ARSON DETECTION (CAUSE AND ORIGIN)

TABLE OF CONTENTS

1. Introduction
   1.1 Purpose
   1.2 Definition and Terms

2. Outside Observation Upon Arrival

3. Inside Fire Building, Before & During Operations

4. Fatal Fires and Arson

5. Evidence Collection & Preservation

6. Determining Point of Origin

7. Overhauling Examination

8. Commercial Fires
1. INTRODUCTION

1.1 PURPOSE

1.1.1 The officer in charge of a fire operation plays a significant role in arson suppression. He may initiate an investigation based on information he has received and upon his personal observations or suspicions. The company officers and the firefighters assist by bringing evidence of arson to his attention.

1.1.2 Indications of an incendiary fire can be detected by alertness and keen observation of the officers and firefighters at the scene of a fire. Officers and firefighters arriving and operating at a set fire can do much to assist the fire marshal's subsequent investigation. Likewise, by carelessness and failure to detect and preserve evidence, they may cause the perpetrator to escape detection.

1.1.3 In our Department, successful arson investigation can be the result of team work between officers and firefighters who detect evidence at fires, and fire marshals who conduct the investigation that follows. It is towards this end that the following information was prepared.

1.2 DEFINITIONS AND TERMS

1.2.1 A, B, C & D Deleted

1.2.2 Incendiary Fire:
A designation given to a fire, in which the Fire Marshal has determined through physical examination of the fire scene and interview with witnesses that the fire was intentionally set by someone. A fire may be suspected of being incendiary if there is evidence of, among other things, the presence of an accelerant or a firesetting device, two or more separate and distinct fires burning at the same time, an eye witness to the setting of the fire, a confession, or a combustible substance deliberately placed at the point of origin. The above listing is not complete and corroboration may be required with each item.
1.2.3 Suspicious:
A designation given by the Incident Commander in command of a fire operation and is one of the circumstances in which the Fire Marshal is called to the fire scene to investigate and determine the cause, origin and circumstances of the fire. A fire is suspicious if:

♦ There are indications that the fire may have been set and all accidental causes have not been eliminated. (When all accidental causes have been eliminated, the fire is incendiary.)

♦ A threat preceded the fire.

♦ It is one in a series of similar fires.

♦ Premises normally locked are found unlocked.

♦ Stock or belongings were removed prior to the fire. Briefly, any act or circumstance which cannot be explained and which tends to indicate that the fire may have been intentionally set.

1.2.4 Trailers:
Material arranged to spread fire from its point of origin to other areas of an occupancy. (Cotton waste, rags, paper, fluids, excelsior, waste film and others.)

1.2.5 Plants:
Material arranged to start and feed initial fire. (Candles, matches, electrical, mechanical, chemicals and others.)

1.2.6 Accelerants:
Gasoline, kerosene, turpentine, alcohol, paint thinner, cut or disconnect gas lines etc.

1.2.7 Ignition Device:
Mechanical, chemical, or electrical means used to initiate a fire.

1.2.8 Protected Area:
The clean or unburned area left by stock, furniture, contents, etc. covering shelves, floors, or other combustible areas.

1.2.9, 1.2.10, 1.2.11 Deleted

2. OUTSIDE OBSERVATIONS UPON ARRIVAL
Company officers and firefighters, first at the scene, have an excellent opportunity to make observations that a Fire Marshal, arriving later, cannot be expected to make. Arson might well be overlooked unless these observations are made and noted for his investigation. Remain alert to conditions encountered upon arrival.
2.1 Be observant of persons or automobiles leaving the fire building or vicinity of the fire in what could be interpreted as a suspicious manner.
   ♦ Make a mental note of their description, age, sex, how dressed, etc. ♦
   Write down the license number and description of the car.

2.2 Observe whether doors and windows are open or shut, particularly on a cold day. Note if window shades were drawn to block the outside view, particularly during the daytime.

2.3 When flames are visible, remember and write down where you saw them first and their appearance.
   ♦ What floor or floors?
   ♦ What side of the building?
   ♦ Through how many windows?
   ♦ Was fire through the roof?

2.4 Did flames from the building appear to be gently rolling and quiet or violently driving (blowtorch like) and accompanied by a roaring sound?
   ♦ What color was the flame?
   ♦ Did the flame spread with great rapidity?
   ♦ Were the flames separate and distinct?

2.5 Note sight or sound of explosions.

2.6 Check for out of service hydrants; hydrants knocked over, blocked or clogged with rubbish and if all caps were removed. Note if the standpipe or sprinkler siamese was broken or out of service.

