

Appendix G

CONFINED SPACE ATMOSPHERIC TESTING

Atmospheric testing is necessary to evaluate airborne hazards present in the permit space, and to verify that acceptable entry conditions are present.

1. Evaluation

Initial evaluation of the atmosphere of a confined space should be analyzed with a EHSC approved instrument that is sensitive enough and designed to evaluate any hazardous atmospheres that may exist or arise. The results of the atmospheric testing will have a direct impact on the:

- < development of the entry procedure,
- < selection of PPE,
- < duration of worker exposure, or
- < whether an entry will be made at all.

The Environmental Health and Safety Center should be called for assistance with the evaluation and interpretation of the data, and the development of the entry procedure.

2. Verification

Prior to entry, a PRCS which may contain a hazardous atmosphere shall be tested for residues of all contaminants identified by the evaluation testing using an instrument specified in the entry permit. Results of testing shall be recorded on the entry permit and compared to the acceptable entry conditions. If testing reveals oxygen deficiency or the presence of toxic gases or vapors, the space must be ventilated or purged and retested before entry. The atmosphere shall be tested continuously during entry operations.

3. Measurement duration

The measurement of each atmospheric parameter shall be made for at least the minimum response time of the test instrument specified by the manufacturer. It is recommended that the measurement be made for twice (**2x**) the response time.

4. Stratified atmospheres

The density of gases and vapors will cause them to be:

- < heavier than air, and settle to the bottom of a space, (hydrogen sulfide),
- < lighter than air, and concentrate at the top of the space, (methane), or
- < the same as air, and accumulate in the center, (carbon monoxide).

When monitoring for entries involving a descent into atmospheres that may be stratified, the space should be tested every four feet (**4 ft.**) in the direction of travel and to each side. The entrant's rate of progress should be slowed to allow for sampling and detector response.

5. Order of testing

When using an atmospheric testing instrument that requires the manual selection of test parameters, the order of testing **MUST** be:

- < **Oxygen** - most combustible gas meters require a specific amount of oxygen, (min 20.8%), to be present in order to give a correct reading for flammable / explosive gases.
- < **Flammable / Explosive gases** - are tested next because they represent more of an immediate and life threatening hazard, in most cases, than toxic gases or vapors.
- < **Toxic gases or vapors**

Testing Procedure

1. Appoint a person to act as air monitor that has completed confined space training as well as training in the proper use of the monitoring equipment.
2. Check out a Multi-Gas Monitor that has been **calibrated** within the past **month**. A copy of the manufacturer's operating instructions shall accompany the equipment. (May be in abbreviated form.)
3. In a clean atmosphere, perform equipment check-out procedure or operational check as stated in the operating instructions.
4. If possible, draw an air sample through a hole leading to the space before opening the entry port. Other wise, open the entry port and start sampling every **4 feet** in the direction of travel and from side to side. It is recommended that the sampling time be twice (**2 x**) the **response time** of the equipment.
5. Test atmosphere parameters in the following order:
 1. Oxygen
 2. Flammability
 3. Toxic
6. Compare sampling results to the following **acceptable entry conditions**:

Oxygen (O ₂)	greater than 19.5% and less than 23.5%
Flammability	less than 10% of Lower Flammable Limit (LFL) [†]
Carbon Monoxide (CO)	less than 35 ppm [†]
Hydrogen Sulfide (H ₂ S)	less than 10 ppm
Other Substances	less than Permissible Exposure Limit (PEL)

[†] Same as Lower Explosive Limit (LEL), [†] parts per million

Note: The Industrial Scientific monitors will sound an alarm if these levels are exceeded.

EXIT THE SPACE IMMEDIATELY IF THE MONITOR SOUNDS AN ALARM.

7. Record sampling results on the entry form.
8. It is recommended that the following readings be taken:
 1. before ventilation,
 2. after ventilation,
 3. initial entry survey, and
 4. monitored continuously there after.
(Record readings every 30 minutes.)
9. Contact the Environmental Health and Safety Center (**515-8658** or **515-6860**) if atmospheric hazards can not be corrected with continuous forced ventilation.