Chapter 7

INCENDIARISM

INTRODUCTION

Incendiarism, commonly known as arson, is a purposely-set fire. Such fires are then, by definition not accidental in nature. The accident investigator must be aware of the telltale signs of arson, however, so that he may call in the proper criminal investigators to take over the investigation. He must also be extremely careful whenever he is in a fire scene to ensure that vital evidence for criminal prosecution is not destroyed before the criminal investigators arrive. For this reason, accident investigators should treat fire scenes with extreme caution until arson as been eliminated as a possible cause of the fire.

A further note of interest is that, even if the fire is determined to have been purposely set, there will undoubtedly be many worthwhile safety lessons to be learned. Once ignited, a fire is a fire regardless of the source of ignition. The ship's built-in structural fire protection, the ability of the officers and crew to control the situation, the adequacy of the detection and suppression systems and the sufficiency and suitability of the fire fighting equipment will all be tested. The accident investigator can glean as many valuable safety lessons from a purposely-set fire as he can from an accidental fire. A case in point was the 1990 fire on board the Bahamian Registered Passenger Ship *Scandinavian Star*. This fire was purposely set while the vessel was underway from Oslo, Norway to Fredrikshavn, Denmark with 383 passengers and 99 crew on board. As a tragic result of this fire, 158 persons lost their lives. The investigation of the *Scandinavian Star* fire discovered many fire safety deficiencies and as a consequence, sweeping improvements in fire safety were mandated for passenger ships internationally by the International Maritime Organization.

INDICATORS OF INCENDIARISM

Following is a list of indicators of possible incendiarism that will be covered in this chapter. This list should not be considered inclusive of all the indicators of incendiary fire causes. Also, there may be times when any of these indicators may be present in an accidental fire.

- Absence of all accidental causes;
- Multiple fires;

- Trailers;
- Presence of liquid accelerants;
- Use of common equipment and/or appliances;
- Structural damage prior to the fire;
- Removal or substitution of contents prior to the fire;
- Major appliances removed prior to fire;
- Absence of personal items or important papers;
- Location of the fire;
- Evidence of other crimes;
- Unnatural fire spread, excessive damage, and/or extreme heat;
- Time between exit of occupant and fire;
- Previous fires in same vessel;
- Presence of fuel near the point of origin;
- Time of day;
- Convenient heat source;
- Activities of crewmen; and
- Statements by crew/owners representatives.

ELIMINATE ACCIDENTAL CAUSES (NEGATIVE *CORPUS DELICTI)*

Prior to determining any fire to be incendiary, all other causes for that fire must be eliminated. *Corpus delicti* is the "body" upon which a crime has been committed; e.g., the charred remains of a house which burned due to the criminal act of arson. Negative *corpus delicti* means burning has occurred, but as a result of an accidental cause or causes.

MULTIPLE FIRES

If, during the course of conducting a file scene examination, the fire investigator discovers more than one point of origin, it must be proved that each fire is independent of the other(s) (not caused by communication of the first fire to other areas and fuels).

The investigator must establish that these multiple fires are separate and unconnected, and that no accidental or natural cause could produce separate fires. In nearly all such cases, establishing the *corpus delicti* is quite simple. The investigator should be prepared to explain why these multiple fires could not have been caused by such things as heat transfer (i.e., radiation, conduction, and/or convection*),* burning fuels dropping to start secondary fires, overhaul, or flashover. The investigator should check for trailers when examining a fire scene with multiple unconnected fires.

TRAILERS

The working definition of a trailer is "any combustible or flammable material used to spread fire from one point or area to another."

Trailers usually leave char or burn patterns on surfaces where used, such as floors, carpets, steps or through doors, windows, or wall openings (may be existing openings or openings made for fire spread).

Class "A" trailers are ordinary combustible materials that will leave an ash or glowing residue. These trailers usually leave a surface burn on the *overlay* on which they are used.

Some of the common materials used as Class "A" trailers are newspapers (flat, rolled, or "bunched"); rope, string, twine, etc.; fuse cord, which may produce "skip" char pattern or may leave an asphalt-like residue; clothing, bedclothes, drapes, or other household materials; waxed paper or tissue paper; and fabric softener sheets. Occasionally, although rare, room contents may be arranged to form a trailer. These often are used with incendiary devices such as candles.