2.7 Be observant of everyone at the scene upon arrival.
   ♦ Was anyone arguing or fighting?
   ♦ Did anyone attempt to obstruct the progress of firefighting operations?
   ♦ Check for persons seen frequently at fires and showing too much eagerness to provide assistance and information.

2.8 If occupants claimed they were in bed at time of the fire, notice their dress, such as shoe laces being laced and tied and if wearing ties, etc. In other words, if they had shown haste or had taken their time in dressing.

2.9 Remember any comments about the fire made by occupants of the building or by neighbors. What was said by the person who first discovered the fire can be very important.
3. **INSIDE THE FIRE BUILDING, BEFORE AND DURING OPERATIONS**

Physical evidence that a firefighter usually discovers, in a broad sense, can be defined as something material, visible and tangible, and could consist of one or several of the following:

3.1 Were there any signs of forcible entry? Was the door locked or unlocked? After gaining entry, note if an attempt was made to block entry, of the fire company with furniture or other items.

- ♦ Look for signs of burglary, opened windows, skylights, and doors. Check for the presence of pry tools, pry marks or broken locks.
- ♦ Observe if any windows were nailed shut.

3.2 Check for any evidence of trailers, plants, incendiary devices or separate fires. (Must be able to prove that second fire was not normal spread or communication of first fire.) Try not to disturb any trailers or plants.

3.3 Were there any irritating, noxious or toxic gases, or the odor of petroleum products?

3.4 Note the unexplained rapid extension of fire. (This point emphasizes the importance of noting the fire's position when first coming upon the scene.)

3.5 Make examination for structural damage made prior to the fire.

- ♦ Holes in the wall where accelerant could have been placed, or papers stuffed in holes, etc.
- ♦ Check whether the sprinkler or standpipe valves were turned off and if any damage occurred to such systems.

3.6 Look for presence of flammable accelerants.

- ♦ When found in areas where they would not normally be found for a given occupancy. ♦ When found throughout the area or when found above the fire floor.

3.7 Note possible indicators of the use of flammable accelerants.

- ♦ Charring of the floor or low burn marks on the wall or under the door or on the lower part of the door. (Leave doors, baseboards, etc., intact where possible. Their removal could hinder or delay physical examination of the scene by the fire marshal.)
- ♦ Char in broken patterns or "puddle-like" circle burns on the floor. ♦ Check for low burning and deep charring.
- ♦ Check for heavy body of fire with little contents.
3.8 Remember color of smoke and flames during early stages of the fire and note any subsequent changes. This will assist in learning whether gasoline, kerosene, turpentine or other accelerant has been used. Members should become familiar with all the various odors which they might come in contact with so that they may be able to more accurately describe these odors should they be called on as a witness etc.

3.9 Removal of contents prior to the fire such as expensive or personal items. Note substitution of contents, i.e., cheap furniture in place of expensive.

3.10 Unusual location of fires; in closets, under steps or porches, in attics or in desk drawers. Note furniture with burn marks underneath or on the lower parts.

3.11 Excessive fire damage, not usually associated with the type of structure and contents, when compared with the burning time. (Accelerants increase damage)

3.12 Injuries, sometimes the result of the flash of flammable vapors from accelerants being spread by the arsonist. Note any burn marks on the forehead, cheeks, and under the chin and the nose.

3.13 Short period of time between the exit of the occupant and the fire. If the fire breaks out shortly after occupant leaves, it could indicate the fire was set.

3.14 More than one fire in the same structure or apartment over a period of time; days, weeks, etc.

3.15 Presence of burned or unburned newspapers near the point of origin.

3.16 Fires occurring on holidays or weekends; provides excuse for the owner to be out of town during the fire. Note dates of any newspapers found at the fire.

3.17 Fires during renovations; lack of money to finish the renovations or renovations not being done to the satisfaction of the owner.

3.18 Fires started during electrical storms so that the storm can be blamed.

3.19 Try to mentally reconstruct as much as possible.
   ♦ Determine the path of heat travel back to the point of origin. ♦ Establish approximate burning time.
   ♦ Evaluate the combustion characteristics of the material involved. ♦ Mentally compare similar materials and situations.
   ♦ Fit known facts to various possibilities.
3.20 Record information received from occupants and witnesses.

- Don't interrogate! Let the person talk freely. They will usually talk to fire personnel at the scene. Listen to what the occupants and witnesses are saying about the fire.
- Get names and addresses, if possible.

