Chapter 6

Confined Spaces

Definitions

A confined space is defined as any structure that must be entered and that has or may contain dangerous concentrations of hazardous gases or vapors or an oxygen deficient atmosphere.

Entry to these spaces must be rigorously controlled to prevent serious injury or death.

Hazardous Conditions

Hazardous conditions include, but are not limited, to the following:

- An atmosphere containing less than 19.5% oxygen (normal air contains 20.9% oxygen). This is usually the result of oxygen displacement by inert gases such as nitrogen, argon, helium, or sulfur hexafluoride.

- Flammable gases and vapors (e.g., methane, ethane, propane, gasoline, methyl-ethyl ketone, alcohol).

- Toxic gases and vapors (e.g., hydrogen sulfide, nitrogen dioxide, 1,1,1 trichloroethane, perchloroethylene, methylene chloride).

Hazard Prevention

The primary objective is to prevent oxygen deficiency or other hazardous condition. This must be accomplished by accepted engineering control measures, such as general and local ventilation and substitution of materials. Only when such controls are not possible should respiratory protection be used.

Written operating procedures governing the identification, testing, and entry into a confined space with a potential for oxygen deficiency must be established by the operating personnel and approved by the Responsible Safety Officer.

Monitoring devices, audible alarms, warning lights, and instructional signs should be installed where there is a potentially oxygen-deficient atmosphere. These installations must be approved by the Responsible Safety Officer.

Before entering a confined space, the steps below must be followed:

- Air quality must be tested to determine the level of oxygen and toxic or flammable air contaminants.
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- Air purging and ventilation must be provided whenever possible.
- The confined space must be isolated from supply lines capable of creating hazardous conditions.
- Lock-out procedures must be used to secure electrical systems, pressure systems, piping, machinery, or moving equipment.

If a person must enter a confined space containing hazardous gases, the procedures below must be followed:

- Protective equipment must be worn, including air supply respirator plus harness and lifeline.
- At least one person must be stationed outside the confined space, with suitable respirator.
- Communication with personnel in the confined space must always be maintained.

Program Review

The entry procedures shall be reviewed when it is identified that enough protection was not provided during a confined space entry operation. Examples include, any unauthorized entry of a confined space; a hazard not covered by the permit, the occurrence of an injury or near miss; employee’s complaints, etc. Procedures identified in this review shall be included in future confined space entry operations, where appropriate.

Refer to Appendix 5 Confined Space Entry Program and the forms section - Confined Space for a checklist of Confined Space Procedures.

Respiratory Protection Program

I. Reduction and Elimination of Hazardous Contaminants

1. Have Engineering sources review process for methods that could substitute a non-toxic or less toxic substance in an operation for a more harmful one.

2. Have proper personnel check or install ventilation system to remove harmful gases, dusts, and vapors before they can contaminate air around the work place. Consult outside help, if necessary.

3. Administer a time limit that a worker can spend in a harmful atmosphere-rotating the worker to another job periodically.
4. After reasonable effort is expended in reduction and elimination of hazardous contaminants, and if the level of contaminants is still above the acceptable level, then go to the next section on protection by respirators.

II. Protection by Respirators

A. Placing Mask on Face.

1. Check that the exhalation valve flap is firmly secured to the exhalation valve seat and is free to operate.

2. Check that the air-purifying elements are properly inserted and attached to the respirator.

3. Check that the positions of the plastic adaptors are properly aligned to permit good visibility and not interfere with exhalation valve. Align improperly positioned adaptors by rotating them in the face plate. Line up the face piece and adaptors for best position.

4. Place the head harness around the head and fasten it.

5. Position the respirator on the face so that the wide portion of the face piece is over the nose.

6. Adjust the head harness to provide snug, comfortable, wearing of the respirator.

   NOTE: Gear should be marked with the name of the worker to whom it is assigned.

B. Respirator Fitting Rests - Each Time the Complete Respirator is Worn.

1. Perform a face fit test that respirator mask will form a good seal against the wearer’s face and prevents contaminants from leaking into the mask.

