Confined Space and Air Monitors Ready Reference

Updated 10/2018

1. The Law

A. OSHA 29 CFR 1910.146 – Permit-Required Confined Space
- OSHA requires employers to protect employees who may need to enter confined spaces in the scope of their employment.
- This was the first OSHA standard to incorporate other standards for compliance. To be in compliance with the confined space standard, you must also be in compliance with the Respiratory Protection, Hazard Communication, and the Lockout/Tagout standards.

B. OSHA 29 CFR 1910.146(c)(5)(ii)(C) – Air Monitors
- Before an employee enters the space, the internal atmosphere shall be tested, with a calibrated direct-reading instrument, for oxygen content, for flammable gases and vapors, and for potential toxic air contaminants, in that order, because low oxygen can affect the proper reading of the other sensors on the multi-gas monitor. Any employee who enters the space, or that employee's authorized representative, shall be provided an opportunity to observe the pre-entry testing.

C. OSHA Standards Require an Employer to:
- Identify the confined spaces and permit-required confined spaces in the workplace
- Identify the hazards in those spaces
- Identify procedures for controlling the hazards
- Train employees in confined space entry
- Keep records of compliance and training for all confined space entry activities

2. The Essentials

A. What is a Confined Space?
- Large enough to have an employee enter to perform work
- Limited or restricted means for entry or exit
- Not designed for continuous employee occupancy

B. What is a Permit-Required Confined Space?
- Any space that contains one or more of the following:

- Contains or has potential to contain hazardous atmosphere
- A material that has the potential for engulfing
- Internal configuration such that entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section
- Any other recognized serious safety or health hazard

C. Are There Any Exemptions for Permit-Required Confined Spaces?
- Yes, permit-required confined spaces have exemptions if employers can demonstrate that:
  - The only hazard is the atmosphere **AND**
  - Continuous forced air ventilation is enough to keep dangerous air contaminants below acceptable levels
- Exemptions are important because exempt employers do not need to:
  - Develop a permit space program
  - Use a permit system or fill out an entry permit
  - Use an entry supervisor or standby attendants
  - Establish rescue and emergency services

D. What Are the Basic Elements of a Permit-Required Confined Space Program?
- Detailed Written Program – (Contact Safety Support Team and JJ Keller)
- Air Monitoring (Minimum 4 gas) – (MSA Altair 4X, Ventis MX4, Draeger X-AM 2500, BW GasAlert Micro Clip XT)
- Ventilation – Ramfan or Echo
- Rescue and Retrieval Equipment – (DBI/Sala, MSA, Guardian, or Miller)
- Attendant
- Permit System
- Training – (Safety Support Team Training and JJ Keller training modules)

E. What Are the 13 Basic Steps to Create A Confined Space Program?
OSHA Confined Space Advisor

1. Identify the Confined Spaces
- Look for locations in the workplace which would meet the basic definition of a confined space

2. Evaluate the Potential Hazards
- It is critical to understand all the hazards before entering a confined space. Possible hazards might include:
  - Oxygen hazards (normal is 20.9% - oxygen deficient below 19.5%)
  - Explosive or flammable hazards (monitors will alarm at 10% the LEL)
  - Toxic hazards (carbon monoxide alarms at 35 ppm and hydrogen sulfide at 10 ppm) – other toxic sensors are available, but there are not many to select from
  - Energy hazards which need lockout/tagout
  - Engulfment hazards
  - Configuration hazards
  - Slip, trip, and fall hazards

3. Prevent Unauthorized Entry
- All confined spaces should be marked with a confined space warning sign

4. Develop Pre-Entry Planning and Confined Space Entry Procedures
- It is important for the entry supervisor to properly evaluate the hazards of each confined space before signing the permit that it is safe for entry.
- The pre-entry planning is covered in detail on the actual Confined Space Entry Permit.
  Wisconsin Sample Entry Permit

5. Select the Proper Safety Equipment

- To best control the potential hazards in a confined space, employees must be trained to use the correct safety equipment:
  - Air Monitors – To check for oxygen, flammables, and other potential toxics
  - Personal Protective Equipment – Such as respirator, gloves, full-body harness, protective clothing, hard hats, chemical boots, and safety glasses
  - Ventilation Equipment – To either blow or draw air contaminants from a confined space
  - Communication Equipment – Two-way radios should be considered, if flammable atmosphere is present must be intrinsically safe.
  - Other Equipment – Such as tripods and winches, lighting, GFCI's, non-sparking tools, and barriers

6. Train Team Entry Members
Authorized Entrants
- Must know the hazards they may face, be able to recognize signs and symptoms of exposure, and understand consequences of exposure
- Must know how to use needed equipment

Attendants
- Must also know the hazards and effects of exposure
- Maintain continuous contact with entrants until relieved
- Monitor activities inside and outside of permit space
- Summon rescuers as needed
- May not perform other duties which may interfere with primary duty to monitor entrants

Entry Supervisor
- Main responsibility is to issue confined space permits
- Must know the hazards of permit space and verify that all tests are conducted and procedures in place before endorsing a permit
- Terminate entry if necessary and cancel permits
- Verify that rescue services are available and have means for summoning them

Rescue Services
- Must receive the same training as authorized entrants
- Additional training in PPE, rescue equipment, first aid, and CPR
- Yearly simulated rescues

7. Develop and Implement Rescue Procedures
- The OSHA standard discusses 3 methods of performing rescues:
  - Non-entry rescue using a tripod and winch
  - Entry rescue by company employees, properly equipped and trained.
  - Entry rescue by emergency responders from outside the company, verified that they have the equipment and training to conduct a rescue.

