B85 Transfer of Gasoline From Footwear to Flooring Materials: Can This Occur at a Fire Scene?

Yevgenia Kravtsova, BS, University of Toronto, 3359 Mississauga Road, Mississauga, ON L5L 1C6, Canada; and Dalia Bagby, MS, Centre of Forensic Sciences, 25 Grosvenor Street, Toronto, ON M7A 2G8, Canada*

After attending this presentation, attendees will understand that gasoline can be transferred from footwear to different flooring materials over several meters depending on the flooring type and initial quantity of gasoline used and that transfer is most likely to occur in situations where gross contamination of footwear has taken place.

This presentation will impact the forensic community and/or humanity by raising awareness of this possible mode of fire scene contamination and that the risk of a worst-case scenario can be avoided by refuelling suppression-related equipment away from the scene.

This presentation will explore the potential for post-fire introduction of a volatile ignitable liquid by contaminated footwear and subsequent identification of volatile ignitable liquid residues in the collected debris samples. It is sometimes alleged, in the courtroom, that traces of gasoline or other volatile ignitable liquid detected in samples from the scene originated from the contaminated footwear of fire-service personnel during suppression efforts via "tracking" (i.e., the direct transfer of volatile ignitable liquid from the soles of contaminated shoes to the flooring substrates). Gasoline powered equipment, such as positive pressure ventilation fans and cutting tools, is sometimes used at fire scenes during suppression, salvage, and overhaul. This equipment may require refueling, raising the concern that volatile ignitable liquid could be inadvertently tracked into an area from which samples might be collected.

A series of experiments were done in which a known volume of gasoline was deposited on an item of footwear and the wearer walked across one of a series of common flooring substrates. Gasoline was selected as the volatile ignitable liquid used in the tracking experiments since it is a common fuel used in suppression-related equipment.

For the study, samples of pre-burned substrate were positioned along a walking path for the subject to tread upon. Tracking courses of up to 8 m were used, depending on the volume of gasoline applied. For different tracking runs, the courses consisted of either a non-absorbent substrate (linoleum tile) or an absorbent substrate (carpet or bare wood). Each of the substrates was pre-burned on the upper surface by exposure to flame from a propane torch. Another series of carpet samples were charred by exposure to the radiant heat of burning furniture in a fire cell. For each trial, a volume of gasoline (either 1 drop, 1 mL, or approximately 10 mL) was applied to the bottom of rubber-soled work- boots and tracked through the course of flooring material. For the large volume trial, done to simulate gross contamination, approximately 10 mL of gasoline was deposited on the footwear by having the subject stand in a basin of liquid gasoline and measuring the volume applied by difference. Each tracking run was followed by collection of samples at the corresponding transfer locations and each run was done at least twice. Sample collection was done as quickly as possible after each tracking run. A sample at the first step (i.e., the point of contact between the sole of the boot and the flooring) was collected and packaged within the first minute after exposure and all other samples were collected and packaged within 10 minutes. The collected samples were packaged in glass Mason jars and subsequently analyzed in the laboratory by dynamic headspace gas chromatography-mass spectrometry (GC-MS).

When 1 drop of gasoline was used, no gasoline was identified on any of the wood or carpet samples. On linoleum, no gasoline was identified beyond the first step. When 1 mL of gasoline was used, deposition was detected on all flooring types within 1m of the starting point. No deposition was observed more than 4 m from the starting point on any flooring type. When 10 mL of gasoline was used, it was possible to detect gasoline deposition no farther than 6 m from the starting point on either carpet or bare wood flooring and gasoline was identified in one of two linoleum samples taken at 8 m. Note that the contamination of footwear with 10 mL of gasoline represents, in the opinion of the authors, a degree of contamination beyond that which would be expected to occur during the refueling of equipment.

This study suggests that gasoline can be carried for a number of meters on footwear and that the distance it may be transferred is dependent upon the initial volume of gasoline deposited and the nature of the flooring material. It is incumbent on all persons present at a potential crime scene to mitigate this risk of scene contamination by avoiding the refueling of equipment in the immediate vicinity of the fire scene.

Contamination, Fire Debris Analysis, Ignitable Liquids

 ** Presenting Author*