Class "B" trailers are flammable/ combustible liquids. The liquids, when used as trailers, soak into any type of porous overlay. When they burn, they usually leave a deep-seated burn or blisters if used on tile or linoleum overlay.

Some common Class "B" hydrocarbon liquids used as trailers are gasoline, kerosene, lighter fluid, turpentine, or any other common or readily available liquid accelerant fuel.

Ketones and alcohol are the most common Class "B" non-hydrocarbon liquids used as trailers.

PRESENCE OF LIQUID ACCELERANTS

When accelerants are found in areas where they would not normally be, the investigator must determine the reason for their presence. Once it can be established that the presence of these accelerants was not caused by the justified actions of the crew/room occupant, the investigator can proceed with the investigation using this information as an indicator that the accelerants were introduced by another person, and that this fire may be of incendiary origin.

Probable Cause

When the presence of accelerants is detected in a fire, some indicators of incendiarism are:

- The accelerant is found throughout an area and was not spread by explosion or due to container leakage.
- The accelerant is found above the floor area and was not spread by an explosion.
- The accelerant is found on or in furniture, drawers, cabinets, boxes, files, desks, books, etc.

Properties of Accelerants

Almost all commonly used liquid accelerants tend to form flammable/explosive vapors at room temperature. Ignition of a given accelerant vapor requires that the vapor be within its flammable/explosive range at the point it encounters an ignition source, and at or above its ignition temperature. Hydrocarbon liquid accelerants do not ignite spontaneously.

Many commonly used hydrocarbon liquid accelerant vapors are heavier than air and tend to flow downward into stairwells, drains, crevices, and cracks. These liquids also are lighter than water, immiscible, and display”rainbow" coloration when floating on water. The "rainbow" coloration can also be the result of other hydrocarbon residue (e.g., carpet, carpet padding, plastics, etc.). Certain other liquid accelerants (e.g., alcohols, acetone, and polar solvents) are water soluble.

Liquid accelerants have a tendency to flow down grade and form pools or puddles in low areas. Many of these liquids are readily absorbed by structural materials and natural or manmade substances. They also are powerful solvents that tend to dissolve or stain many floor surfaces, finishes, and adhesives.

When a liquid accelerant is poured on a floor and ignited, two things begin to take place. First, many types of synthetic surfaces (e.g., vinyl) or surface treatments will mollify (soften) beneath the liquid. Second, at the edge of the pool, burning vapor adjacent to

the liquid will cause many floor surfaces to char while certain others (such as vinyl) melt, then char. As the liquid boils off, its edge recedes. Floor surface charring (or melting and charring) follows the receding liquid edge. The floor area under the liquid accelerant is protected from the burning until the liquid boils off that section.

Experiments indicate that the greatest temperatures in a liquid accelerant fire occur above the center of the burning liquid pool. Maximum concentrations of accelerant residues are found at the edges of the burn pattern, and minimum concentrations toward the center. Some arson investigators believe this is controversial and take samples from both the edge and the center.

Accelerants with high vapor pressure like alcohol or acetone tend to "flash and scorch" a surface, whereas accelerants with higher boiling components like gasoline tend to "wick, melt, and burn" leaving stronger patterns. The amount of ventilation available to the fire is a factor in burn pattern appearance.

Common Indicators

There are some common indicators which may assist the investigator in determining the presence (or use) of a liquid accelerant (fuel).

Charring of Floor Surfaces

Most accidental structural fires may produce very little floor charring, since temperatures at floor level are usually below ignition temperature in most fires. There may be charring to flooring which is the result of post-flashover. "V" burns or grooves between floorboards may indicate the presence of a liquid fuel. Liquid accelerants may soak between floorboards, burn, and develop small, sharp "V" patterns between edges of the floorboards.

Liquid Accelerants

Liquid accelerant fires are associated with an area of origin, instead of a point of origin. This is because the liquid flows outward away from the point at which it is poured. The arsonist usually pours this liquid over a large area, splashing it or trailing it throughout the room or structure.

If the investigator finds traces of a liquid accelerant in a structure, he/she must determine if its presence is normal for that location and that occupancy. The presence of gasoline on a mattress in a crew cabin is obviously highly suspicious. On the other hand, evidence of gasoline found at a fire in an automobile repair garage would not necessarily be suspicious. The presence of a liquid accelerant at the scene of a fire, nevertheless, is a strong indication that the fire was of incendiary origin.

