



International  
Association  
of Fire Chiefs



National  
Fire Protection  
Association

# Fundamentals of Fire Fighter Skills

SECOND EDITION

Chapter 37

Fire Cause  
Determination

## Objectives (1 of 3)

- Describe the role and relationship of the fire fighter to criminal investigators and insurance investigators.
- Differentiate accidental fires from incendiary fires.
- Describe the point of origin.

## Objectives (2 of 3)

- Define the chain of custody.
- Describe demonstrative, direct, and circumstantial evidence.
- Describe techniques for preserving fire cause evidence.

## Objectives (3 of 3)

- Describe the observations that fire fighters should make during fire-ground operations.
- Describe the steps needed to secure a property.
- Explain the importance of protecting a fire scene.

# 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.

# Who Conducts Fire Investigations? (1 of 3)

- 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? (2 of 3)

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

# Who Conducts Fire Investigations?

(3 of 3)

- Fire fighters must serve as the eyes and ears of the investigator, and pass on their observations.
- Fire cause investigation should not be confused with a criminal investigation of arson.
- The investigator should never have a preconceived idea about what started the fire.



## Law Enforcement Authority

- Investigation must determine not only the cause and origin of the fire, but also who was responsible for starting it and what sequence of events led up to it.
- Whether the members of a fire investigations unit have police powers and can conduct a criminal investigation 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 and Explosives (ATF)
- Insurance companies often investigate fires.

## Causes of Fires (1 of 4)

- Every fire has a cause, which the fire investigator tries to uncover.
  - Some fires have simple causes.
  - Others result from a complex set of circumstances.
  - In some cases, the cause of a fire can never be determined with absolute certainty.

## Causes of Fires (2 of 4)

- 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.

## Causes of Fires (3 of 4)

- Fires result when a competent ignition source and a fuel come together for long enough to ignite.
- Act or omission
  - Igniting a piece of paper with a match is an act.
  - Leaving a pot of grease unattended on a hot stove is considered an omission.

## Causes of Fires (4 of 4)

- The cause of a fire can also be classified as either incendiary or accidental.
- Investigators should always consider a fire to have an undetermined cause until the specific cause is established.

## Fire Cause Statistics

- 366,600 average home structure fires reported in the United States between 2007 and 2011
  - Caused 2570 average fatalities and over \$7.2 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.



## Incendiary Fire Causes

- Fires caused by arson requires a second phase of investigation to identify the person responsible.
  - A trained, qualified fire investigator should always be called to determine the cause of any fire that may have been deliberately set.

# Identifying the Point of Origin—Fire Fighter II Standard (1 of 3)

- One of the first steps in a fire investigation
- Usually begins with an examination of the building's exterior
- Continues inside the building, beginning with the area of heaviest damage

# Identifying the Point of Origin—Fire Fighter II Standard

(2 of 3)

- Depth of Char
  - Related to intensity of the fire at a particular location
  - Charring is usually deepest at the point of origin.



# Identifying the Point of Origin—Fire Fighter II Standard (3 of 3)

- 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.



# Digging Out—Fire Fighter II Standard (1 of 2)

- 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—Fire Fighter II Standard (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

## Evidence—Fire Fighter II Standard

- 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—Fire Fighter II Standard

- Items that can be observed, photographed, measured, collected, examined in a laboratory, and presented in court
- Example: Burn pattern





# Trace Evidence—Fire Fighter II Standard

- Also called transfer evidence
- A minute quantity of physical evidence that is conveyed from one place to another

# Demonstrative Evidence—Fire Fighter II Standard

- Anything that can be used to validate a theory or to show how something could have occurred

# Direct and Circumstantial Evidence—Fire Fighter II Standard

- 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—Fire Fighter II Standard (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—Fire Fighter II Standard (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.

# Chain of Custody–Fire Fighter II Standard (1 of 3)

- 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—Fire Fighter II Standard (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.



# Chain of Custody–Fire Fighter II Standard (3 of 3)

- Collecting and processing evidence
  - 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 found, location, and name.
  - Keep a constant watch on the evidence.
  - Preserve the chain of custody.



# Witnesses—Fire Fighter II Standard (1 of 2)

- 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.

# Witnesses—Fire Fighter II Standard (2 of 2)

- Do not make statements of accusation, personal opinion, or probable cause to anyone other than the investigator.
- Never make jesting remarks or jokes.



# Observations During Fire-Ground 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.

# Observations During Fire-Ground Operations (4 of 9)

- Search and Rescue
  - Consider location and extent of the fire.
  - Note whether circuit breakers were on or off.
  - Note the location of any people found in the building.

# Observations During Fire-Ground Operations (5 of 9)

- 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.

# Observations During Fire-Ground Operations (6 of 9)

- 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.



# Observations During Fire-Ground Operations (7 of 9)

- 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.

# Observations During Fire-Ground Operations (9 of 9)

- Injuries and fatalities
  - Document location and position of any victims, especially in relation to the fire and the exits.
  - 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.
- 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.
  - 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 cordoning off the area with fire- or police-line tape.
- Before leaving the scene, make sure that the building is properly secured, and no hazards to public safety exist.

# Securing and Transferring the Property (4 of 4)

- 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.

# Securing and Transferring the Property (Special)

- Fire department has authority to bar access to premises during fire fighting operations and for a reasonable time after suppression has been terminated
- Fire department authority ends when last member of department leaves the premises



## Indications of Arson (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 (2 of 2)

- Evidence of an ignitable 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 an ignitable liquid was poured and ignited.
- Sometimes the first indications of a possible arson fire are circumstantial.

## Cause Determination

- Fire investigation involves more than determining cause and origin.
  - They determine if the fire code had been followed by the owner.
  - Fire protection equipment operated properly
  - Codes may need to be changed or updated.
- The NFPA investigates fires worldwide.

# Arsonists—Fire Fighter II Standard

- 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—Fire Fighter II Standard

- Pathological fire-setters
- Most are adult males, often loners.
- Usually introverted, polite but timid, and have difficulty relating to other people

# Juvenile Fire-Setters–Fire Fighter II Standard

- 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— Fire Fighter II Standard

- 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–Fire Fighter II Standard

- Fires are similar to those set by adults.
- Same motivations of adult fire-setters
- 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–Fire Fighter II Standard

- Six common motives
  - Vandalism
  - Excitement
  - Revenge
  - Crime concealment
  - Profit
  - Extremism

# Legal Considerations (Special)

- Two statements relevant based on Michigan vs. Tyler by US Supreme Court
  - “Once in a building (to extinguish a fire), firefighters may seize (without a warrant) evidence of arson that is in plain view..... (and) officials need no warrant to remain in a building for a reasonable time to investigate the cause of the blaze after it has been extinguished.”
  - “If there has been a fire, the blaze extinguished and the firefighters have left the premises, a warrant is required to re-enter and search the premises, unless there is consent...”

## Summary (1 of 3)

- 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.

## Summary (2 of 3)

- 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.

## Summary (3 of 3)

- Fire fighters can help identify patterns, signs, unusual activities, or conditions, and preserve materials that might be valuable evidence.
- Fire fighters and investigators must work together to ensure that the fire is completely extinguished and that evidence is identified and preserved.