Fire Cause Determination

Captain Jason Braun, #afmkenya2019
16 December 2020
Fire Cause and Determination
“Fire Investigation Awareness”
Fire Fighter Objectives

• Differentiate accidental fires from incendiary fires.
• Describe the point of origin.
• Define the chain of custody.
Fire Fighter Objectives

- Describe techniques for preserving fire-cause evidence.
- Describe the observations that fire fighters should make during fire-ground operations.
Fire Fighter Objectives

• Describe the role and relationship of the Fire Fighter II to criminal investigators and insurance investigators.
• Describe how to assist the fire investigators in the process of digging out the fire scene.
• Describe the types of evidence that may be uncovered at a fire scene.
Fire Fighter Objectives

- Describe techniques for preserving fire-cause evidence.
- Describe the steps needed to secure a property.
- Explain the importance of protecting a fire scene to aid in cause determination.
- Describe the common motives of an arsonist.
Introduction

• Fire fighters provide essential assistance to fire investigators by:
  – Identifying and preserving possible evidence
  – Recalling and reporting objective findings
• Fire departments determine the causes of fires so they can take steps to prevent future fires.
• Important evidence can be consumed by the fire or destroyed during fire ground operations.
Who Conducts Fire Investigations?

- The chief of the department has a legal responsibility to determine the causes of fires.
- Many departments automatically dispatch an investigator to all working structure fires as well as to any other fire where the IC suspects something unusual.
Who Conducts Fire Investigations?

- Other departments may require an investigator only when damage exceeds a predetermined level or when there are injuries or fatalities.
- The incident commander may be expected to conduct a preliminary investigation and decide whether an investigator is needed.
Who Conducts Fire Investigations?

• Fire fighters must serve as the eyes and ears of the investigator.
• Fire cause investigation should not be confused with a criminal investigation.
• The investigator should never have a preconceived idea about what started the fire.
Law Enforcement Authority

• Investigation determines:
  – Cause and origin of the fire
  – Who was responsible for starting the fire
  – What sequence of events led up to the fire

• Whether a fire investigations unit have police powers depends on state and local laws.
Investigation Assistance

• A state fire marshal or similar authority may have an investigations unit.

• Federal resources are also available for major investigations.
  – The U.S. Bureau of Alcohol, Tobacco and Firearms (ATF) and now ATFE addition of Explosives.

• Insurance companies often investigate fires.
Causes of Fires (NFIRS)

- Every fire has a cause, which the fire investigator tries to uncover.
  - Un-intentional
  - Intentional
  - Act of Nature
  - Failure of equipment or heat source
  - Undetermined because in some cases, the cause of a fire can never be determined with absolute certainty.
Fire Cause Statistics

- 2.1 million fire incidents reported in the United States in 2017
  - Caused 3,570 fatalities and over $10 billion in direct property damage
- Most structure fires occur in residential occupancies.
  - Home fires represent 73% of all structure fires.
Fire Cause Statistics

• 396,000 home structure fires reported in the United States in 2016
  – Caused 2580 fatalities and more than $6.8 billion in direct property damage
Accidental Fire Causes

- Hundreds of possible causes and multiple factors and circumstances
- Most fires, fire deaths, and injuries occur in residential occupancies.
  - Commonly reported accidental causes of fire involve smoking, cooking, heating equipment, and electrical equipment.
Definitions

- Building of origin
- Room of origin
- Area of origin
- Point of origin
- Soot Staining
- Protected areas
- Accelerants
Building of Origin
Sometimes it's easy?
Sometimes it’s not!
Room of Origin/Area of Origin
Definitions

• Point of Origin
  – Location where ignition occurs and fuel begins to burn
  – An ignition source comes into contact with a fuel supply.
  – The cause of the fire is the set of circumstances that brought the ignition source into contact with the fuel.
Point of Origin
Soot Staining
Protected Areas
Accelerants
Sometimes called “Poor Patterns”
Poor Patterns and Pooling
Trailers
How do we figure it out?