If the investigator finds evidence of extensive floor damage with an irregular shape, he/she should view it with suspicion and should look further for possible evidence of an accelerant. A dramatic line of demarcation between burned and unburned flooring is an excellent sign of the *use* of a liquid accelerant.

Because a liquid accelerant will settle to the lowest level of a floor, its presence often can be detected in such locations as the corners of a room or along the base of a wall. Often the investigator will find the evidence he/she is looking for by removing the baseboard, quarter round, or tacked carpet strip, since the liquid accelerant may run under those items and become trapped.

Low Levels of Charring

Another indication that a liquid accelerant may have been used is evidence of very low charring at the base of a wall or at the base of furniture items. Because an accelerant will burn at floor level, the investigator may observe charring of such things as table legs and baseboards at a lower level than would normally be expected following an accidental fire. Examination of the underside of low furniture items will prove valuable. One would not expect an accidental fire to char the undersides of coffee tables or night stands. If that condition is found, it indicates that a liquid accelerant may have flowed under the piece of furniture, with flames burning it from below. The investigator should examine the bottom edge of a door for charring. During an accidental fire, charring of this area would be extremely unusual. Finding charring in this location should alert the investigator to take steps to search for evidence of an accelerant. Hydrocarbon liquids have a greater ability to penetrate than does water. They may seep into areas that water cannot.

Liquid accelerants tend to soak between floorboards before burning. Where this occurs, there may be dark charring along the line of the cracks or joints of the floorboards. This can result in the burning away of some wood along the joints of the floorings. The burning will appear as a dark "V" or groove.

Many times, a liquid accelerant will soak into the wood flooring itself, causing holes to burn through the door. If this occurs, the investigator may have to prove that the flooring burned from above and not from below. A fire, which has burned through a piece of wood, will normally leave a beveled edge around the hole. This bevel will usually be on the same side of the wood as the fire. A hole burned through wood flooring from above should reveal a slight bevel slanting downward and inward toward the hole. The underside of dooring which has burned through should appear relatively clean of any charring around the hole.

Liquid accelerants may run through the flooring and burn under it. Evidence of the liquid accelerant may be trapped between the floor and the subfloor. When a liquid accelerant runs through dooring and burns, it frequently leaves an unusual burn pattern on the sides of the door pists, similar to a "lace curtain." This unusual burn pattern on the sides of the joists is caused by the liquid accelerant burning downward. On concrete or cement floors, evidence of an accelerant may appear in the form of an irregular pattern of

various shades of gray to black. It will often have a blotchy appearance due to the uneven soot and hydrocarbon residue remaining.

Liquid accelerants may soak into any absorbent material, such as carpet, door-length drapes, and plaster walls.

An area may have to be cleared of debris before a liquid accelerant pattern is discovered. When sweeping or rinsing the floor, be careful not to destroy the evidence underneath. Pouring water onto the floor may indicate the direction of settling or running of the accelerant.

Spalling of Concrete or Masonry

The spalling of concrete or masonry floors may indicate the presence of a liquid accelerant. Spalling is the result of the concrete reaching sufficiently high temperature and then rapidly being cooled by water. This causes the surface to crack and loosen and produce a pitted appearance. Some investigators look upon the spalling of concrete as a strong indication that a liquid accelerant has been distributed on the surface and burned. But spalling also can be produced by a fire set in ordinary combustibles.

Spalling of the concrete should be considered only as a possible indicator of an accelerant's presence. Spalling also may consist of larger craters in the concrete, which may be mistaken for the results of explosives. Spalling also is caused by the boiling and rapid evaporation of the moisture found in most concrete.

Other factors that may cause spalling include the age of the concrete, concrete mixture, chemical reaction mechanical breaks, extreme cold or extreme heat; and fall down of heavy objects. If in doubt, take samples from the spalled area and have them analyzed for accelerant presence.

