

Smoke Simulant Exposure During Training

Here is some evidence from the CDC (as posted from the The U.S. Fire Administration's Emergency Management and Response – Information Sharing and Analysis Center (EMR-ISAC) dated April 17, 2014, 14(16).):

We recently published an article about performing Health Hazard Evaluations (HHE) (PDF, 188Kb) along with a guide on how public health officials work with National Institute of Occupational Safety and Health (NIOSH) to perform them. NIOSH graciously sent us an example of an HHE report evaluating fire fighter trainers' exposure to smoke simulants during exercises and drills (PDF, 2.9 Mb).

The HHE program received a request from a fire department with concerns about the health effect of smoke simulants used in training simulations. Three trainers reported respiratory problems after tower training with smoke simulated aerosol mist using mineral oil, diethylene glycol, formaldehyde, and acrolein. Air testing in the training area showed levels were above exposure limits. They also found levels outside the training room could also exceed safe limits. Brief exposures could irritate eyes and lungs and cause serious lung damage. The mineral oil mist and diethylene glycol aerosol were small enough to deeply penetrate the lungs.

Departments that use similar training methods should review the HHE report and the listed recommendations, which mainly focused on proper and consistent use of appropriate personal protective equipment (PPE), specifically respirators with cartridges or canisters effective against oil-based aerosols and formaldehyde.

From the report:

What We Found

- Levels of mineral oil mist in air were above exposure limits. These measurements were taken during training exercises involving only oil-based smoke simulant.
- Levels of diethylene glycol in air were above the exposure limit. Levels of formaldehyde in air were about half the exposure limit. These measurements were taken during a training exercise that involved only glycol-based smoke simulant.
- Levels of mineral oil mist, diethylene glycol, formaldehyde, and acrolein in air were above exposure limits. These measurements were made during training exercises that involved smoke simulants, heat, and fire.
- Levels of these compounds in air could exceed exposure limits outside the training room when a trainer opens the door to look inside.
- The mineral oil mist and diethylene glycol aerosols were small enough to penetrate deeply into the lungs.
- Brief exposures to the compounds we measured could irritate the eyes and lungs or cause more serious lung damage.
- Levels of mineral oil on trainers' turnout gear and surfaces in the training room after training exercises were mostly non-detectable. Page ii Health Hazard Evaluation Report 2012-0028-3190
- From our interviews, the most commonly reported symptom was cough.
- Our medical record review confirmed a respiratory illness due to prolonged exposure to mineral oil mist.

What the Employer Can Do

- Rotate training officer duties throughout a full day of training exercises.
- Ensure that trainers do not re-enter the training tower without wearing appropriate respirators until the tower is visibly clear of smoke simulant.
- Require trainers to wear self-contained breathing apparatus inside the training tower even if they are outside the training room during training exercises that involve heat or fire.
- Require trainers to wear self-contained breathing apparatus or full-facepiece air purifying respirators with cartridges or canisters that are effective against oil-based aerosol and formaldehyde during training exercises that involve only smoke simulants. Trainers should wear these respirators inside the training tower even if they are outside the training room. Respirators should also be worn during maintenance and adjustment activities if smoke simulant release is expected.
- Maintain all respirators and make sure they fit and function properly.
- Create a schedule for changing out respirator cartridges and canisters.
- Fit test the trainers for each of the respirators that they are to wear.
- Encourage trainers to report any health concerns or symptoms associated with work tasks to a supervisor.