3.21 Look, listen, and get all possible vital information for your report and the Fire Marshal. No one but a trained and experienced investigator should attempt to interrogate a witness. Great damage to a case may occur, or a witness might refuse to cooperate as a result of amateurish questioning. Do not put the names or statements of witnesses on the face of fire reports.

4. FATAL FIRES AND ARSON

Fire personnel may be called to testify in a fatal fire whether the fire was accidental or of incendiary nature. It is important that all facts and data assembled be correct and complete. Testimony may be in civil or criminal court.

4.1 At fatal fire and arson investigations, security of the incident scene is of the utmost importance. Evidence must be documented, collected and preserved. Depending on the incident, the investigation may extend over a period of time. In these situations, a fire line must be established. Relatives, neighbors, spectators, the media and members of the Department shall not cross established fire lines unless authorized by the assigned Fire Marshal and/or Chief of Operations.

4.2 The fire scene examination may involve three individual investigations. Fire origin, fire cause, and fire death investigation.

4.2.1 When and where possible, and fire conditions permit, do not move the body, pending arrival of the Fire Marshal and Medical Examiner. (Signal 10-45, Code 1)

4.2.2 The fire officer should note possible reasons why the person could not escape from the room.

4.2.3 Note all facts concerning the victim's location, position and appearance.

- Where was victim found?
- Was the location of the victim normal to the occupancy?
- Was there evidence of violence on the body?
- What was the location of the body in reference to the point of fire origin?
- How was the victim dressed?
- Was the victim found facing a means of egress?
- Was the victim in a face-up or face-down position?

What objects or items were near the body?
- Who specifically discovered the body and made above observations?
4.3 Determining the cause and manner of death.

4.3.1 The Fire Marshal and the Medical Examiner, make this determination. However, note and observe any conditions that will aid them to determine if victim was dead before the fire or died as a result of the fire.

4.3.2 Most victims die from asphyxiation in conjunction with carbon monoxide (CO) poisoning, or spasm of the epiglottis (strangling), caused by the inhalation of super-heated fire gases and smoke, which will prevent CO from entering lungs.

4.4 Absence of CO in the blood could indicate death prior to the fire.

♦ CO may cause victim to appear life-like (pink to cherry red color of lips, eyelids, or skin). This would indicate the victim was alive at the time of the fire.

♦ The victim may show soot in or around the nose and mouth (indicates breathing continued during the fire).

4.5 Lividity is caused by the settling of blood to the lowest horizontal areas of the body; may show as pink or red skin. (Do not confuse with CO cherry red color.) Lividity usually starts one to two hours after death and is completed after three to four hours and could indicate that the victim was moved after death and placed at the fire scene.

4.6 Physical and visual condition of the victim.

♦ The skull of the victim may give the appearance that the skull exploded. * This is caused by the expansion (steam) of fluid in the tissues. This should not be confused with external damage from a blow to the head, since external damage could cause the skull to be forced inward.

♦ A pugilistic position does not indicate violence or a struggle. This is due to the contraction of the muscles that occurs during the fire. (It appears that the person was trying to defend himself.) Severe muscular contraction may result in bones protruding through the skin of the limbs.

* Heat penetrating into the cranial cavity produces steam from the fluids of the body, which in turn produces pressure sufficient to cause an internal explosion. In such cases, careful examination of the skull bones will reveal the beveling of the bone from internal to external, whereas if an external blow had been inflicted the beveling would be in the reverse order, namely from external to internal.

4.7 Victim may be found in an unburned area.

♦ Victim may have regained consciousness as heat increased and may have attempted to escape the fire area.

♦ CO may cause the victim to react in an irrational manner.

♦ Victim may be found in an unnatural location. (Children may attempt to hide from the fire). Under beds, in closets, behind or under furniture, etc.
5. **EVIDENCE COLLECTION AND PRESERVATION**

Many of the legal problems associated with evidence could be avoided if all evidence were collected by the Fire Marshals. However, since they may arrive on the scene at a much later time, fire personnel may be required to identify, safeguard, collect, and preserve evidence at a given incident.

5.1 Safeguarding procedures must be taken by the officer in charge where a fire was not extensive and the fire units are returned to service.

5.1.1 One firefighter, fulfilling a watchline function with a hand extinguisher, is sufficient to establish the Fire Department control of the premises.

5.1.2 To safeguard the firefighter, and provide additional security, a request for assistance should be made to the Police Department. Do not leave only the patrolman in charge.

5.1.3 No one should be allowed into the occupancy until the Fire Marshal arrives. When he does arrive, the firefighter can return to his unit.

5.2 An important element in the investigation of fire is the preservation and packaging of evidence.

Contamination is seldom a problem associated with the collection of evidence, but can become a problem in relation to its packaging and preservation.

