D25 The Use of Toxicological Evidence in Fire Investigation

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Learning Overview: The goals of this presentation are to: (1) put forth a methodology for using toxicological data for the testing of hypotheses using the application of the Scientific Method to the investigation of fire and explosion incidents; and (2) provide examples of its use and discuss the limitations.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing a new and reliable methodology, will show how it can be used and its value, and include a discussion of the limitations.

Scientifically reliable determinations in forensic investigations are predicated on the use of a scientifically reliable methodology. The methodology recommended by National Fire Protection Association (NFPA) 921, the *Guide for Fire and Explosion Investigations*, states the "standard of care associated with the forensic investigations of fire and explosion incidents is the Scientific Method." NFPA 921 defines the Scientific Method as "The systematic pursuit of knowledge involving the recognition and definition of a problem; the collection of data through observation and experimentation; analysis of the data, the formulation, evaluation and testing of hypotheses; and, where possible, the selection of a final hypothesis."

Recognizing that *data* is information that can be documented and verified, and *evidence* is *data* that is relevant and reliable in a specific context, *evidence* is the key to the reliable application of the Scientific Method to the investigation of fire and explosion incidents. Data for use as evidence using the Scientific Method may come in many forms. Fatal fires or fires that involve human injuries may provide such data and evidence. There is a direct connection between the conditions necessary for the production of toxic products of combustion in fires and the dose response of the uptake of the products of combustion in mammals. This direct connection of autopsy and injury data from victims of fire may provide the fire investigator with important, discriminant, scientific evidence to assist in the testing of hypotheses associated with the fire origin and *fire cause* determination.

Through the combined use of fire testing, fire modeling, and physiological modeling, the fire investigator may be able to test or further validate their origin and *fire cause* hypothesis(es), and other aspects of a fire incident based on the facts of the case and data collected during autopsy or hospital evaluation. As demonstrated in the case study, autopsy data and evidence were compared against carbon monoxide (CO) concentrations and temperature profiles for two competing origin and *fire cause* hypotheses. Only one of the fire scenarios produced toxicant doses and thermal conditions are uniquely consistent with the victim's injuries. A discussion of the limitations of the use of autopsy data and identification of unique conditions with the fire dynamics of "locally under-ventilated" fires will be discussed. Ultimately, the evaluation of autopsy data in combination with the facts of the case and dynamics of the fire assisted in producing scientifically reliable origin and *fire cause* determination using the application of the Scientific Method.

Toxicology, Fire, Investigations