

## Evaluation of Hazards in the Post-Fire Environment



### PROBLEM/ISSUE

Today's emergency responders, including fire service, law enforcement, EMS, and other disciplines, spend a considerable amount of time in the "post-fire" environment. Work in this environment includes, but is not limited to victim recovery, salvage and overhaul, origin and cause investigation, and criminal investigations. Current research suggests that the airborne hazards associated with the post-fire environment are likely much greater than previously understood<sup>123</sup>. The InterAgency Board for Equipment Standardization and Interoperability (IAB) has been asked to respond to questions regarding the use of multi-gas detection instrumentation to drive decisions on selection of Personal Protective Equipment (PPE) for protection of fire fighters and other personnel from airborne hazards in the post-fire environment.

### BACKGROUND

The IAB is a collaborative panel of emergency preparedness and response practitioners from a wide array of professional disciplines representing the public safety sector at all levels of government. Based on direct field experience, IAB members advocate for and assist the development and implementation of performance criteria, standards, test protocols, technical/operating guidance, and training requirements for all-hazards incident response with an additional special emphasis on Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) issues. The Equipment SubGroup (ESG) of the IAB focuses on identifying appropriate response equipment and promoting the development of associated standards and operational considerations. The IAB recommendations are published as the Standardized Equipment List (SEL) found at both [www.iab.gov](http://www.iab.gov) and [www.rkb.us](http://www.rkb.us).

### DISCUSSION

The primary question at hand is whether the use of handheld multi-gas detectors<sup>4</sup> is appropriate and sufficient for determining the level of PPE to be worn during operations in a given post-fire environment. As more research is conducted, it is becoming clear that the post-fire environment presents a broad spectrum of chemical hazards, *including gases, vapors and particulates*, and that the hazards are likely *not limited to the immediate fire area*. Areas contiguous to the fire area, and even far downwind from the fire area, may contain concentrations of chemical hazards that jeopardize the health of those exposed to or contaminated by them. Thus, effective assessment of the post-fire environment requires not only the detection of multiple toxic gases and vapors, but also (and perhaps more importantly) assessing the presence and makeup of suspended particulates that may contain significant additional health risks including polycyclic aromatic hydrocarbons (PAHs). These risks include not only direct exposure, but also secondary exposure from contaminated garments or equipment.

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Given the time spent by responders in these environments every day, the lack of complete and verifiable data on post-fire hazards is in itself, a serious issue. Given the natural inclination of personnel to doff PPE at the earliest opportunity, every structure fire, car fire, or other incendiary incident creates an unknown health risk to emergency responders. The InterAgency Board's recommendations include both modifications to existing procedures, and continued research to determine the full extent of post-fire hazards.

**RECOMMENDATIONS**

The InterAgency Board (IAB) recommends the following:

**1. Organizations should not rely solely on multi-gas detectors to determine PPE donning and doffing action levels.**

While multi-gas detection instrumentation can be used to provide qualitative and quantitative information for some gaseous and vapor hazards, it cannot provide a comprehensive assessment – not only is the scope of its gas/vapor detection limited, but it also lacks the capability for particulate detection. This is not to say that these detectors are not useful. The issue here is whether they provide sufficient information for PPE donning and doffing decisions, and they do not. Assuring the safety of personnel in during post-fire operations requires broader information than these devices can provide. Standard operating procedures should treat a negative reading from multi-gas devices as “helpful but insufficient” for determination of appropriate conditions for the removal of personal protective equipment.

**2. Organizations should alter their procedures to conduct field expedient decontamination procedures as soon as reasonably feasible after post-fire operations, and laundering and decontamination of garments must, at a minimum, be conducted in accordance with NFPA and manufacturer recommendations.**

It is clear that particulates with potential significant health hazards are readily deposited onto equipment, protective ensembles and skin surfaces. However, because departments lack clear guidance on the hazards associated with deposited particulates found in the post-fire environments, practices on decontamination and laundering vary widely. As with any unknown hazard, we recommend erring on the side of safety. Use of field expedient decontamination procedures, ensemble/equipment decontamination and personal hygiene showers should be implemented as soon as reasonably feasible after exposure to these environments.

**3. Further research should be conducted to identify and quantify the full spectrum of post-fire environment hazards, as well as appropriate protection and decontamination technologies.**

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When compared to the amount of research on fire and explosive incidents, the hazards of the post-fire environment have received relatively scant attention. This is unfortunate, since in general the amount of exposure time in this environment far exceeds the duration of the active incident. We strongly recommend that priority be given to research in the following areas:

- Comprehensive identification and quantification of the hazards, threats and risks to human health presented in post-fire environment
- Efficacy of current respiratory protective equipment in the post fire environment, and identification of alternatives if necessary
- Determination as to whether currently available air-purifying respiratory protective equipment may have applicability in the post-fire environment when used in conjunction with commonly available basic gas detection technologies
- Efficacy of structural firefighter protective ensemble against identified dermal hazards and potential “workable” enhancements that would reduce skin absorptive risks
- Development of a set of mitigation strategies and PPE selection guidelines based upon the above findings
- Efficacy of methods and determination of best practices for decontamination (including field expedient decontamination) from post-fire hazards
- Identification of man-portable or vehicle transportable detection and analysis capabilities capable of identifying and quantifying the full spectrum of risks to responders and the public

\*\*As the InterAgency Board identifies new information concerning this topic, it will be posted in the “Documents” area of the IAB website. Please contact the InterAgency Board at [info@interagencyboard.us](mailto:info@interagencyboard.us) with any comments, feedback, and questions. Additional information on the InterAgency Board is available at [www.IAB.gov](http://www.IAB.gov).

<sup>1</sup> Queensland Fire and Rescue Service Scientific Branch, “Firefighter Exposures to Airborne Contaminants during Extinguishment of Simulated Residential Room Fires,” (August 2011). (Available at [https://iab.gov/Uploads/commonwealth\\_fire\\_report\\_phase\\_one\\_-\\_august\\_final.pdf](https://iab.gov/Uploads/commonwealth_fire_report_phase_one_-_august_final.pdf))

<sup>2</sup> Queensland Fire and Rescue Service Scientific Branch, “Firefighter Exposures to Airborne Contaminants during Extinguishment of Simulated Liquefied Petroleum Gas (LPG) Fires,” (April 2011). (Available at [https://iab.gov/Uploads/commonwealth\\_fire\\_report\\_phase\\_three\\_-\\_may\\_final.pdf](https://iab.gov/Uploads/commonwealth_fire_report_phase_three_-_may_final.pdf))

<sup>3</sup> McCarry, B., Shaw, L., Shaw, D., and Fernando, S., Occupational and Environmental Health Laboratory (OEHL), McMaster University, “Exposures of Fire Fighters during Training Exercises,” Ontario Professional Fire Fighters Association, Health & Safety 2012 (Toronto, CA), February 9, 2012. McMaster (Available at [https://iab.gov/Uploads/opffa\\_health\\_and\\_safety\\_conference\\_2012.pdf](https://iab.gov/Uploads/opffa_health_and_safety_conference_2012.pdf))

<sup>4</sup> “Multi-Gas Detectors” as used here, refers to hand-held instruments commonly in use by the fire service to detect and measure the existence of specific gases and vapors using Photo Ionization or Infrared sensors. Normally, these devices will detect up to six different compounds. Commercial examples include, but are not limited to the MX6 iBrid™, MSA Altair, and the Rae Systems MultiRAE Plus.

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