5.3 One method is to use a completely air-tight container made from non-odorous materials.

5.3.1 This container should be a one (1) gallon metal can such as a NEW paint can. (Never use a can that was previously used.)

   A. The evidence should be cut or folded to fit into the can and top must be tamped securely into place immediately.

   B. Most common flammable liquids will float on water. A sample can be taken from the water on the floor or in the basement. Merely skim the surface of the water and enclose the sample in a clean new can.

5.3.2 If a new can is not available, use a clean glass jar with a tightly fitting lid. The rubber seal around the lid may react with the sample and contaminate the evidence.

5.3.3 Try to avoid the use of plastic containers. Vapors may escape through plastic and evidence may be contaminated by the deterioration of the plastic container.

5.3.4 A plastic bag can be used in an emergency. It should be new, of heavy gauge and used in pairs.

   A. Place evidence into one bag and tie it closed. Then place that bag into the other and tie it closed.

   B. As soon as possible, place into a can or jar and submit to the Fire Marshal.
5.4 Any evidence must remain in the hands of someone who will be available to testify as to the continuity of the evidence.

5.4.1 Continuity of evidence must be kept. Where possible, do not remove evidence pending arrival of a Fire Marshal.

A. Request Photo Unit to respond to take pictures of the evidence if a marshal is not responding.

B. Label and mark evidence and note where it was found at the fire scene. Never label, mark, or alter evidence in any way prior to photos.

C. Evidence cannot be left in the office unless it is locked up or someone else signs and stays with it. Remember, continuity of evidence is important and vital to any case. Any break in continuity breaks the chain of evidence.

6. DETERMINING POINT OF ORIGIN

The point of origin is where the fire started. It is at this point that a determination usually can be made as to whether the fire was accidental or of incendiary nature. If all accidental causes have not been eliminated, then the fire is suspicious and the Fire Marshal should be called. (Refer to signal 10-41)

6.1 The point of origin may be an exact point or a general area (as when an accelerant is used).

6.2 Be cognizant of the importance of locating the point of origin and the relationship between the point of origin and the fire cause.

♦ The fire cause is found at the point of origin.
♦ Evidence of incendiarism may be located near or at the point of origin.

6.3 Overhaul operations should be minimized if possible, when the fire is suspicious. It should likewise be performed more carefully.

♦ Overhaul may hinder the examination of the fire scene or make it more difficult. Evidence could be buried or destroyed.

♦ Try to determine whether overhaul debris is normal or unusual for that area. It could indicate the fire was set if items are found that normally would not be in the area.

6.4 Make an examination of the exterior of the structure.

Determine if the fire started on the outside. If so, how did it communicate to the inside? Check the outside for any evidence as to how it started.
6.5 Make an examination of the interior of the structure.

6.5.1 Fire personnel usually must work backward in relation to the fire's travel or spread. Work from the clean area, to the smoke stained area, to the heat peeling area, to the char area.

6.5.2 Ceiling damage may help to locate the point of origin.

6.5.3 Normal fire travel is upward and outward. Burning and charring along the lower length of a wall or under a door could mean an accelerant was used.

6.5.4 "V" Pattern burns may help to identify the point of origin.**

A. "V" Pattern burns usually point toward the point of origin.

B. Absence of "V" Pattern of burning could mean an accelerant was used. Rapid intense heat from accelerant may cause perpendicular burns on walls.

** Because of the upward tendency of every fire, some type of inverted conical shape or "V" pattern burn may be characteristic; the apex at the bottom being the point of ignition, with the fire rising and spreading. Naturally, this pattern will be altered by the presence of any obstruction, or of readily burned fuel in localized areas.

6.6 Multiple points of origin.

6.6.1 This may indicate arson. Each point of origin must be examined before making a final decision.

6.6.2 It is important to determine that a second fire was not due to a flashover or normal burning, starting at a point other than at the original point of origin.

6.6.3 Determination must also be made that other fires were not started by a person moving a burning item such as a mattress or drapes burning at the top and then dropping to the floor to start another fire.

6.7 Glass objects used as indicators to help locate the point of origin.

6.7.1 Glass objects may be affected by smoke, heat and flame. Smoke production varies with factors including the type of material burned and the rate and duration of burning.