- NFPA 921 Chapter 4 covers basic methodology. Using the Scientific Method and a Systematic Approach.
- Every investigation needs to be done the same way every time, and document, document, document! (I.e.: Field Notes, Diagrams, Photos, Interviews, etc.)
- Right of Entry, even though you have a right to do the investigation, does not mean you can enter the property.
- How are you there as an investigator? (See NFPA 921 Chapter 11) 4 ways to enter include: Exigent Circumstances (“reasonable period of time”), Consent, Administrative Search Warrant, and Criminal Search Warrant.
Investigation Process

- Start from the least burnt to the most burnt. (Differs from book)
- First photo is always address.
- Starting on exterior doing 360 around building/car documenting as we go.
- Work into the interior working from un-burnt to most burn.
Investigation Process

• Narrowing down to the area of origin, then the room of origin, and hopefully to the point of origin.

• Do this by using experience and fire rate and intensity patterns. Interview of residents/witnesses are crucial.

• “V” pattern is most common, but there are at least 80 different validated patterns that we know of.
Investigation Process

- Depth of char is also mentioned, this has some misconceptions, but is also a good indicator.
- Annealing of springs is another good indicator due to heat on metal. (About 750 degrees)
- Incandescent bulbs can be another indicator.
- “Clean burn” or calcification is when all moisture is taken out of usually Gypsum Board, but can also show on other materials.
Identifying the Point of Origin

- Burn patterns and smoke residue can be helpful in identifying the area of origin.
  - Charred V-pattern indicates that fire spread up and out from something at the base of the V.
Patterns
Identifying the Point of Origin

• Depth of Char
  – Related to how long a material was exposed to fire, from time of ignition to time of extinguishment
  – Charring is usually deepest at the point of origin.
Annealing of Springs
Bulbs as Indicators
Calcification & “Clean Burn”
• Term used to describe the process of carefully looking for evidence within the debris
• Remove and inspect the debris, layer by layer, from the top of the pile down to the bottom.
Digging Out (2 of 2)

• Removing and inspecting debris enables the investigator to determine:
  – Sequence in which items burned
  – If an item burned from the top down or from the bottom up
  – How long it burned
Re-Construction After Dig
Sometimes There Isn't Much Left
Evidence

• Refers to all information gathered and used by an investigator in determining cause
• Can be used in a legal process to establish a fact or prove a point
Physical Evidence

• Items that can be observed, photographed, measured, collected, examined in a laboratory, and presented in court

• Example: burn pattern
Trace or Transfer Evidence

- A minute quantity of physical evidence that is conveyed from one place to another
- Example: A suspect’s clothing that contains residue of the same flammable liquid found at the scene of a fire
Demonstrative Evidence

- Anything that can be used to validate a theory or to show how something could have occurred
- Example: A computer model of the burned building or burn tests.
Direct and Circumstantial Evidence

- **Direct evidence**
  - Includes facts that can be observed or reported first hand

- **Circumstantial evidence**
  - Information that can be used to prove a theory, based on facts that were observed first hand
Preservation of Evidence (1 of 2)

• Fire fighters who discover something that could be evidence should:
  – Leave it in place.
  – Make sure that no one interferes with it or the surrounding area.
  – Notify a company officer or fire investigator immediately.
Preservation of Evidence (2 of 2)

- If evidence could be damaged or destroyed during fire suppression activities, cover it with a salvage cover or some other type of protection, such as a plastic garbage can.
- Evidence should not be contaminated, or altered from its original state, in any way.
- *No high pressure streams during overhaul (Dribble the water, DON’T blast it!)
- *When you must overhaul to find hidden fire, try going on the other side of the wall, and stay away from area or room of origin.
Also known as chain of evidence or chain of possession

Legal term that describes the process of maintaining continuous possession and control of the evidence from the time it is discovered until it is presented in court
Chain of Custody (2 of 3)

