What you can't see can hurt you

A review of *Ultrafine Particle Exposure During Fire Suppression—Is It an Important Contributory Factor for Coronary Heart Disease in Firefighters?* ***Original article written by:*** CS Baxter et al. Journal of Occupational Medicine 52(8):791-6, 2010.

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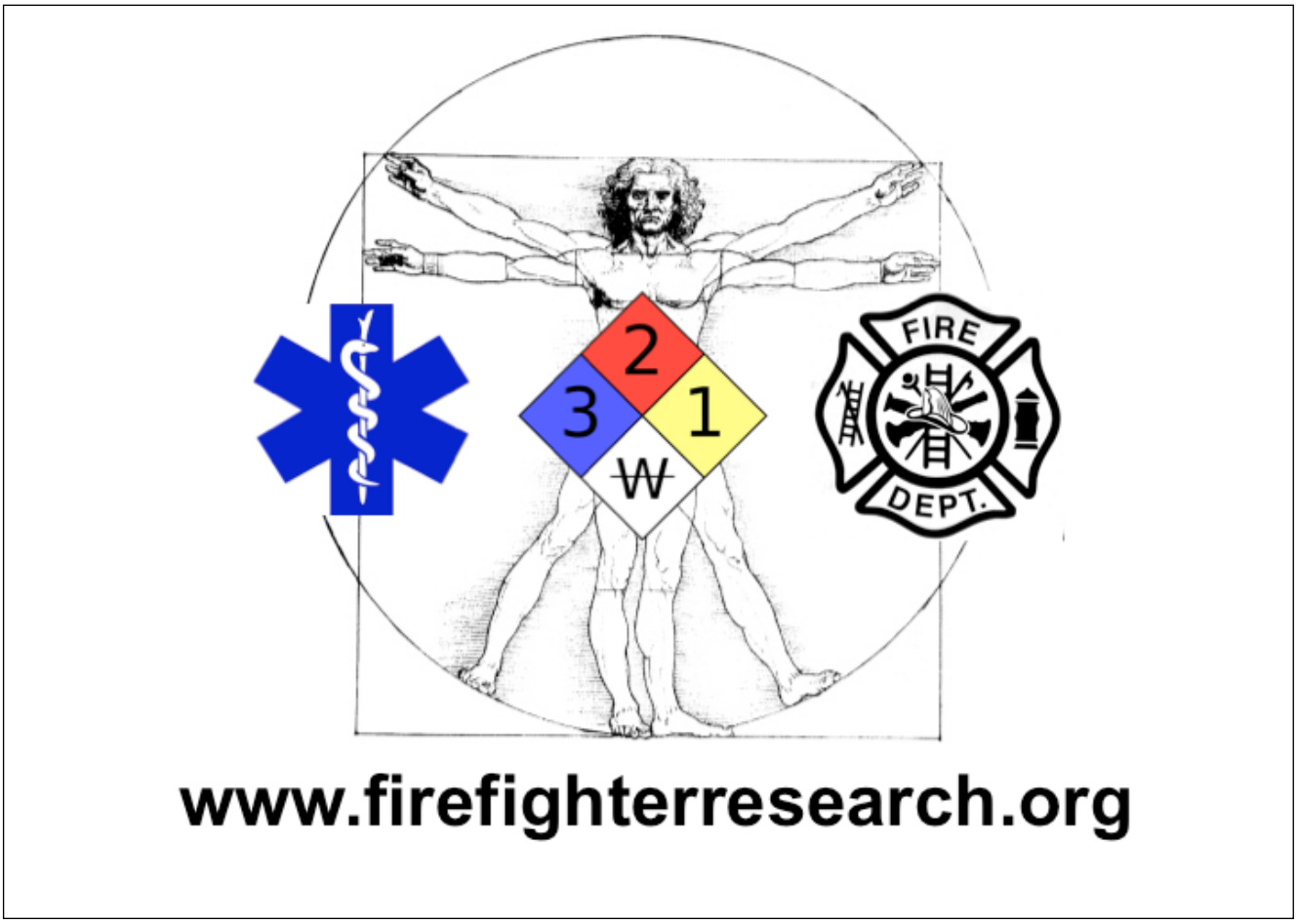

Introduction

In order to connect the Fire Service with important research relevant to health, safety, and operations; the Emergency Responder Human Performance Lab will present a concise summary of a new research article each month.

This month we review a research study from Underwriters Labs, the Chicago Fire Department, and the University of Cincinnati examining ultrafine particle exposure after a structure fire. This fireground hazard is rarely considered and cannot easily be detected with equipment at our disposal.

Although the cause is not clear, it is well known that heart attacks are the single biggest cause of line-of-duty deaths (LODD) among firefighters accounting for nearly half of the fatalities. Heavy exertion can trigger heart attacks, especially in less fit individuals, and blood platelets are activated by heat stress that may worsen a heart attack.

Some of the adverse exposures faced by firefighters are found in fire smoke both during and after fire suppression. Even simple smoke from a wood-burning stove can cause inflammation in healthy individuals. The toxic mixture within fire smoke is more damaging to the heart and other body organs. Contained within fire smoke are small inhalable particles known as fines and ultrafines. These particles (less than 0.00001 mm in diameter) are less well known to the fire service but are very damaging to the firefighter's health.

What the study did

Seven full-scale fire tests were conducted in the fire test laboratory at Underwriters Laboratories. The seven tests represented typical residential and automobile fire scenarios. The six residential scenarios included a living room, bedroom, kitchen, attic, and composite and traditional wood deck structures. The automobile scenario involved a passenger compartment fire.

The sampling probe was positioned at 5 ft. 6 in. (about face height) to count the size and density of particles. In the attic fire, smoke particles were measured from ignition through overhaul. For the other scenarios, smoke particles were measured only during overhaul.

What the study reported

Particle densities during overhaul exceeded the background particle density by 2 – 400 times. The highest concentration of particles was found in the structure fire scenarios and lower concentrations in the outside wood deck scenario and the car fire scenarios.

What it means for the fire service

Inhalable particle exposure after fire suppression is common. Ultrafine particle concentration can be very high even when there does not appear to be a significant amount of fire smoke in the room. The exact exposure required to cause health issues is not known but these particles cause cardiac toxicity in other workers and severe forms of atherosclerosis in mice. Tollbooth workers and boilermakers are routinely exposed to ultrafine particles and suffer worse forms of cardiac disease and arrhythmia when compared to other occupations.

A firefighter's exposure to ultrafine particles may be intermittent but the deeper and more rapid breathing of exertion during overhaul will magnify each individual exposure. There is no easy way to measure particle density on the fireground and filtering facepiece respirators are not effective against ultrafine particles. SCBA use during overhaul is the only effective protection available to the firefighter. Don't assume that because the air in the structure looks clear that it will not hurt you.