

DHS Science and Technology Directorate

Respiration Protection for Firefighters During Overhaul Operations

Toxic Particulates Place Firefighters at Risk

After a structure fire has been suppressed, firefighters carry out salvage and overhaul operations to check for and extinguish any smoldering hot spots, while at the same time trying to minimize damage to the structure and its contents.

Early in the overhaul operations, firefighters wear their self-contained breathing apparatus (SCBA) to protect them from high carbon monoxide (CO) levels. Later in the operation, it is common practice to remove the SCBA when the CO concentration drops below the 8-hour Occupational Safety and Health Administration (OSHA) permissible exposure level of 35 parts per million. The responders then often don a particulate filter, which does not provide protection against toxic chemical vapors, to complete the overhaul procedures.

Though this approach may be deemed safe as far as CO levels are concerned, firefighters may be at risk of other long-term health issues, such as cancer or respiratory problems, by wearing just a particulate filter. First, there is no correlation between the CO concentration and those of other toxic compounds, and there is no simple way to measure the concentrations of other toxic gases that may be present. Another problem is that the dust masks that are commonly used as a particulate filter cannot protect against the extremely fine particulate matter present in the overhaul environment.

Developing a Solution to Help First Responders Breathe Easy

The Department of Homeland Security Science and Technology Directorate is working with TDA Research, Inc. (TDA) to develop a respirator system specifically for use during overhaul operations. The system will be used instead of an SCBA or dust mask, and will provide firefighters with respiratory protection against both chemical vapor and particulate hazards.

The new system will protect against airborne hazards, while being much lighter and more comfortable than the traditional SCBA. The technology will also be low maintenance, will not require frequent change of expensive filter cartridges, and will be affordable for agencies with limited budgets.

System Will Use a Stackable Filter Approach

TDA is teaming with Avon Protection Systems (Avon) for this project. Together, the team will develop a stackable modular filter system composed of a replaceable particulate filter module capable of removing very fine particulates that can be present during overhaul operations, and a charcoal filter module optimized for removing toxic chemical vapors present in the fire overhaul environment.

The new system will be available for use with a traditional air purifying respirator (APR) or with a powered air purifying respirator (PAPR) to meet these requirements. It will also be compatible with equipment from any manufacturer by using a standard STANAG 40mm connection.

Avon's existing AvonAir™ system will serve as the basis for developing the new firefighter overhaul respirator, which reduces development time and technical risk. A National Institute for Occupational Safety and Health (NIOSH) approval for the system configurations that meets firefighter needs is planned. This is an 18 month development effort. It is anticipated that the new system will be available to responders in early 2019.



Figure 1. Planned TDA/Avon APR/PAPR system compared to an SCBA