

# ROCO RESCUE

## CONFINED SPACE II

## RESCUE I-PLUS

- **Hydrogen Sulfide (H<sub>2</sub>S) – measured in Parts Per Million (PPM)**

- Smell of rotten eggs at moderate concentration (0.2 ppm)
- Smell seems to dissipate as the olfactory function is quickly fatigued giving the false impression that the toxic gas is no longer present
- Heavier than air
- Colorless, flammable gas (poison and flammable hazard)
- PEL for H<sub>2</sub>S: 10ppm TWA, 15ppm STEL, 300ppm IDLH, LEL 4.3%, UEL 46%

**NOTE:** Reference SDS

H <sub>2</sub> S PPM	CONDITION	TIME
4.50	Moderate odor of “rotten eggs”	
10.0	OSHA PEL	8 Hours
30.0	Strong odor of “rotten eggs”	
100	OSHA IDLH Loss of sense of smell in 2 minutes	2 minutes
200	Respiratory and eye inflammation	1 Hour
500	Loss of consciousness	30 Minutes
700-1000	Rapid unconsciousness, apnea, death	1 Hour
2000	Immediate unconsciousness, respiratory arrest, death even if removed immediately to breathing air	3-10 Minutes
4000	LEL	

### ATMOSPHERIC MONITORING:

OSHA requires that atmospheric monitoring be performed in the following testing sequence:

1. **OXYGEN (O<sub>2</sub>) Level** - measured in a percentage (%) – normal range of 19.5% to 23.5%.
2. **FLAMMABILITY** - measured in percentage (%) – 10% of LEL is the OSHA action level.
3. **TOXICITY** - measured in Parts Per Million or PH value.

#### **General Monitoring Considerations:**

- *Identify the proper type monitoring equipment for the suspected hazard.*
- *Identify and don appropriate PPE to be worn during monitoring if required.*
- *Confirm calibration bump testing and proper operation of monitor.*
- *Obtain environmental sample from confined space.*
- *Document readings and analysis.*
- *Take necessary precautions for safe entry.*
- *Confirm ventilation effects on space being monitored.*

**ROCO RECOMMENDATION:** Although OSHA does not define a specific timeline to conduct pre-entry atmospheric monitoring, we recommend that a “baseline test” be conducted approximately 30 minutes prior to the entry and then another test is conducted immediately prior to entry. A comparison of these readings could indicate that atmospheric changes have occurred inside the space. If a space has been vacated for a period of time, it is recommended that similar baseline testing be repeated.

Also, while OSHA allows for periodic monitoring and sets no exact timespan between testing, Roco recommends continuous air monitoring any time workers are in the space. In addition, pre-entry testing as well as periodic testing should be based on the hazard assessment for a given space, previous work activities that may have introduced atmospheric hazards, and any known history of hazardous atmospheric conditions. Another consideration is how rapidly those hazards can change the atmosphere, which may require additional precautions for safe entry.

### MONITORING FREQUENCY:

OSHA does not define a specific timeline for conducting pre-entry atmospheric monitoring or periodic testing. OSHA 1910.146 (c)(5) refers to testing the internal atmosphere before an employee enters the space and testing as necessary to maintain acceptable entry conditions. Testing should be based on the hazard assessment for a given space as well as how rapidly those hazards could cause a change in the atmosphere, which may require additional action for safe entry.

#### Atmospheric Monitoring Guidelines

1. Prior to entry.
2. Periodically during entry – UNLESS continuous monitoring is warranted!
3. Prior to ventilation; then after ventilation is activated to check effectiveness.
4. Re-check if spaces have been vacated for any length of time.

### ADDITIONAL ROCO RECOMMENDATIONS:

- a) A baseline test conducted within 30 minutes of the entry and then again tested immediately prior to entry in order to determine if changes in the atmosphere have occurred.
- b) This testing sequence should be repeated anytime the space is vacated for a period of time.
- c) Again, while OSHA allows for “periodic” monitoring and sets no specific timespan between testing, Roco recommends continuous air monitoring anytime workers are in the space.

### ATMOSPHERIC STRATIFICATION:

Different gasses have different vapor densities (weights). Breathing air has a vapor density of one (1). Using that as a base, gasses with vapor densities less than 1 (carbon monoxide 0.986) will tend to rise and accumulate near the TOP of a space.

Gasses with vapor densities greater than 1 (H<sub>2</sub>S 1.191) will tend to accumulate or stratify near the BOTTOM of a space. Gasses with similar densities to air may stratify in the mid-range of a space. Temperature and humidity may cause different gasses to react and stratify at different levels than expected.

When monitoring a space, start by turning on the monitor in a clean atmosphere or upwind from possible contaminants. This allows the monitor to run its self-diagnostics. If started in a contaminated atmosphere, it may skew calibration values giving incorrect readings and levels. Beware of off-gassing and wear proper PPE if needed for protection while monitoring. Consider monitoring areas where workers will congregate.

#### Testing Stratified Atmospheres

According to OSHA “Testing Stratified Atmospheres” Appendix B(4), the atmosphere should be tested at 4-ft intervals up and down and side-to-side (if applicable).

**NOTE:** This would indicate (and Roco recommends) that an entry team take a monitor with them as they move through the space even it was remotely tested prior to entry. The speed of team movement will be slowed as dictated by the monitor’s cycle rate.

#### Monitor:

- Top
- Middle
- Bottom
- Breathing Zones
- Eddies

If using a hose or wand, consider the cycle rate of the monitor and the time it takes a sample to get from the end of the hose to the sensors. (Check manufacturer’s instructions on usage and cycle rates.)