**Chapter 29: Fire Cause Determination**

**Chief Concepts**

* Fire fighters usually reach a fire scene before a trained fire investigator and are able to observe important signs and patterns that the fire investigators can use in determining how and where the fire started.
* Determining the causes of fires allows fire departments to take steps to prevent future fires.
* The size of the fire department and the size of the fire determine who performs the fire investigation and when a fire is investigated.
* When a fire investigator is not on the scene while the fire is being extinguished or overhauled, fire fighters must be particularly careful to preserve evidence.
* Basic fire investigation includes locating the point of origin, determining the fuel used, and identifying the ignition source for the fire.
* Fire investigation should be performed by one of the following: trained fire department investigators, the fire marshal’s office, insurance-company investigators, or a law-enforcement agency.
* An origin and cause investigation determines where, why, and how the fire originated.
* At the point of origin, an ignition source comes into contact with a fuel supply. As part of their examination of a fire scene, fire investigators first search for the general area of origin and then attempt to locate the exact point of origin.
* The cause of a fire can be classified as either incendiary or accidental. Arson is an incendiary cause, whereas accidental fires do not involve a criminal or malicious intent.
* Accidental fires have hundreds of possible causes and involve multiple factors and circumstances. The most important reason for investigating and determining the causes of accidental fires is to prevent future fires. To reduce the number of fires, efforts must concentrate on the most frequent causes and those involving the greatest risks of death, injury, and property damage.
* Most fires, fire deaths, and injuries occur in residential occupancies. The most commonly reported accidental causes of fire in these occupancies involve cooking, heating equipment, electrical equipment, lightning strikes, and smoking.
* Sometimes it may difficult or impossible to identify the specific source of ignition because the fire destroyed every trace of evidence. Fire investigators will classify these fires as having an undetermined cause.
* According to NFPA 921, a scientific method and a systematic analysis are needed to determine the origin and cause of a fire. The fire investigator must determine where the fire started and how it was ignited.
* At the location of the fire, the fire investigator will look for clues indicating the specific cause of the fire. This fire investigation will begin on the exterior of the structure and move to the interior.
* Depth of char, burn patterns, and smoke residue can be helpful in identifying the point of origin but are not conclusive evidence.
* After the fire investigator identifies the area of origin, fire fighters may be asked to assist in digging out the fire scene to help look for evidence within the debris.
* Evidence refers to all of the information gathered and used by fire investigators in determining the cause of a fire:
  + Physical evidence—Items that can be observed, photographed, measured, collected, examined in a laboratory, and presented in court to prove or demonstrate a point
  + Trace or transfer evidence—A minute quantity of physical evidence that is conveyed from one place to another
  + Demonstrative evidence—Anything that can be used to validate a theory or to show how something could have occurred
  + Direct evidence—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 directly
* Fire fighters have a responsibility to preserve evidence that could indicate the cause or origin of a fire. If fire fighters discover something that could be evidence, they should leave it in place and notify a supervisor or fire investigator immediately. Evidence is most often found during the salvage and overhaul phases.
* Physical evidence must be handled in a manner that protects the integrity of the chain of custody. Every step in the capture, movement, storage, and examination of the evidence must be properly documented.
* The fire investigator’s SOGs/SOPs (for collecting and processing evidence generally include the following steps:
  + Take photographs of each piece of evidence as it is found and collected.
  + On the fire scene, sketch, mark, and label the location of the evidence.
  + Place evidence in appropriate containers to ensure its safety and prevent contamination. Tag all evidence at the fire scene.
  + Keep a constant watch on the evidence until it can be stored in a secure location.
  + Preserve the chain of custody in handling all the evidence.
* Although fire fighters may not interview witnesses, they can identify potential witnesses to the fire investigators.
* The fire fighter’s role in identifying and preserving evidence continues throughout the fire-suppression sequence, and takes into account the following factors:
  + The time of day and the weather conditions
  + People leaving the scene
  + The extent of the fire and the number of locations in which fire is found
  + The security of the building
  + Any signs of property break-in
  + Vehicles or people in the area
  + Indications of unusual fire situations
  + Unusual colour of smoke
  + The positions of the windows and roof
  + The reaction of the fire during initial attack
  + Any signs of abnormal behaviour of fire
  + The condition of the building contents
  + The need to coordinate overhaul and evidence-preservation activities
* The building and premises must be properly secured and guarded until the fire investigator has finished gathering evidence and documenting the fire scene—for example, by posting fire fighters or police personnel at the site. Fire fighters must be aware of any provincial/territorial or local laws pertaining to right of access by the owners or occupants while the property is under the control of the fire department.
* If a fire investigator is not immediately available, the premises should be guarded and maintained under the control of the fire department until the investigation takes place and all evidence is collected. In the interim, take the following steps:
  + Suspend salvage and overhaul, and secure the scene.
  + Keep nonessential personnel out of the area. Deny entry to all unauthorized and unnecessary persons.
  + 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.
* Incendiary fires refer to all fires that are deliberately started for malicious or criminal intent. You must be aware of factors that could indicate an intentionally set fire, report any relevant observations to a supervisor or fire investigator, and help protect evidence in such a scenario.
* Arson fires have several distinct, recognizable patterns or indications; for example, a deliberately set fire might have multiple points of origin or include multiple simultaneous fires.
* Fire investigations involve much more than simply determining what caused the fire, where it started, and whether it was accidental or incendiary (intentionally set). Many fire investigations examine other aspects of a fire incident; for example, if the fire results in injuries or fatalities, the investigation often will study every factor that could have contributed to or prevented those losses.
* Fire investigators typically examine the construction and contents of the building to determine whether fire and building codes were followed, if the built-in fire protection systems functioned properly, or if lessons from the fire could be applied by amending codes or inspection procedures.
* An arsonist is someone who deliberately sets a fire with criminal intent. Arsonists fall into several categories, with various explanations for their behaviour. The fire service has identified two groups who are responsible for a large number of fires: pyromaniacs and juvenile fire-setters.
* The six common motives of arsonists are listed in NFPA 921:

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