Chapter 12

Potential Area of Origin Determination

Section A: True/False

Directions: Write True or False on the blanks provided; if False, write the correct statement on the lines provided.

1. _____ Fire investigation is a forensic science where evidence is simultaneously destroyed or altered as it is generated. (345)

2. _____ Fire patterns are the overall collection of fire effects. (348)

3. _____ During the analysis of fire patterns, investigators also consider protected areas as markers that may assist in scene reconstruction. (345)

4. _____ The analysis of adjacent patterns and the correlation with available fuel packages cannot assist in the determination of the area or areas of origin. (346)

5. _____ As fire conditions intensify, visible fire effects and patterns cannot change the initial patterns. (347)

6. _____ In an oxygen deficient environment, such as a compartment that generated full-room involvement, it is possible that less damage may be present or persist around the origin of the fire then elsewhere in the compartment. (347)

7. _____ Lower temperatures result in decreased heat flux, which then has more capacity to generate damage including fire patterns. (348)

8. _____ Fire patterns are formed on surfaces of a structure as a result of direct flame contact or the exposure to heat generated by a fire. (349)

9. _____ Throughout the investigative process, the investigator should assume that the most damaged area indicates the area of origin. (351)

10. _____ An investigator who is reconstructing the history of the fire must understand how each pattern at a fire scene was generated and, if possible, its sequence. (352)

11. _____ Investigators should use vectors with dashed lines for horizontal fire spread, and vectors with solid lines for vertical fire spread. (357)

12. _____ Investigators must first identify where arcing occurred before they can see the overall arc fire pattern. (358)

13. _____ When circumstances indicate that a conductor may have arced, the investigator examines half conductor sections. (358)

14. _____ Dirt accumulation, char, rust, frayed insulation, or cut insulation are the results of other fire damage and do not indicate an arc site. (359)

15. _____ The presence on conductors of melting itself indicates an arc site. (359)

16. _____ An X-ray can capture the arcing for examination and may eliminate the need to conduct destructive testing. (360)

17. _____ Plume shape is affected by the relative distances of the burning fuel package from the vertical surface. (365)

_____

_____

18. _____ A V-shaped pattern is frequently found in compartment fires. (366)

_____

_____

19. _____ U-shaped patterns appear when the burning fuel package is near the vertical surface. (366)

_____

_____

20. _____ The center of the circular-shaped pattern should show lesser damage from the fire by having a lesser depth of char or depth of calcination or other measurable damage effect. (368)

_____

_____

21. _____ When fire investigators examine patterns found on a door, they should also consider whether hot debris falling against or near the lower portion of the door contributed to the development of patterns being observed. (372)

_____

_____

Section B: Fill in the Blank

Directions: Write the correct answer on the blanks provided.

1. Scene reconstruction, and correlation of damage with fuel sources, can be difficult when numerous _____ create patterns in an area. (348)
2. During scene evaluation, debris removal, and scene reconstruction, an investigator should develop a _____ as to the potential area or areas of origin of the fire. (348)
3. An investigator should understand the _____ and _____ that can produce physical effects in a compartment. (349)
4. In an incident with full-room involvement, basing the origin area on the degree of damage alone will likely lead to a(an) _____ hypothesis. (347)
5. Fire patterns have visible _____ where the fire or products of combustion affected a surface, leaving adjacent surfaces less affected or intact. (349)

6. Fire patterns can indicate fire movement, _____ _____, or both. (352)
7. Vector diagrams show scene examination findings drawn over a _____diagram of an incident scene or compartment. (357)
8. Investigators should have available a low-power magnification device, to examine the _____ in the field. (358)
9. Creating an _____ _____ begins with an accurate sketch of the compartment under investigation. (360)
10. Inverted cone patterns are _____ in shape, with a wide base that narrows to a point centered over the fire. (367)
11. An hourglass pattern forms when a fire burns _____, close to a vertical surface. (368)
12. Ventilation patterns result from the movement of _____ in the compartment or building during the fire. (371)

Section C: Picture Identification

Part I: Plume patterns

Identify the type of plume-generated pattern in the images below.

1. _____ (366)

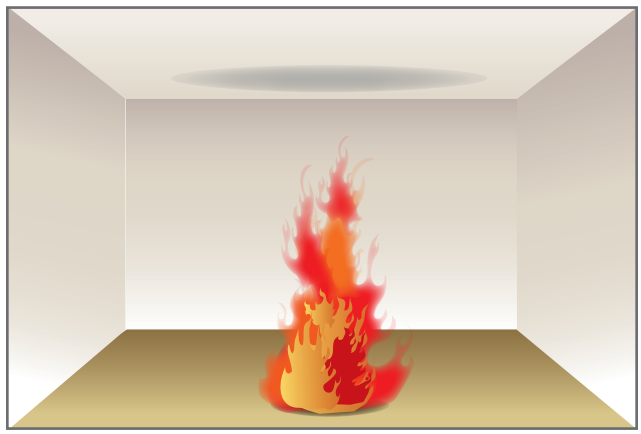
2. _____ (367)

3. _____ (367)

4. _____ (367)

5. _____ (368)

6. _____ (368)



Section D: Matching

Directions: Write the correct answers on the blanks provided.

Part I: Types of arcs

Match the terminology with the correct description.

Arc Types:

A. Parting Arc

B. Arcing Through Char

Descriptions:

_____ 1. Occurs when the insulation protecting a conductor breaks down and becomes somewhat conductive, allowing current to flow through the insulation. (360)

_____ 2. Occurs when a cord from an appliance is removed from a receptacle while current is still flowing (appliance is on). (360)

Section E: Multiple Choice

Directions: Write the correct answers on the blanks provided.

