Loveland Fire Rescue Authority
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CONFINED SPACE AIR MONITORING

Developed By Chris Fischer
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TASK SKILL DESCRIPTION AND DETAIL

The greatest danger in confined spaces is hazardous atmospheres, which can be divided into three categories: asphyxiating, flammable, and toxic. Asphyxiating atmosphere as an atmosphere that contains less than 19.5 percent oxygen, below this concentration a person's respiratory function may be compromised. OSHA considers an atmosphere to pose a serious fire or explosion hazard if a flammable gas or vapor is present at a concentration greater than 10% of its lower flammable limit (LFL) or if a combustible dust is present at a concentration that obscures vision at a distance of 5 feet, or less. A flammable atmosphere can also arise from oxygen-enriched atmospheres. Oxygen-enriched atmospheres are defined by OSHA as atmospheres containing more than 23.5 percent oxygen. A toxic atmosphere refers to any atmosphere containing gases, vapors, or fumes known to have poisonous physiological effects. The most commonly encountered toxic gases (based on OSHA research data) are carbon monoxide (CO) and hydrogen sulfide (H_2S). Toxic atmospheres may be caused by a manufacturing process, a product stored, or a work activity being performed in a confined space.

Air Monitoring Equipment

- Combustible Gas Indicator (CGI) – This is the most accessible, easiest to use, and is the preferred device.
- Photoionization detectors (PIDs) - if volatile organic compounds (VOCs) are suspected
- Single Gas Detectors – Limited to 1 gas.
- Qrae colormetric tubes

Air Monitoring Atmosphere

The confined space atmosphere is tested for:

- The proper oxygen content (between 19.5 and 23.5% oxygen)
- The presence of flammable or explosive substances
- The presence of toxic gases and vapors

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Effects of O2

- Above 23.5% - Materials can ignite easily and will burn rapidly
- 21% - Normal
- <19.5% - Oxygen Deficient
- 17% - Some muscular impairment, increased respiratory rate
- 12% - Dizziness, headache, and rapid fatigue
- 9% - Unconsciousness
- 6% - Death in minutes

INITIAL Air Monitoring

- Turn on CGI (Refer to Air Monitoring training manual page for start-up and use of the CGI.)
- Start upwind and monitor all areas around the space.
    - Testing is first done from OUTSIDE/UPWIND of the confined space.
- Monitor the area outside the opening and just inside prior to opening the space if possible.
- Test for Oxygen first then LEL and finally toxic gases. (when using a CGI all readings are done simultaneously)
- Once the space has been opened, connect the extension tubing to the Air Monitor and place or lower it inside the confined space.
- Normal O2 levels are 20.9%
    - Above 23.5% is Oxygen-enriched and below 19.5% is Oxygen-deficient
- Add time when additional tubing is used.
    - Extra time is required for testing whenever the extension tubing is connected to the monitor at a flow rate of 1 second per foot of tubing used. Never use Tygon or rubber tubing as extension probes when measuring VOCs, because these materials strongly absorb VOCs.
- Monitor all areas in the space (Top/Middle/Bottom)
    - Because certain dangerous vapors and gases are heavier or lighter than air, tests must be conducted at different levels within the space also known as testing stratified atmospheres they may be safe at one level but hazardous at another.
- Record all levels on air monitoring tracking form.
    - Use a separate form for each location that you are monitoring.
- Ventilate the space accordingly (Refer to Confined Space Ventilation training manual page)

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- Once Ventilation is in place monitor at the entrance and the exit to ensure adequate ventilation.
- As entry teams enter the space monitoring is continuous both inside and outside of the space.
- Record all levels on Air Monitoring Tracking Form (See Below)

LFRA Confined Space Air Monitoring					
Location______________________________			Air Tester Name _______________		Monitor Type_____
Date/Time		Percent Oxygen	LEL	CO	H2S
Monitoring Results		Top ______________ Middle____________ Bottom___________	Top____________ Middle_________ Bottom_________	Top____________ Middle_________ Bottom_________	Top ____________ Middle__________ Bottom__________
		Top ______________ Middle____________ Bottom___________	Top____________ Middle_________ Bottom_________	Top____________ Middle_________ Bottom_________	Top ____________ Middle__________ Bottom__________
		Top ______________ Middle____________ Bottom___________	Top____________ Middle_________ Bottom_________	Top____________ Middle_________ Bottom_________	Top ____________ Middle__________ Bottom__________
		Top ______________ Middle____________ Bottom___________	Top____________ Middle_________ Bottom_________	Top____________ Middle_________ Bottom_________	Top ____________ Middle__________ Bottom__________
		Top ______________ Middle____________ Bottom___________	Top____________ Middle_________ Bottom_________	Top____________ Middle_________ Bottom_________	Top ____________ Middle__________ Bottom__________
		Top ______________ Middle____________ Bottom___________	Top____________ Middle_________ Bottom_________	Top____________ Middle_________ Bottom_________	Top ____________ Middle__________ Bottom__________
		Top ______________ Middle____________ Bottom___________	Top____________ Middle_________ Bottom_________	Top____________ Middle_________ Bottom_________	Top ____________ Middle__________ Bottom__________
		Top ______________ Middle____________ Bottom___________	Top____________ Middle_________ Bottom_________	Top____________ Middle_________ Bottom_________	Top ____________ Middle__________ Bottom__________
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TASK SKILL INSTRUCTIONAL REQUIREMENTS AND IMPLEMENTATION

This heading includes information about the following:

- See LFRA Training Materials > SOT Training > Confined Space Training

REFERENCE INFORMATION

This heading includes information about the following:

- NFPA 1006: STANDARD FOR TECHNICAL RESCUER PROFESSIONAL QUALIFICATIONS
- Occupational Safety and Health Administration (OSHA) Standard 1910.14. Permit-required Confined Spaces