Floor Coverings

A floor covered by asphalt or vinyl tiles also may reveal an irregular burn pattern and discoloration similar to that observed on cement. Tiles may be blistered. These are good indicators that a flammable liquid may have been distributed on the surface. Attempting to recover trapped accelerant residue from beneath the tiles can be frustrating because the adhesive used to secure the tiles usually also has a petroleum base. Often, the investigator will have to sweep a floor clean of all fire debris and even rinse the floor with water before he/she can examine it properly. If floor asphalt or vinyl tiles are submitted for laboratory examination, a comparison sample also must be submitted.

Liquid accelerants will cause blistering and/or destruction of floor tiles or linoleum floor coverings. This type of floor covering may indicate flow patterns and should be examined closely.

Localized "gapping" of vinyl near seams within the pour or burn pattern may be caused by a liquid accelerant burning inside the seam. "Ghost marks" also may occur between the seams of floor tiles in the pour area where an accelerant seeped, dissolving the tile adhesive and resulting in a checkerboard pattern on the sub-floor.

The burning of the liquid and adhesive tends to curl the edges of the tile upward and may result in a deeper char burn between the seams on flooring or heavy discoloration of the area compared to surrounding areas. The curling of edges may be caused by normal shrinkage from loss of flexibility caused by the nature of floor tiles and fire conditions.

Contents of Rooms

Liquid accelerants may produce unusual burning of contents of rooms or their components. Charring on the bottom surface of doors is often an indicator of liquid accelerants at floor level. However, when a door is closed and the fire is fully developed, hot gases may extend to the floor. These gases may escape under the door and cause charring on the underside of the door. Burning of the floor surface along its edge or at contact with walls may be due to the presence of liquid accelerants. Corners and wall-to-floor edges may be dead air spaces, which suffer little, if any fire damage unless liquid accelerants are present. The liquid accelerants may carry flame behind baseboards or molding. Moldings should be removed and the backside examined. If fire damage is observed on the protected area of the wall or on the backside of the baseboard or molding, there is a strong possibility that a liquid accelerant was present.

The charring of the undersides of furniture usually indicates that the fire burned at some level below the surface being examined (i.e., the fire was burning below the furniture). This may be due to the use of a liquid accelerant. There may be other possible causes of charring of the underside of furniture such as drop down, melting, burning foam, etc.

Flashover

The effect of flashover is another phenomenon that the investigator must consider. Hot smoke and gases cause flashover from a fire rising to ceiling level and then burning rapidly upon reaching ignition temperature. The heat radiated downward from this flashover causes horizontal surfaces such as table tops, and beds to char or singe. The effect that this radiated heat has on a objects is similar to the effect of an accelerant. Two important differences exist. Flashover produces an even or uniform burn on exposed surfaces as opposed to the uneven burn associated with an accelerant. Also, an accelerant would be expected to run down a vertical surface and produce a unique burn pattern, but the damage resulting from flashover usually will be limited to horizontal planes.

Another effect of flashover is to ignite curtains, drapes, and other common combustibles, causing them to drop from their rods and hooks. Such items burning on the floor or on furniture may give the appearance of multiple set fires.

Char Pattern

The burning of combustible components (wood) produces char in a broken pattern. Depth of char will depend on such factors as the rate and duration of heating, ventilation effects, surface area-to-mass ratio, size of wood grain, species of wood, moisture content, surface coating, etc.

A large rolling char pattern simply may be the result of a very fast-moving hot fire. Or, it may be the result of the burning of liquid accelerants. This type of char is identified by very large blisters with deep cracks between blisters. The cracks between blisters are sometimes referred to as dehydration cracks, and they develop as the fuel is exposed to heat.

Consider whether the material was exposed to flame in the early or late stages of the fire's growth. Materials that were involved after the fire vented itself may develop large char naturally.

Burning in a "downward" direction may be considered unnatural. Liquid accelerants may have run and carried flames downward. Liquid accelerants may soak into floors and cause holes to be burned through the flooring. Holes produced by liquid accelerants on floor surfaces are often irregularly shaped, and may even follow the direction of flooring joints

Splash Patterns on Bulkheads

Arsonists frequently throw or splash accelerants on a wall or bulkhead prior to ignition. This liquid will run downward and when ignited will leave a distinctive pattern often referred to as "fingering." Liquid accelerant poured at the base of the wall, and then burned will usually leave an inverted "V" pattern on the wall after being extinguished, because of the vertical flame plume of the burning volatile fuels not reaching the ceiling. This pattern is caused by the liquid flowing outward along the base of the wall and then burning very rapidly, so that oxygen is drawn into the flames with such velocity that a chimney effect is produced.