2. Check for proper fitting by making sure that facial scars, beard, sideburns, sunken cheeks, will not interfere with a proper fit, most especially when negative pressure is created during inhalation.

3. A negative pressure fit test should be performed by closing off the respirator inlet and inhale. A vacuum and partial inward collapse of the mask should result. If a vacuum cannot be maintained for at least 10 seconds, readjust the face piece and try again.
4. A worker should close off the exhalation valve with the palm of his hand and breathe out gently to perform the positive pressure fit test. Air should not escape through any gaps in the seal. Then a test should be performed to determine if irritation is present around the seal of the mask. Adjust face piece accordingly and try different respirator if necessary in order to find one that gives a good fit. If a face piece bulges slightly and no evidence of outward leakage of air at the seal, face fit is considered satisfactory.

**NOTICE**: Care must be taken so that the position of the face piece is not disturbed while performing either of both of these tests.

**NOTICE**: During any fitting, the respirator head harness should be as comfortable as possible and still provide satisfactory face seal. Do not over tighten, it may cause leakage.

C. Respirator Care

1. Check the general condition of mask such as the straps, valves, filter elements, air hose, hose clamps, and gaskets, before and after use and during cleaning. Replace, if necessary.

2. Inspect at least once a month those respirators provided for emergency use only, and make sure to wash, clean, and sanitize them after each use.

3. Check for approval code display of the mask by either the NIOSH or MSHA.

D. Preventive Maintenance

1. Remove the filter and/or straps, then wash and clean the respirator after each use, in a mild soap solution with soft brush, and air dry it (do not dry the respirator in temperature above 125°F). Immerse the respirator weekly in a sanitary solution for at least two minutes. After washing and immersing the respirator, rinse it thoroughly to prevent dermatitis residue on the mask. Keep all solutions cooler than 125°F.

2. Sanitize the mask with solutions such as:
   
   a. Hypochlorite Solution (100 PPM) or,

   b. A simple laundry bleach solution (100 PPM) [composed of 1 tablespoon of bleach diluted with one gallon of water].

3. Store respirators in resealable plastic bags.
4. Protect them from sunlight, dust, chemicals, moisture, and temperature extremes.

5. Discard both elements of the pair if there is evidence of dirt, paint, or contaminants having accumulated on either or both. An air-purifying element must never be washed.

**NOTE:** Discard use-purifying elements in a safe place consistent with good industrial hygiene practice.

E. Storage.

When the respirator is not in use, it should be placed in a closed plastic film bag. It should then be stored in a clean, dry, cool area that is free from contaminating particles, vapors, and gases.

**CAUTION:** Respirators can be affected by temperature, humidity and airborne contaminants. Therefore, it is important that the respirator equipped with purifying elements be stored inside a tightly closed plastic bag while the respirator is in storage.

F. Replacement of Air-Purifying Elements

Filters should be replaced if necessary or if inhalation becomes difficult due to plugging of the filter by retained particles. The following instructions must be carried out in replacing the filters on both air purifying elements:

1. Remove the filter element from the case.

2. Discard the filter (disposed in a safe manner).

3. Place a new filter element inside the filter case and make sure the edge of the filter sits securely against the rim.

G. Keeping a Log Sheet

A written record will be kept to keep tract of the inspections, the cleaning, the filter replacement of the respirator, the date when the above actions were performed, initials of the person who performed the actions, and remarks/comments about the above actions. See the forms section of this manual for the Respirator Log Sheet.
Monitoring

To assure the adequacy of a respiratory program, monitoring shall be conducted on exposure hazards as a basis to provide for a continuing healthful environment for employees. Personal sampling equipment may be used in accordance with accepted industrial hygiene standards to sample each work area. Results of these samples will pinpoint areas where respiratory protection is required. Supervisors will also observe employees using respiratory protection to ensure that they leave the area to wash, change cartridges, or if they detect breakthrough or resistance. Supervisors detecting any unsafe practices will take immediate action to include removing the employee from the area and/or instructing him/her as to the unsafe act(s) and the appropriate actions.