- Every step in the capture, movement, storage, and examination of the evidence must be properly documented.
- Each successive transfer of possession must be recorded.
• SOPs for collecting and processing evidence generally include:
  – Take photographs of each piece of evidence.
  – Sketch, mark, and label location of evidence.
  – Place evidence in appropriate containers.
  – Tag all evidence.
  – Record the time evidence was found, where it was found, and name of the person who found it.
  – Keep a constant watch on the evidence.
  – Preserve the chain of custody.
• People who were on the scene when fire fighters arrived could have invaluable information about the fire.
• Interviews with witnesses should be conducted by the fire investigator or by a police officer.
• Do not make statements of accusation, personal opinion, or probable cause to anyone other than the investigator.

• Never make jesting remarks or jokes at the scene.
Observations During Fireground Operations (1 of 9)

- Dispatch and Response
  - Note the time of day.
  - Note the weather conditions.
  - Note any route obstructions.
Observations During Fire Ground Operations (2 of 9)

• Arrival and Size-Up
  – Compare the dispatcher’s description with the actual fire conditions.
  – Note the appearance of any vehicles and people on the scene.
  – Note any unusual items or conditions.
Observations During Fire Ground Operations (3 of 9)

• Entry
  – Look for evidence of any prior entry.
  – Note whether the windows and doors are intact, whether they are locked or unlocked, and whether there are any unusual barriers limiting access to the structure.
  – Note whether windows and doors are locked or unlocked, as well as any signs of forced entry by others.
Observations During Fire Ground Operations (4 of 9)

• Search and Rescue
  – Consider location and extent the fire.
  – Note whether circuit breakers were on or off. (Only turn main off, not individual breakers!)
  – Note the location of any people found in the building.
• Ventilation
  – Note whether windows and doors were open or closed, locked or unlocked.
  – Note color and quantity of smoke, as well as presence of any unusual odors.
• Suppression
  – Observe behavior of fire and how it reacts when extinguishing agent is applied.
  – Note the presence of incendiary devices, trailers, and accelerants.
  – Note the condition of the fire alarm or suppression systems.
• Suppression (cont.)
  – Note whether obstacles were placed to block entry.
  – Note anything unusual about the contents of the building.
  – Note charring in unusual places.
Observations During Fire Ground Operations (8 of 9)

• Overhaul
  – Evidence located during overhaul should be left where it is found, untouched and undisturbed, until the investigator examines it.
  – Avoid throwing materials into a pile.
  – Watch for evidence that was shielded from the fire and is lying beneath burned debris.
• Injuries and Fatalities
  – Document location and position of any victims, especially in relation to the fire and the exits. (If DOA, leave them there and when possible cover for overhaul)
  – Clothing removed from any victim should be preserved as evidence.
  – Document what may be lying under the victim’s body after it is removed.
Securing and Transferring the Property
(1 of 4)

• Maintaining site integrity is critical to the fire investigation.

• Fire fighters must be aware of any state or local laws pertaining to right of access by the owners or occupants.
  – A fire officer or a fire fighter should accompany anyone who enters the premises for any reason until the scene is released.
Securing and Transferring the Property
(2 of 4)

• Until the investigator arrives on the scene:
  – Suspend salvage and overhaul, and secure the scene.
  – Keep nonessential personnel out of the area.
  – Photograph the fire scene extensively.
  – If weather, traffic, or other factors could destroy the evidence, take steps to preserve it in the best way possible.
Securing and Transferring the Property
(3 of 4)

• The property should be secured by cordonning off the area with fire- or police-line tape.
Securing and Transferring the Property
(4 of 4)

- Before leaving the scene, make sure that the building is properly secured, and no hazards to public safety exist.
- When fire department operations are over, the property will be returned to the owner.
  - This should not be done until the investigation is complete and all evidence is collected.
Indications of Arson/Incendiary Fires (1 of 2)

• Arson fires have several distinct, recognizable patterns or indications.
  – Multiple points of origin or multiple simultaneous fires
  – Trailers made from combustible materials

• An incendiary device is a device or mechanism that is used to start a fire or explosion.
Indications of Arson\Incendiary Fires (2 of 2)

• Evidence of a flammable liquid often indicates an incendiary fire, but does not necessarily establish arson as the cause.
• Extensive burn damage on a floor’s surface could indicate that a flammable liquid was poured and ignited.
• Sometimes the first indications of a possible arson fire are entirely circumstantial.
The fire service has identified two groups who are responsible for a large number of fires: pyromaniacs and juvenile fire-setters.