Containers

The discovery of liquid accelerant containers in or around the fire may be a good indicator that a flammable accelerant is present. Liquid containers should be retained as evidence for laboratory analysis comparison samples. If the container is not damaged, it may help to prove that accelerant spread was not due to explosion. In addition, latent fingerprints possibly-can be obtained from the container. Have qualified persons attempt to obtain the fingerprints. If plastic containers were used to carry the accelerant into the scene, they may be melted or totally consumed in the ensuing fire. They may still contain residue. Do not cut, break, or crush the container; this could result in the accelerant or vapor residue being lost.

Flashback

Firefighters are the first professional observers at a fire scene. Their observation of smoke and name color is more valuable than that of the average person. Firefighters may have observed flashback during operations to extinguish fires, which should be considered as strong evidence of the presence of an accelerant. Flashback occurs when gas or vapor from a fuel re-ignites and flashes back over the fuel surface.

Odors

Liquid accelerant odors also may have been detected by firefighters. Odors often remain after extinguishment, and may have been detected during overhaul operations.

Evidence

Residue (evidence) should be collected as soon as possible. Many liquid accelerants evaporate rapidly, and any delay may result in loss of opportunity for collecting positive samples. Liquid accelerants may leave an oily surface on water or contents. Look for this and obtain samples from it. Residue of liquid accelerants may be detectable by the use of ultraviolet light, which may aid in identifying locations where samples should be obtained.

A hydrocarbon detector may assist the investigator in detecting residue of liquid accelerants. This instrument measures vapors of accelerant residue in parts per million and is used to assist the investigator in determining the presence and/or location of an accelerant. A vapor detector will not identify the liquid accelerant, and its findings should never be testified to in a court of law. This instrument is merely a "tool of the trade."

Accelerant detection canine teams also may be used to detect accelerant residue. The investigator should confer with the canine handler for best results and always should advise the crime lab that a canine assisted in locating evidence. If use of accelerants are suspected, the marine investigator should contact local fire investigative authorities to see if they have canine teams that may be used to further the investigation.

COMMON EQUIPMENT OR APPLIANCES AS INCENDIARY FIRE CAUSES

Frequently common household, commercial, and/or industrial equipment or appliances are used as incendiary devices. Some examples of these are discussed below.

Heating Equipment

Electrical heat-producing appliances can serve as incendiary devices. Investigative examination should include checking the control settings. Make sure the appliance was

turned on, plugged in, or operating at the time of the fire. Look for tool marks on the fuel lines or evidence of tampering with fuel supply lines, wiring, etc.

Cooking Equipment

Toasters, coffeemakers, toaster ovens, etc., should be examined. How many fires are caused by a pan of oil/grease left on the stove? Were they accidental? Examine appliances for evidence of tampering, such as removing the bimetal strip or the fusible link.

Lighting Equipment

Look for clothes draped over lamps or high intensity lamps. Check for tampering with the lamps. Be sure to examine the entire branch circuit. Look for evidence of lighting equipment in unnatural places, and check for evidence of combustible fuel having been arranged nearby.

Small Appliances or Equipment

Irons, hair dryers, curling irons, etc., are all possible incendiary devices. Determine whether the appliance or equipment is being used in an unnatural location or during an unusual time. Examine the appliance or equipment for tampering or modification.

Cigarettes

Cigarettes may be used as a time-delay device. When cigarettes are used as an ignition device, it is often difficult to prove intent.

STRUCTURAL DAMAGE PRIOR TO FIRE

Check for holes in walls, floors, or ceilings made to allow the fire to spread into other structural areas or from one area to another. Keep in mind that such damage could be accidental or simply poor upkeep. Also, make sure the damage was not the result of overhaul or fire suppression activity.

REMOVAL OR SUBSTITUTION OF CONTENTS PRIOR TO FIRE

Removal of Contents

Expensive objects, antiques, or objects with sentimental value may be removed prior to an arsonist setting a fire. Some examples to look for are:

- wedding or family photo albums;
- jewelry; and
- televisions, VCRs, CD players, etc.

