ensure employee safety.
- Any additional permits (such as for hotwork).
**Rescue Services** – may be provided by off-site service and/or on-site employees. The employer;

- Needs to evaluate rescue related tasks, equipment, and their ability to function appropriately for rescue.
- Ensure rescue services are capable of responding to an emergency in a timely manner.
- Inform the hazards they may confront.
- Provide access to all permit confined spaces so appropriate rescue plans can be developed.
- Ensure employee rescue services are trained in basic First-Aid/CPR.
- Ensure that employee practice rescue exercises are performed yearly and that rescue services are provided access to permit spaces so they can practice rescue operations.

*OSHA prefers non-entry rescue with retrieval systems unless this equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant.*
Confined Spaces in Construction

- Construction Standard Release on May 4, 2015
- Standard went into effect on August 3, 2015.

- Subpart AA of 29 CFR 1926
- Standard Numbers 1926.1200 to 1926.1213
Construction Activities

When to Follow the Construction Standards?

- OSHA's regulations define "construction work" as "construction, alteration, and/or repair, including painting and decorating." at 29 CFR 1926.32(g) in following the Construction Standards.

- See Letter of Interpretations (LOI) 8-11-94 and 11-18-03
Maintenance Activities

When to Follow the General Industry Standards?

- Unlike construction work, there is no regulatory definition for "maintenance," nor a specified distinction between terms such as "maintenance," "repair," or "refurbishment" in following the General Industry Standards – OSHA LOI 11-18-03.

- In OSHA's directive on the General Industry confined space standard, the Agency stated that maintenance involves "keeping equipment working in its **existing** state, preventing its failure or decline."

- OSHA LOI 2-1-99.
New Confined Space Construction Standard 1926 Subpart AA

- OSHA used the *General Industry* confined space standard template to provide the basics in creating the new *Construction* confined space standard. However, there are more definitions and greater descriptive detailed informational requirements throughout the standard along with some new key differences.
Construction Standard Key Differences

- More detailed provisions requiring **coordinated activities** when there are multiple employers at the worksite.
Construction Standard Key Differences

- Requiring a **competent person** to evaluate the work site and identify confined spaces, including permit-required confined spaces.
- Re-classify a permit-required confined space to a non-permit confined space.
- “Competent Person” means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them.
Construction Standard Key Differences

- Requiring **continuous atmospheric monitoring** whenever possible.

- The atmosphere within the space must be continuously monitored unless the entry employer can demonstrate that equipment for continuous monitoring of the atmospheric hazard is not commercially available or you can demonstrate periodic monitoring is sufficient for the safety of the entrant.
Construction Standard Key Differences

- Requiring **continuous monitoring of engulfment hazards** in providing an early warning system to the authorized entrants or attendants when the confined space cannot be isolated.
Construction Standard Key Differences

- "Suspension" of a confined space entry permit

Entry Supervisor duties allows for the suspension of a confined space entry permit, instead of having to terminate the permit.
Confined Spaces In General Industry or Construction

- In closing, there are many requirements in implementing a compliant confined space program. I hope this training will assist you in keeping your employees safe when they have to enter into a permit-required confined space at your Generation Site.
Thank You and Be Safe!

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Email: lps@dairynet.com