## H24 Fatal Fire Modeling: Replicating Environmental and Human Factors Associated With the Recovery and Analysis of Burned Human Remains

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The goal of this presentation is to present replicative modeling of structural and vehicular fires provides forensic scientists with the opportunity to identify specific variables that are directly correlated with the production of burn patterns, which serves to improve the overall accuracy and reliability of our analysis of burned human remains.

This presentation will impact the forensic science community by showing that just as each fire scene is unique, so are the burn patterns produced on the body, which directly result from being exposed to different types of environmental conditions during and after the fire.

A year ago, a report by the National Academy of Sciences called for higher standards and increased accuracy of scientific research in the forensic sciences. Experimental replication of known and realistic conditions is but one of several solutions that forensic anthropologists can use to address these concerns. Traditionally, our investigation of burned human remains begins in a laboratory setting, which is far removed from the *in situ* context of the taphonomic changes that originally produced the skeletal burn patterns used in our analysis. This presentation will show that just as each fire scene is unique, so are the burn patterns produced on the body, which directly result from being exposed to different types of environmental conditions during and after the fire. Replicative modeling of structural and vehicular fires provides forensic scientists with the opportunity to identify specific variables that are directly correlated with the production of burn patterns, which serves to improve the overall accuracy and reliability of our analysis of burned human remains.

A total of eight donated human cadavers were burned different environments that replicated actual forensic casework using two vehicles, four furnished burn cells (structures), a travel trailer, a dumpster, and a light craft airplane that had crashed into a building. Though these seem like random scenarios, many of these environments produced patterned similarities, as well as differences, depending on the types of combustible fuels, objects in contact with the body, duration, and methods of extinguishment. All of the experiments went to flashover (where all contents ignite), and burned for a duration of 15-30+ minutes.

**Combustibles and Points of Contact*:*** Initially during the fire, certain surfaces of the body remained protected from heat, since they were in direct contact with other objects (floor/furniture/fabrics/seats). However, these points of contact gradually changed as the furnishings burned away and from limb flexion into the pugilistic posture, which exposed more surfaces of the body directly to heat. Bodies that remained elevated from the floor on exposed mattress springs, seating frames (household and vehicular) had more uniform heat-related damage to soft tissues and bone than those that remained directly in contact with a flat surface (metal bench/floor/stove/trunk) during the fire.

**Fallen Debris:** During the fire, especially after flashover, various types of debris collapsed onto and around the body, more so for structural fires than vehicular. This process created two different taphonomic artifacts of fragmentation and protection. Collapse of fire debris increased fragmentation of brittle burned bone from impacts to the body and/or from the body shifting position as supportive materials burned away. Debris also provided more areas of protection from direct flame and dehydrated the remaining soft tissues. For example, the aircraft crash fire burned for 20 minutes with temperatures over 2000° F that destroyed the body of the plane and part of the building, yet the human body remained well protected from being buried in fire debris, leaving only the face, hands, and knees exposed.

**Human Factors*:*** Scenes were realistically extinguished by firefighters with pressurized water, then searched and excavated by fire and death investigators, who had no prior knowledge of the original conditions. Each of these activities contributed to the further breakdown and alteration of burned human remains. This inherent problem was minimized with extensive photographic documentation of the original *in situ* context of the victim and the entire field investigative process.

Results from these documented structural and vehicular fires will be presented to illustrate the how each kind of fire environment produces different types of burn patterns and should be considered when analyzing burned human remains, along with postmortem changes from human factors during recovery.

**Fatal Fire Investigation, Burned Human Remains, Taphonomy**

 ** Presenting Author*