An inventory of remaining contents may identify missing items when compared to the proof-of-loss statement. Interview crewmembers who may have noticed removal of contents. Crewmembers also may be able to state that objects are missing.

Contents Out of Place or Not Assembled

The occupant may stack or pile combustible contents to provide fuel for the fire.

Locking plates from beds should show locking surfaces clear of smoke stains and/or heat damage if the units were assembled at the time of the fire. Drawers in the closed position, usually burn late in the fire. Evidence of empty storage containers, such as boxes, drawers, etc., are unusual and suspicious.

Again, the arsonist believes evidence will be destroyed in the fire. However, if the investigator is thorough enough, the evidence usually can be located.

ABSENCE OF PERSONAL ITEMS OR IMPORTANT PAPERS

Most crew cabins contain personal items. Absence of personal items may indicate that only basic contents were left to burn. Items that may be removed include cash, savings account book, expensive clothing, jewelry, family photographs, licenses, certificates, documents or handcrafted items.

ADDITIONAL INDICATORS

Location of the Fire

A fire in an unusual location should arouse the investigator's suspicions. Unusual locations are areas with no identifiable heat source. Fires in bathrooms, closets, or crawl spaces are all considered unusual.

Evidence of Other Crimes

A fire may have been set to cover other crimes such as murder, burglary, embezzlement, tax fraud, etc. Keep in mind that another crime could have been staged to help explain the set fire. This is a situation where the owner/occupant must be thoroughly investigated by appropriate law enforcement investigators.

Unnatural Fire Spread, Excessive Damage, and/or Extreme Heat

Unnatural fire spread may be due to the presence of some accelerant. What appears to be unnatural fire spread by itself proves nothing, but such situations should cause the investigator to conduct an extensive scene examination. Questions that the investigator should ask are:

- Was the fire damage increased due to the presence of some accelerant?

- Was the fire damage excessive as compared to similar fires in similar occupancies? The answer to this question will require extensive scene examination.

Evidence of extreme heat may be unnatural and may be due to an accelerant. Structural fires may produce extreme temperatures (up to or above 2,000^{o} F (1,093.3^{o} C)). These temperatures are usually attained during the later stages of the fire or when the structure is fully involved. During the earlier stages of the fire, and at the lower levels within the structure, temperatures may not exceed 1,500^{o} F (815^{o} C) to 1,600^{o} F (871.1^{o} C).

Metals

The melting of metals within the structure may indicate an extremely hot fire. Consider the following:

- The discovery of an aluminum storm window frame which melted during the fire might not indicate excessive heat if the fire vented through that window opening. Additionally, since the upper portion of the window frame extends into the upper portion of the involved room, one could expect the aluminum frame to melt.

- Finding the aluminum threshold of a doorway melted could indicate excessive heat, since the floor surface generally stays much cooler than the upper portions of an involved room.

Occasionally chromium or other shiny metal surfaces may become discolored due to exposure to extreme heat. After the fire, these surfaces may retain this discoloration as an indicator of the presence of extreme heat. Take into consideration the extent to which an object has been affected and the level (height) at which the object was located. The following list is simply a guideline and should not be used as a definitive guide in attempting to determine actual temperatures.

Heat Colors

Color	Temperature (F^{o})	Temperature (C^{o})
Yellow	450	232.2
Brown to Purple	550	287.8
Blue	600	315.5
Faint Red	900	482.2
Dark Cherry	1,100	593.3
Full Cherry	1,400	760.0
Salmon	1,600	871.0
Lemon	1,800	982.0
White	2,200	1,204.4
White	2,400	1,315.5

Source: Factory Mutual Engineering Corporation, A *Pocket Guide to* Arson *Investigation,* 2nd Ed. Norwood, MA: 1979

Limited Entry or View

Firefighters have encountered attempts by the arsonist to block access to the fire scene, or to block entry to a structure. (The investigator must be able to prove that the blocking was done prior to the fire in order to slow entry or extinguishment.) A few of the arsonist's tricks are:

- removing door hardware (handles or knobs);
- doors and/or windows nailed, bolted, wired shut; and
- moving contents to block doors and/or windows.

