the presence of engineered wood I-joists and actions they can take when engineered wood floor systems are encountered. Fire Departments need to identify structures within their jurisdiction containing engineered wood products through pre-incident planning and inspections and develop appropriate response procedures. Builders, contractors, and owners should consider protecting engineered wood I-joists by covering the underside with fire-resistant materials.

F4.2

Title: Preventing Fire Fighter Deaths and Injuries Caused by Failure to Wear Vehicle Safety Restraints

Authors: **Lutz V**, Romano N

Introduction: The National Fire Protection Association (NFPA) reports that motor vehicle incidents are consistently the second leading cause of on-duty fire fighter fatalities. A NFPA 30-year study (1977-2006) reveals that only 13% of the 406 fatal crash victims were wearing safety restraints, and 45 fire fighters died when they fell from a moving apparatus.

Methods: The NIOSH Fire Fighter Fatality Investigation and Prevention Program (FFFIPP) studies fatal fire fighter occupational incidents, with the goal of identifying effective prevention measures. Through on-site investigations, FFFIPP personnel collect agent, host, and environmental information from the pre-event, event, and post-event phases of the fatal incident.

Results: A review of FFFIPP investigations from 1998 - 2007 identified 63 motor vehicle related cases involving the death of 46 fire fighters where not being seated and restrained in a moving vehicle likely contributed to the fatality. Relevant findings from these investigations include: (1) fire departments often have established safety restraint standard operating procedures (SOPs) that are not enforced, and (2) there have been instances when fire fighters had to remove safety restraints to perform required tasks because of apparatus/equipment design and/or placement.

Conclusions: Evidence collected during FFFIPP investigations suggests that fire departments must not only develop, but need to enforce SOPs that require all occupants in moving apparatus to be seated and restrained at all times the vehicle is in motion. Manufacturers, fire departments, and those who refurbish emergency vehicles must take into consideration all movements needed to reach equipment and ensure that safety restraints can be worn by all occupants when performing required tasks.

F4.3

Title: Physiological Effects of Boot Weight in Men and Women Fire Fighters

Authors: **Turner N**, Chiou S, Zwiener J, Weaver D, Spahr J, Sinkule E, Haskell W

Introduction: Most fire fighters wear heavy rubber boots or lighter leather boots. Increases in oxygen consumption per kg of weight added to the foot may depend on gender, boot material, and whether or not subjects are wearing additional protective clothing or equipment.

Methods: Twenty-five men and 25 women fire fighters, while wearing full turnout clothing, a 10.5-kg backpack, gloves, helmet, and one of six randomly assigned pairs of fire fighter boots, walked for six minutes at three mph on a treadmill while carrying a 9.5-kg hose and then climbed a stair ergometer for six minutes at 45 steps per minute.

Results/Discussion: Minute ventilation (VE), oxygen consumption (VO2 and VO2kg), CO2 production (VCO2), and heart rate (HR) were measured, and an average of the breath-by-breath data from minute six was used for analysis. During treadmill exercise, boot weight had a significant effect ($p \leq 0.05$) on VO2, VO2kg, and VCO2 in men and women; boot weight had a significant effect ($p \leq 0.05$) on VE and HR for men only. In men, a 1-kg increase in boot weight caused a 9% increase in VE and 6 - 8% increases in VO2 and VO2/kg. The increase in VE observed in men could result in an approximate 8% decrease in service time for a 45-min SCBA cylinder. In women, 3% increases in VO2 and VO2/kg were observed. Gender differences observed during treadmill walking may be due to a decrease in women's stride length while carrying a load. During stair climbing, a 1-kg increase in boot weight caused a 3.5% increase in VO2 in men only ($p \leq 0.05$). This 3.5% increase is less than the 5% increase observed in a previous study of leather and rubber boots where subjects wore only gym shorts and may reflect a diminished effect of boot weight with full turnout gear.

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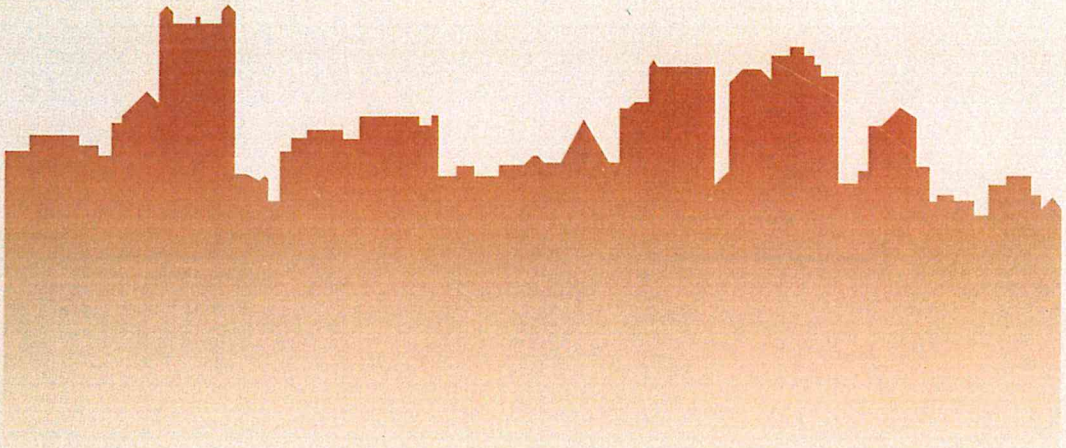

October 21-23, 2008

Pittsburgh, PA

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