



Coffee Break Training - Fire Investigation Series

Fire/Arson and Explosion Investigation Curriculum: The Scientific Method Applied to Fire and Explosion Investigation

No. FI-2013-16 November 4, 2013

Learning Objective: The student shall be able to explain the scientific method and its application in fire and explosion investigations.

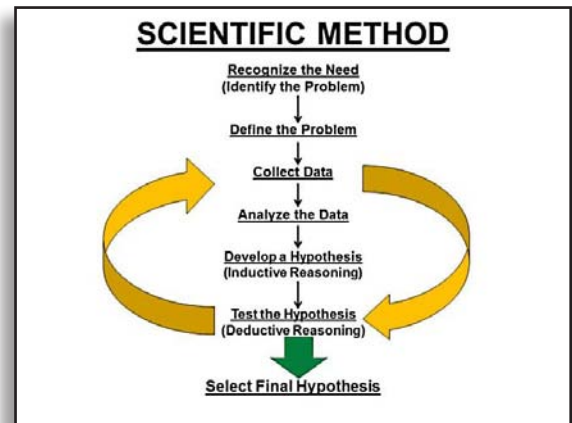
NFPA 921, *Guide for Fire and Explosion Investigations*, defines the scientific method as the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of a hypothesis. Since the adoption of the first edition of NFPA 921 in 1992, the courts have placed more scrutiny and attention on the methodology used by investigators (expert witnesses) to form their opinions concerning the origin and cause of fires and explosions.

Basic Methodology, Chapter 4 of NFPA 921, lists the steps of the scientific method as follows: Recognize the need, define the problem, collect the data, analyze the data, develop a hypothesis, test the hypothesis, and select a final hypothesis. There are numerous benefits for using the scientific method to examine fire and explosion cases, namely general acceptance of the methodology in the scientific community, use of a uniform, peer-reviewed protocol of practice and improved reliability of testimony from opinions formed using a systematic approach.

Listed below is a summary of the application of the scientific method to fire and explosion investigations as outlined in NFPA 921:

1. **Recognize the Need (Identify the Problem).** Fire investigator is notified of an incident and asked to respond to the scene to conduct a fire scene examination.
2. **Define the Problem.** Includes determining the origin and cause of an incident by conducting a comprehensive examination of the scene to identify what role the fuel(s) and potential ignition sources may have played in fire development and spread or determining the cause of death of a fire victim.
3. **Collect Data.** Facts and information about the incident should be collected through recognition of physical evidence such as fire patterns, direct observations, measurements, documentation such as photography, evidence collection, testing, experimentation and witness interviews.
4. **Analyze the Data.** The investigator relies upon his or her knowledge, training and experience in objectively evaluating the totality of the data. This subjective approach to the analysis of data may include knowledge of similar loss histories (observed or obtained from references), training and understanding of fire dynamics, fire testing, and research of experimental data.
5. **Develop a Hypothesis (Inductive Reasoning).** Based upon the data analysis, a preliminary working hypothesis(es) based on empirical data should be developed to explain the fire's origin, cause and development that is consistent with on-scene observations, physical evidence and information obtained from witnesses.
6. **Test the Hypothesis (Deductive Reasoning).** The investigator uses his or her knowledge and skills to challenge or test potential hypotheses analytically. The hypotheses being considered should be compared with all other known facts, the incidence of prior loss histories, authoritative fire test data, published treatises, and fire tests and experiments to eliminate all other reasonable (potential) origins and causes for the event. This may involve reviewing the analyses with other investigators who have relevant training and experience to identify those hypotheses that can be supported by the same set of facts. Investigators should interactively repeat Steps 4, 5 and 6 until there are no discrepancies between the hypotheses. By rigorously testing various hypotheses against the data, those that cannot be conclusively eliminated should still be considered viable.
7. **Select Final Hypothesis (Conclusion or Opinion).** When the hypothesis is thoroughly consistent with evidence and research, it becomes a final hypothesis and can be authoritatively presented as a conclusion or opinion of the investigator. If a final hypothesis is not supportable to a probability and is only possible or suspected, the cause should be reported as "undetermined."

Additional information on the application of the scientific method in fire/arson and explosion investigation can be obtained from The Scientific Method for Fire and Explosion Investigation online training module at <http://www.cftrainer.net/>.



The scientific method is the foundation upon which an investigator's opinions must be based to form legally defensible conclusions in a fire or explosion investigation.