6.7.2 Heavy smoke stains, remote from the point of origin, usually indicate a slow fire build up. Light smoke stains usually indicate a rapid build up of the fire, little fire damage and are found close to the point of origin. (Hydro-carbons or products thereof may be an exception to the above).
6.7.3 Crazing of glass (cracking due to heat).
- Small crazing means intense and rapid heat build up and will be found closer to the point of origin.
- Large crazing indicates remoteness from the point of origin and/or a relatively slow heat build up.
- Checkering of glass (half moon effects or marks) usually results from water being applied to heated glass. This indicates the window was still in place when the firefighters operated at the fire.

6.8 Depth of charring as an indicator of fire's travel and the point of origin.
Wood structural members may burn at approximately one inch every 45 minutes. (Estimated burning rate under lab conditions at 1400 deg. F, burning all exposed sides.)
- Depth of char may indicate the amount of time burned.
- Deepest char may be found at the point of origin. However, this is not always necessarily so, since most intense heat and fire may be above the point of origin.
- Smaller blister type charring may indicate longer burning and hot fires.

6.9 Lack of specific point of origin.
The extent of floor damage and depth of char may identify the area of origin. If the fire burned over a large floor area, it could indicate the fire was started with an accelerant.
7. **OVERHAULING**

It is during this stage that members will perhaps have their last available moment to reflect upon the events surrounding the fire. When these events contradict everything his experience and job knowledge has taught him, he should immediately advise the officer in charge of his suspicions. It is at this stage that physical evidence surviving the fire will become obvious.

7.1 Company officers and members should be aware that the following indicate the possibility of arson:

- Ransacked conditions of an occupancy.
- Indications of separate fires.
- Deep-seated and localized charring could indicate use of a flammable liquid to set fire.
- Evidence of the fire dropping down through tongue and groove flooring.

**Note:** This is not always significant, however, it is included in this listing as it is a factor.

- Any, remains of trailers and incendiary devices or unusual residues.
- Any presence of flammable liquid odors or containers.
- Absence of furniture in an occupancy reported to have been occupied.
- Absence of security dogs or pets known to have been maintained on the premises.
- Presence of furniture believed inappropriate for the occupancy and which tend to indicate an attempt at insurance fraud.
- Any motor vehicle fire in which the owner or driver is not present to account for the fire.

7.2 Overhauling operations should be minimized, if possible, when the fire is suspicious. Overhauling may hinder the examination of the fire scene. Evidence could be buried or destroyed.

During overhauling operations where arson is suspected:

- Be careful to ensure that evidence is not washed downstairs or thrown out of windows.
- Do not remove evidence from fire scene unless necessary.
- A record should be made of the time, location and circumstances under which evidence is found, the names of witnesses present, and the names of all persons having custody of the evidence until it is received by a fire marshal.
- Prevent all unnecessary traffic through areas containing evidence.
- As requested by the Fire Marshal, remove carefully and appropriately protect, sections of structural members, etc., which might contain evidence of all flammable liquids when analyzed in a laboratory.
- Try not to destroy the area at the point of origin.

7.3 If any evidence of arson is found during overhaul, call it to the attention of the officer in charge and safeguard it for the Fire Marshal.
8. COMMERCIAL FIRES

8.1 Because of the variety of investigations for which the Division of Fire Investigation is responsible, priorities have been established. Commercial incendiary fires share top billing with but few others, most notably the report of a DOA.

If the officer in charge of a commercial fire establishes that it may be of an incendiary origin, there is likelihood a Fire Marshal will arrive before overhauling is completed. (Dependent on the extent of the fire and time of 10-41.)

8.2 When Fire Marshal will be delayed in responding, the dispatcher shall so advise the officer in command of the fire.

8.3 If after arrival at a commercial fire, the Fire Marshal classifies it as being incendiary, the police can thereafter maintain security. (See Sec. 5.1)

8.4 Until the Fire Marshal arrives, allow no one, including owner, to enter premises unless authorized by the officer in charge.

♦ Observe closely, those authorized access. Obtain names and addresses of anyone allowed in, and provide for their being accompanied by a firefighter at all times.

♦ Safeguard contents. (Prevent burglary claim.)

♦ Safeguard physical evidence of incendiariosm.

♦ Account for all valuables necessarily removed by members from the premises.

8.5 Do not discuss the fire with other than authorized personnel, i.e., - officer in command, Fire Marshal, etc.

8.6 The Fire Marshal upon his arrival will:

♦ Report to the officer in command of the fire and obtain his evaluation and reasons for declaring the fire of suspicious origin.

♦ Make a physical examination.

♦ Determine the cause and origin of the fire.

♦ Remove physical evidence for lab analysis when necessary. ♦

Call for the Photo Unit, if he deems it necessary.

♦ Conduct an investigation.

♦ Take appropriate legal action.