



AIR MONITORING – STRUCTURE FIRE

2014revA

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Procedure:

- The byproducts and gasses from combustion present a serious health risk to LFRA personnel. In the post structure fire environment, the air may contain various toxic gases even after the visible smoke has cleared. The intent of this policy is to determine a reasonable level when SCBA may be doffed during overhaul and investigation phases following extinguishment of a structure fire.

Incident Action Plan Considerations

- Full PPE and SCBA shall be worn during fire suppression activities.
- During the overhaul process and after the visible smoke has cleared, companies may request that the air be monitored for the possible removal of SCBAs.
- The following limits should be met prior to removal of SCBAs:

Constituent	Level	Rationale
Carbon Monoxide (CO)	< 35 ppm	NIOSH has determined 35 ppm as the REL-TWA.
Hydrogen Sulfide (H ₂ S)	< 5 ppm	NIOSH has determined 10 ppm as the REL-C, but no TWA or STEL has been determined. OSHA has 10 ppm as the TWA for shipyard workers.
Hydrogen Cyanide (HCN)	< 2 ppm	NIOSH has determined 4.7 ppm as the REL-STEL, no REL-TWA has been determined. Studies have shown that CO and HCN may work synergistically to increase their damaging effects, indicating a low HCN level is important.
Lower Explosive Limit (LEL)	< 10 %	If the LEL is above 10%, there may be an unidentified source of flammable gas within the structure.
Oxygen (O ₂)	20.5 - 23.5 %	A low O ₂ reading indicates that some other gas is displacing O ₂ in the air, if the other gas cannot be determined, it should be assumed to be toxic. Oxygen rich atmospheres increase fire and explosion hazards.
Visible Smoke	Visually Clear	If visible smoke can still be seen, SCBA should continue to be worn to protect mucus membranes and the lungs.

NIOSH: National Institute for Occupational Safety and Health

REL: Recommended Exposure Limit

TWA: The Time-Weighted Average concentration for up to an 8-hour workday.

STEL: Short Term Exposure Limit of 15 minutes.

C: Ceiling limit, not to be exceeded at any time.

Company Level Functions

- Once air monitoring activities have met the above guidelines, members can be permitted to remove SCBAs.
- If any individual wishes to continue operating with their SCBA, they should be allowed to do so.
- If asbestos-containing materials are suspected within damaged or overhaul areas, SCBAs should continue to be worn throughout the duration of salvage and overhaul operations.
- The incident commander or company officers may dictate that the working crews wear dust masks or respirators while continuing overhaul or investigative activities.
- Cross-contamination is a significant problem regarding the reliability of gas meters in a post structure fire environment. Many other gases such as benzene, styrene, nitrogen dioxide, etc. can cause the meter to give false high or false low readings. If there is a question regarding reliability, companies should continue to operate using SCBAs.
- Areas of the structure may be cleared separately (i.e., the 2nd floor is clear, but the basement level still requires SCBA).
- The gases and particulates from the structure fire may settle onto the bunker gear and continue to present dermal exposure. Upon returning to the station, companies should wash their bunker gear, wipe down helmet, boots and mask and take a shower.
- If a member exhibits signs of exposure, the individual should be placed onto 100% oxygen and transported to the nearest hospital. The hospital should be specifically instructed to immediately test for HCN poisoning since the timeframe for detection and treatment is very short. Signs of gas exposure can include confusion, headache, anxiety, drowsiness, vomiting, tachycardia and respiratory changes.

Benchmarks

- Air Monitoring Complete. This is to be aired once the entire structure is cleared and SCBAs are not required. Monitoring should be continued however, to ensure that conditions do not deteriorate.

Validation Summary

- Testing was not done by LFRA to confirm effectiveness of this guideline. These criteria were based on research and testing performed by NIOSH.

Revision History

References:

- Gerberding, J.L., MD. (2006). Toxicological Profile for Cyanide. *U.S. Department of Health, Agency for Toxic Substances and Disease Registry*.
- International Association of Firefighters, Local 799. (2006). *Recommendations to be learned to prevent exposures to cyanide*.
- Krusen, J.M. (2010). Air Monitoring Structure Fires. *Fire Engineering, Volume 163*.

- *NIOSH Pocket Guide to Chemical Hazards*. Centers for Disease Control and Prevention. Retrieved 4/1/2015, from the World Wide Web: <http://www.cdc.gov/niosh/npg/>
- RAE Systems, Inc. (2011). *Protecting First Responders – Real Time Gas Detections for Real Time Decisions*.
- REA Systems, Inc. (2013). *Sensor Specifications and Cross-Sensitivities, Technical Note TN-114*.
- Wyant, G. (2008). *Air Quality after the Fire*. Executive Analysis of Fire Service Operations in Emergency Management.