_____ 1. While examining a fire scene, investigators should consider if: (346)

A. tertiary burning caused the flame plume damage.
B. only one burning caused the flame plume damage.
C. only secondary burning caused the flame plume damage.
D. primary or secondary burning caused the flame plume damage.

_____ 2. One way to compare data is to indicate findings on a floor plan as a _____ diagram where areas of overlap demonstrate where the information sources corroborate each other. (347)

A. Venn
B. Gantt
C. SWOT
D. Fault Tree

_____ 3. What are the two most significant factors when conducting heat and flame vector analysis? (347)

A. Air movement and convective heat
B. Conducted heat and radiant heat flux
C. Oxygen concentration and radiant heat flux
D. Oxygen and ventilation, and radiant heat flux

_____ 4. In the early stages of a fire, what are the primary means of pattern production? (348)

A. Fire plume and the heat flux rates
B. Combustible types and heat index
C. Types of fuel and the ignition source
D. Oxygen concentration and humidity percentage

_____ 5. A ceiling jet formed by the intersection of the plume and a ceiling causes greater heat to transfer first to the ceiling surface and then to _____surfaces. (348)

A. wall
B. floor
C. window
D. furniture

_____ 6. The investigator may use each fire effect as an indicator to initially classify the: (349)

A. cause of a fire.
B. fuel packages.
C. cause of the observed damage.
D. root cause of the created damage.

_____ 7. An investigator should corroborate witness information with: (350)

A. firefighter information.
B. conditions at the scene.
C. conditions outside the scene.
D. data from other investigative cases.

_____ 8. How can investigators take measurements of char depth and the extent of char across a damaged surface? (354)

A. Using a char gauge
B. Taking a 3D photo
C. Using a micrometer
D. By testing hardness of the surface

_____ 9. What is the ultimate outcome of depth-of-char analyses? (354)

A. Analyze the type of charcoal produced
B. A rough estimation of the velocity or duration of a fire
C. Determination of how much combustible material was consumed
D. An objective and measurable determination of the movement or intensity of a fire

_____ 10. What does an Isochar map provide? (354)

A. Degrees of fire intensity
B. Potential area of origin locations
C. Objective evidence of areas with greater heat flux
D. A three-dimensional description of heat index

Section F: Short Answer

Directions: Write the correct answers on the lines provided.

1. What are two factors investigators must understand to present a compelling case for their determination of a potential origin area? (345)

_____

_____

_____

_____

2. When evaluating a hypothesis regarding an area of origin, what questions should the fire investigator consider? (345)

3. What are the three primary categories of information investigators consider while determining the potential area of origin? (347)

4. What causes a fire effect? (349)

5. List five pieces of information investigators should obtain from firefighters. (350)

6. List four items of alarm data that can help an investigator to develop a hypothesis regarding the origin of a fire. (350)

7. What are two variables an investigator should consider when measuring char? (354)

8. What are two pieces of information that should be considered during arc mapping analysis? (358)

9. List four characteristics of an arc site that may be visible without aid or, in some cases, with low power magnification. (359)

_____

_____

_____

_____

10. List five characteristics included on a fire pattern with clear definition. (364)

_____

_____

_____

_____

_____

11. What are three questions a fire investigator should ask when evaluating lines of demarcation and damage within the patterns? (364)

_____

_____

_____

Section G: Scenario

Directions: Answer the following questions based on the scenario below.

Scenario

The fire department responded to a fire at a single-family residence in the early afternoon; no residents were present at the time of the fire. The fire was confined to the kitchen and dining room area, and firefighters were able to extinguish it before it spread further. In addition to other overhaul activities, the Incident Commander ordered the removal of ceilings in the two rooms due to the presence of blown-in cellulose insulation and the potential of rekindle.

The department's fire investigator noted that a triangular fire pattern was present on the wall behind the range, with its base immediately above the range top. Pots, pans, and several acrylic containers were present on the range top and showed signs of uniform fire damage. There was no indication of accelerant use, tampering, or other intentional actions. During interviews, the resident indicated that the range had not been used in three days. The scene was secured and left undisturbed. The investigator classified the fire as accidental, resulting from electrical malfunction of the range.

The homeowner's insurance company hired a private investigator who agreed with the fire department's findings. The insurance company initiated legal action against the appliance manufacturer. A forensic electrical engineer and investigator from the appliance company met at the scene to continue the investigation alongside the department's fire investigator.

An electrical continuity check of the range controls disclosed that the range was "off" at the time of the fire. Electrical wiring and connections did not indicate the presence of arcing, consistent with the range circuit being "dead" when an external fire spread to the range.

During debris removal, investigators noted the presence of heavy charring on the upper side of ceiling materials, while the underside (floor side) was clean. The kitchen featured recessed can lighting. Upon further examination of the light fixture housings, investigators discovered that cellulose insulation was in contact with wiring from the light fixtures. The wiring was not IC rated, so it was not suitable for contact with insulation.

Questions

1. If you collectively consider these pieces of evidence, how would you catalog the original hypothesis made by the fire department and the insurance investigators?

_____

_____

_____

2. What would be your hypothesis about the cause of the fire after the second investigation?

_____

_____

_____

3. Did the initial investigator obtain enough information to support their hypothesis, or was it necessary to conduct the further examination?

_____

_____

_____

4. What additional evidence would you gather if acting as the initial fire investigator?

_____

_____

_____