8. Develop and Implement a Confined Space Entry Permit System
- If hazards are found to exist or there is the potential for developing in a confined space, an entry permit must be filled out and used
- The entry supervisor is responsible to fill out this permit that contains information about the confined space, its hazards and how they will be controlled, members of the entry team, necessary equipment, rescue procedures, and other permits that may be required
- The completed permit must be made available to the authorized entrants

9. Develop and Implement Procedures for Ending the Entry Process
- To keep this process safe, determine:
  - Who will end an entry
  - How employees will know that an entry is over
  - Who will ensure that everything is removed from the space
  - Who will notify rescuers that an entry is over
  - Who will make sure process lines and power are reconnected
  - How a space will be closed off to prevent further entry

10. Review the Entry Operation
- After each entry, conduct a review to determine what went well and what needs improvement. This information can be used to adjust a program, procedures, and training to be more effective.

11. Review All Permit-Required Entries
- This review can be done after each entry, but at the very least, it must be done annually
- Keep an entry log with canceled permits attached for review
- The following should be considered in your review:
  - How often permit-required entries will be reviewed
  - Who will review the permits and the entries
  - What criteria will be used to determine whether changes are needed
  - How the need for retraining will be identified

12. Provide Confined Space Training
- This is the primary way a company can ensure that confined space entries are performed safely
- The OSHA standard requires that everyone with responsibilities under a company's confined space program have training that covers these areas:
  - All hazards associated with confined space entry
  - The equipment required for confined space entry
  - The procedures necessary for safe entry

13. Keep Confined Space Entry Records
- The OSHA standard requires that a company keep accurate records of all confined space entry program activities
- Records should include each employee's name, identification number, job title, and signature along with the date of the training and the signature of the trainer

F. What Are the Two Main Types of Air Monitoring Devices?

- **Digital Gas Detectors** – These contain sensors that measure the concentration of a particular gas or vapor in the air. Most sensors create an electrical signal that is converted to a digital meter reading, indicating the level of a chemical in the air. These instruments require a calibration kit to verify they are reading accurately. While many manufacturers only require calibration every 3-6 months, we recommend calibration before each use in a confined space, for liability reasons.

- **Detector Tubes** – These are sealed glass tubes that contain solid granular material, such as silica gel crystals, coated with a chemical that reacts with the specific airborne chemical of interest. The reaction to specific chemicals in the air will cause a color change in the tube that is directly read by the employee. While this product can identify specific chemicals in a confined space, it only captures a moment in time and will not be able to alert workers to rapidly changing air quality in that space. You must also know what chemicals you are looking for ahead of time when using this product. Drager or Nextteq (Gastec)

G. Should the Potential Presence of Other Contaminants be Considered When Choosing an Air Monitor?

- Yes. While it is required to have an oxygen and flammable sensor on an instrument for testing a confined space, you need to verify if there is the potential for needing other sensors. If no sensor is available, the customer might need to consider detection tubes or other methods to verify potential exposure.

H. What are The Differences Between a Battery Operated Sample Draw Pump, a Hand Aspirator, and Monitors with No Pump?

- **Sample Draw Pumps** can either be built-in to the air monitor or attached separately

- **A Hand Aspirator** is a rubber ball which serves to draw the air sample out of the confined space to the instrument for a reading by repeatedly squeezing this ball. This is a less expensive means of getting a sample. Takes approx 1 squeeze per foot of sample tubing.
- **An Air Monitor with No Pump** indicates that the customer does not need to remotely obtain the air sample. It relies on contaminated air simply passing over the sensors to get a reading. An employee can simply lower the instrument into a hole using a rope; however, this can risk potential damage to the instrument.

I. What Are the Battery Options for Air Monitors?
- **Alkaline –** For infrequent users, batteries last 8-12 hours
- **NiCad (Nickel Cadmium) –** This is a rechargeable battery that has been around for many years, but can be subject to memory problems (don't see much anymore)
- **NiMH (Nickel Metal Hydride) –** This is a newer technology of a rechargeable battery that has no memory problems – also becoming more obsolete because of the Lithium options
- **Lithium or Lithium Ion –** This can be either a rechargeable battery or used in some single gas monitors (this is the newest in technology and quite common)

3. Product Reference

A. Air Monitors
B. Air Sampling Systems and Detector Tubes
C. Blowers and Ventilators
D. Respirators or SCBA's
E. Tripod and Winch with Full-Body Harnesses
F. Cones and Barricades
G. Lockout/Tagout Equipment
H. Explosion-Proof Flashlights
I. 2-Way Radios or Communication Earmuffs
J. Safety Signs
K. Gloves
L. Disposable Coveralls
M. Hard Hats
N. Eye and Face Protection

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