- Many other arsonists start fires for a wide range of motives.
Pyromaniacs

• Pathological fire-setters
• Most are adult males, often loners.
• Usually introverted, polite but timid, and have difficulty relating to other people
• Fires set by pyromaniacs:
  – In easily accessible locations
  – Set in structures such as occupied residences of all types, barns, and vacant buildings
  – Accelerants are rarely used
  – Usually have a pattern
Juvenile Fire-Setters

- Usually divided into three groups according to age:
  - 8 years old and under
  - 9 to 12 years old (preadolescent)
  - 13 to 17 years old (adolescent)

- Children under 8 are seldom criminally motivated when they set fires; they usually are just curious and experimenting.
Preadolescent Fire-Setters

- Do not venture far from home
- Usually do not use elaborate trailers or incendiary devices
- Preadolescents may use fire to cover vandalism and theft.
Adolescent Fire-Setters

- Fires are similar to those set by adults.
- Have many of the same motivations of adult fire-setters
- Often use accelerants
- Two-thirds of fires set in vacant buildings are set by adolescents.
- Vandalism at the scene will be a clue that the fire was set by an adolescent.
Arsonist Motives

Six common motives listed in NFPA 921, *Guide to Fire and Explosion Investigations*:

1. Vandalism
2. Excitement
3. Revenge
4. Crime concealment
5. Profit
6. Extremism
Arson Motive Definitions

- **Motive:** Inner drive or impulse that causes a person to do or act a certain way. Everyone usually has a reason for everything they do, don’t they?

- **Irrational Pyromania:** This one is simple, they are a “firebug”, they just like fire! Only a small percent fall into this category, but account for the largest amount of fires. This is because they set a lot of fires in a short amount of time. These people usually start with small fires and they just escalate to bigger more dangerous fires. (I.e.: Occupied Dwellings)

- **Fraud:** This is the single most common motive. Basically to profit from the fire in one way or another. This is the largest factor in residential and commercial property fires.
Arson Motive Definitions

- **Hate/Spite/Revenge:** This one is self explanatory. They want to get back at someone for some real or imagined insult or hostile behavior.

- **Thrill Seeking/Vandalism:** Usually a motivation related to juveniles and adolescents. Basically boredom and peer pressure to create excitement. Maybe a group or individual act.

- **Hero/Vanity:** Sadly enough firefighters, police, security guards, etc. sometimes can fall into this category. They want to impress, relieve boredom, add excitement in a slow time, or just make a little extra cash.

- **Social protest/Terrorism:** Fire has been used as a weapon of social protest since revolutions first began. If one can not attack an “oppressor” directly, then one could destroy their castle, house, crops, business, flag, etc. to prove their views.
Cause Determination

• Fire investigation involves more than determining cause and origin.
  – They determine whether the fire code had been followed by the owner.
  – Fire protection equipment operated properly
  – Codes may need to be changed or updated.
• Fire cause determination helps fulfill the fire department’s mission of preventing fires.

• A fire’s cause is considered undetermined until it is officially identified as either accidental or incendiary.

• Fire cause information is used to prevent further accidental fires and prevent people from intentionally starting fires.
• Fire investigation must identify point of origin and use physical evidence to determine cause of the blaze.

• Fire fighters can help identify patterns, signs, unusual activities, or conditions, and preserve materials that might be valuable evidence.

• Fire fighters on-scene are the eyes and ears of the investigator until the investigator arrives.
Questions?