

Training Guidelines for the Fire Debris Analyst

Lesson Plan (Module) 6

Date: November 2006

Instructor: Qualified Instructor

Subject: Investigative Process (Origin and Cause)

Total Time: 8 hours

Learning Objectives

- Understand the basic fire investigative process.
 - Recognize the sample collection process.
 - Recognize the constituents of common household materials and their contribution to fires.
 - Understand the terminology of fire indicators.
 - Understand potential sources of ignition.
 - Understand the fire investigator's expectations of the laboratory.
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Suggested Reading

1. *Kirk's Fire Investigation*, 5th Edition, John DeHaan, Ed. Brady/Prentice Hall, Upper Saddle River, NJ, 2002, ISBN:0130604585, Chapters 7, 8 and 9.
2. *NFPA 921, Guide for Fire and Explosion Investigation*. NFPA, Quincy, MA, 2004, Chapters 4, 6, 16, 17 and 18.
3. "Behavior of Glass at Elevated Temperatures", Lentini, J.J., *Journal of Forensic Sciences*, 37(5), pp. 1358-1362, 1992.
4. "Ignition of solid materials and furniture by lighted cigarettes. A review.", Holleyhead, R., *Science and Justice*, 39(2), pp. 75-102, 1999.
5. "Ignition of solid materials and furniture by lighted cigarettes. A review.", Holleyhead, R., *Science and Justice*, 36(4), pp. 257-266, 1996.
6. *Fire Investigation*, Daéid, N.N. Editor, CRC Press, 2004; Chapter 1 "An introduction to fires and fire investigation", Daéid, N.N; Chapter 2 "Fires from causes other than electrical malfunctions: theory and case studies", Maguire, C.
7. *Analysis and Interpretation of Fire Scene Evidence*, J.R.Admirall & K.G. Furton, Editors. CRC Press LLC, 2004; Chapter 2 "Fire Scene Investigation: An Introduction for Chemists", Hine, G.A.; Chapter 3 "Detection of Ignitable Liquid Residues in Fire Scenes: Accelerant Detection Canine (ADC) Teams and Other Field Tests", Furton, K.G. and Harper, R.J.
8. "Evaluation of a portable gas chromatograph for the detection of ignitable liquids", Casamento, S., et al., *Canadian Society of Forensic Sciences Journal*, 38(4), pp. 191-203, 2005.

9. *Scientific Protocols for Fire Investigation*, Lentini, J.J., CRC Press, Taylor & Francis Group, Boca Raton, FL, 2006; Chapters 4, 6-10.
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Introduction

The fire investigator determines what samples are collected and sent to the lab based on interpretation of fire scene indicators. The lab analyst must understand the scene investigative process and why particular samples are collected. The student should be able to effectively communicate with his or her local fire investigators.

Outline

1. Scene preservation and contamination
 - a. Securing the scene
 - b. Awareness of sources of contamination
 - c. Prevention of contamination

2. Identification of origin
 - a. Initial survey and documentation
 - b. Fire scene indicators
 - i. direction
 - ii. intensity
 - iii. V patterns
 - iv. low burns
 - v. halo patterns
 - vi. interpretation and reliability
 - c. Witness interviews
 - d. Alarms/surveillance information

3. Recognition of first fuel ignited
 - a. Residues
 - b. Witness description

4. Identification of ignition source
 - a. Sources of heat
 - i. Electrical
 - ii. Open flame (matches, lighters, candles)
 - iii. Spontaneous heat (chemical, biological, heat induced)
 - iv. Friction heating
 - v. Hot objects
 - vi. Smoking materials
 - vii. Chemical reactions
 - viii. Appliances

5. Application of the scientific method to the fire investigative process
 - a. Testing hypotheses
 - b. Consideration of myths
 6. Establishment of cause
 - a. First fuel
 - b. Ignition source
 - c. Circumstance of their confluence
 7. Contributions of ordinary combustibles to fires
 - a. Melting point of materials
 - b. Heat release rates
 - c. Pyrolysis products
 - d. Physical residues
 - e. Ignitability
 8. Selection of laboratory samples and comparison samples
 - a. Protected areas
 - b. Uncontaminated samples
 - c. Representative sample
 - d. Fire patterns used to indicate presence of ignitable liquids
 9. Detection tools
 - a. Canines
 - b. Electronic sniffers
 - c. Odors
 - d. Visual indicators (slicks)
 - e. ALS
 - f. Ignitable liquid absorbents
 10. Recovery and packaging (See Module 8)
 - a. clean tools and gloves
 - b. selection of appropriate containers
 - c. absorption media
 - d. sealing
 - e. labeling
 - f. storage and transport
 11. Expectations of the investigator
 - a. identification of product
 - b. unique source identification
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Teaching Aids

Physical samples

Practical exercises
Participate in a control burn
Handout
PowerPoint presentation

Summary

Fire investigators use a variety of smoke, heat and fire damage patterns and indicators to help them identify possible or likely areas of origin. At each suspected origin, the investigator examines the debris for residues of the first fuel ignited and possible ignition sources. This fuel may be combustible material that normally belongs to the scene or an accelerant deliberately added (which can be either a solid fuel or ignitable liquid). The analyst must understand the investigative process, the reasons samples are selected, the necessity for comparison samples, and the questions to which the investigator may need to get answers. The terms used by fire investigators must also be understood by the lab analyst to ensure good communication.

Test Questions

1. Controlling chemical contamination from footwear can be restricted by:
 - a. controlled access paths
 - b. footwear baths
 - c. booties
 - d. **all of the above**

2. Gloves should be:
 - a. **changed with each sample**
 - b. packaged in the container with the evidence
 - c. changed with each scene
 - d. never worn

3. Accidental sources of ignition can include:
 - a. lightning
 - b. solar rays
 - c. unsaturated vegetable oils
 - d. appliances
 - e. **all of the above**

4. Potential sources of ignition for gasoline vapors include:
 - a. smoldering cigarettes
 - b. solar radiation
 - c. **static electricity discharge**
 - d. energized electric stove element
 - e. all of the above

5. Which of the following is not a reliable tool for detection of possible ignitable liquid residues at the scene:
- canine
 - infrared photography**
 - field GC results
 - electronic sniffers
6. Reliable indicators of ignitable liquids include:
- shiny alligating patterns
 - spalling
 - clean burns
 - crazed glass
 - none of the above**
7. Indicators of the direction of fire spread include:
- bevel patterns
 - smoke horizons
 - V patterns
 - intensity patterns
 - all of the above**
8. An irrefutable indicator of point of origin is:
- lowest burn
 - deepest burn
 - V pattern
 - clean burn
 - none of the above**
9. The biggest fires in most modern residential properties are supported by which fuel:
- urethane foam**
 - cotton futon
 - vinyl bean bag chair
 - gallon of gasoline