Injuries

Sometimes the flash of flammable vapors from accelerants being spread through a structure will cause burn injuries to the arsonist. The injuries may involve only the arms, hands, and/or face, and at times the injuries may be severe. While interviewing the crew members, examine them for indications of singeing of eyebrows, facial hair, or hair on their head or arms and hands. Look for reddening of the face, arms, or hands, similar to first-degree burns. Be sure to verify their story of how they sustained the injury.

Time Between Exit of Occupant and Fire

As part of the investigation, ascertain the time period between when the last occupant was present at the scene and time of the fire's discovery. One question should be addressed during the examination of any fire scene: "Are the time factors in this incident reasonable, appropriate, or believable?"

Previous Fires in Same Structure

A second fire in the same structure over a short period of time may indicate incendiarism. This is not an absolute, as people may experience more than one accidental fire in their lifetime. However, the circumstances of each previous fire should become a part of the investigation. The first fire may have been an unsuccessful arson attempt, or may not even have been reported. The second fire may involve large quantities of liquid accelerants and/or may result in injuries to the fire setter.

Presence of Fuel Near the Point of Origin

Readily available kindling fuels such as newspapers may be placed at or near the point of origin. Questioning of the owner/occupant should address the reasons for such fuel placement. Interviews with other crewmembers may assist in confirming that these fuels were always in that location, or that this was an isolated incident.

Time of Day

Determine if the fire cause and/or the occupant's explanation of the fire fits with the time of the fire.

- Kitchen fires (e.g., food on the stove) at odd times may (or may not) be an indication of incendiarism.
- Sofa fire (cigarette dropped into a sofa) during daytime hours also may be incendiarism. Sofa or furniture fires caused by cigarettes often are discovered early in fire's progress if occupants are in the area.

Convenient Heat Source

Many times appliances which have a history of causing fires are used as an invented fire cause in an attempt to cover incendiarism. Remember that the possibility of an accidental fire does exist. Examine the appliance for evidence of tampering; also check for indicators of a flammable liquid introduced to the area.

Fires During Renovations/Remodeling

Accidental fires do occur due to various situations associated with renovations and/or repair. Causes of an accidental fire during renovation or repair are poor housekeeping, temporary electrical wiring, or the presence of flammable liquids. Incendiary fires may occur when the owner of the vessel decides the cost of repair is more than the vessel is worth.

Activities of Owners/Crewmembers

Witnesses may report conditions or activities by the owner/crewmember, which may indicate possible incendiarism. Always canvass the crew. Interviews conducted may bring forth information on fights or arguments between members of the crew or labor disputes with management.

Statements by Owners or Occupants

While interviewing the owner/occupant, be aware of statements about economic conditions. Be aware of remarks about labor conditions and about personnel problems within the crew.

DETERMINING FIRE CAUSES

- Reconstruct the scene as much as possible. The investigator needs to know what was on the scene, its condition, and the physical environment prior to the fire.

- Determine the path of heat travel and the point of origin. Fire cause determination is a two-phase activity.

    - Determine the point of origin.
    - Identify the fire cause through a process of elimination.

Remember, the statement is "origin and cause," **never** "cause and origin."

- Establish approximate burning time. Based on similar situations in like occupancies, and on the amount of destruction observed, how long did this fire burn prior to discovery and extinguishment?

- Evaluate the combustion characteristics of materials involved. Based on evidence of burned materials in the fire-involved area, did this fire burn as would normally be expected? Or, was some accelerant probably introduced to the area?

- Compare similar materials and situations. Did this fire produce the results one would anticipate when compared to the many other fires in similar occupancies that you have observed?

- Fit known facts to various possibilities. Considering each and every fact and statement, does the situation appear reasonable (possible), or are facts still missing?

- Coordinate the information obtained during the scene examination with information from occupants and witnesses. Information obtained from the people involved in or associated with the incident, as well as observations on the incident scene are the bases of fire cause determination.

SUMMARY

Incendiary fires are set or started with the intention of destroying. The methods used are limited only by the imagination of the firesetter.

To prove incendiarism, the fire investigator must eliminate all other fire causes. This often is used to support evidence of incendiarism with other evidence.

As we have learned, there are other indicators of incendiarism besides trailers, multiple fires, or the use of flammable accelerants. Often evidence associated with an incendiary fire is recovered at the fire scene. One indicator is not sufficient. Take all available indicators into consideration.

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