Fire Cause Determination for Company Officers

FCDCO-Student Manual

4th Edition, 4th Printing-April 2015

FEMA

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The development of any National Fire Academy (NFA) course is a complex process aimed at providing students the best possible learning opportunity we can deliver.

There are many players in course development, each of whom plays an equally important part in its success. We want to acknowledge their participation and contribution to this effort, and extend our heartfelt thanks for making this quality product.

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COURSE GOAL

The goal of this course is to provide the students with the ability to make observations and gather information that will assist in identifying areas of fire origin, causes of common fires, and the need for additional assistance.

AUDIENCE, SCOPE AND COURSE PURPOSE

The primary audience for this course is fire department company officers (COs), first responders and chief officers whose responsibilities may include fire origin and cause determination. The secondary audience is fire personnel or related professionals who could be involved in overhaul and who might inadvertently destroy potential evidence at the scene. The course is not intended for fire/arson investigators and should not be used as training for new investigators.

"Fire Cause Determination for Company Officers" (FCDCO) is designed to provide basic training in the principal aspects of fire origin and cause determination. It is a basic course that will permit the CO to understand the key role the company members play in helping to determine fire origin and cause and in preserving important evidence for any subsequent investigation.

STANDARDS

The course is designed to meet the applicable sections of National Fire Protection Association (NFPA) 1021, *Standard for Fire Officer Professional Qualifications.*

State and local requirements are not addressed in this course.

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SCHEDULE

TIME	DAY 1	DAY 2
8:00 - 9:00	Introduction (Knowledge Check)	Unit 2: Collection and Documentation of Information (cont'd)
9:00 - 9:10	*Break*	*Break*
9:10 - 10:20	Activity I.1: Fire Scene Observations	Activity 2.1: Building Construction Impact on Fire Cause Determination
10:20 - 10:30	*Break*	*Break*
10:30 - 12:00	Welcome, Introductions and Administrative Unit 1: Fire Officer Observations	Unit 2: Collection and Documentation of Information (cont'd) Unit 3: Behavior of Fire
12:00 - 1:00	*Lunch Break*	*Lunch Break*
1:00 - 2:15	Unit 1: Fire Officer Observations (cont'd)	Unit 3: Behavior of Fire (cont'd)
2:15 - 2:30	*Break*	*Break*
2:30 - 4:00	Activity 1.1: Observations of First-Arriving Company Officer Unit 2: Collection and Documentation of Information	Unit 4: Securing the Fire Scene

TIME	DAY 3	DAY 4
8:00 - 9:00	Unit 5: Determination of Area of Fire Origin	Unit 7: Incendiary Fire Causes and Devices (cont'd)
9:00 - 9:10	*Break*	*Break*
9:10 - 10:20	Unit 5: Determination of Area of Fire Origin (cont'd)	Unit 7: Incendiary Fire Causes and Devices (cont'd)
10:20 - 10:30	*Break*	*Break*
10:30 - 12:00	Unit 5: Determination of Area of Fire Origin (cont'd) Unit 6: Accidental Fire Causes	Activity 7.1: Incendiary Fire
12:00 - 1:00	*Lunch Break*	*Lunch Break*
1:00 - 2:15	Unit 6: Accidental Fire Causes (cont'd)	Unit 8: Motivation of the Firesetter
2:15 - 2:30	*Break*	*Break*
2:30 - 4:00	Unit 6: Accidental Fire Causes (cont'd) Unit 7: Incendiary Fire Causes and Devices	Unit 8: Motivation of the Firesetter (cont'd) Unit 9: Vehicle Fires

TIME	DAY 5	DAY 6
8:00 - 9:00	Unit 9: Vehicle Fires (cont'd)	Unit 12: Fire Cause Determination
9:00 - 9:10	*Break*	*Break*
9:10 - 10:20	Unit 9: Vehicle Fires (cont'd)	Activity 12.1: Fire Scene Examination
10:20 - 10:30	*Break*	*Break*
10:30 - 12:00	Activity 9.1: Vehicle Fire Examination Unit 10: Fatal Fires	Final Examination
12:00 - 1:00	*Lunch Break*	*Lunch Break*
1:00 - 2:15	Activity 10.1: Fatal Fire Scene Examination	Course Wrap-up and Evaluations
2:15 - 2:30	*Break*	*Break*
2:30 - 5:00	Unit 11: Legal Aspects	Graduation

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Firefighter Code of Ethics

Background

The Fire Service is a noble calling, one which is founded on mutual respect and trust between firefighters and the citizens they serve. To ensure the continuing integrity of the Fire Service, the highest standards of ethical conduct must be maintained at all times.

Developed in response to the publication of the Fire Service Reputation Management White Paper, the purpose of this National Firefighter Code of Ethics is to establish criteria that encourages fire service personnel to promote a culture of ethical integrity and high standards of professionalism in our field. The broad scope of this recommended Code of Ethics is intended to mitigate and negate situations that may result in embarrassment and waning of public support for what has historically been a highly respected profession.

Ethics comes from the Greek word ethos, meaning character. Character is not necessarily defined by how a person behaves when conditions are optimal and life is good. It is easy to take the high road when the path is paved and obstacles are few or non-existent. Character is also defined by decisions made under pressure, when no one is looking, when the road contains land mines, and the way is obscured. As members of the Fire Service, we share a responsibility to project an ethical character of professionalism, integrity, compassion, loyalty and honesty in all that we do, all of the time.

We need to accept this ethics challenge and be truly willing to maintain a culture that is consistent with the expectations outlined in this document. By doing so, we can create a legacy that validates and sustains the distinguished Fire Service institution, and at the same time ensure that we leave the Fire Service in better condition than when we arrived.

Firefighter Code of Ethics

I understand that I have the responsibility to conduct myself in a manner that reflects proper ethical behavior and integrity. In so doing, I will help foster a continuing positive public perception of the fire service. Therefore, I pledge the following…

- Always conduct myself, on and off duty, in a manner that reflects positively on myself, my department and the fire service in general.
- Accept responsibility for my actions and for the consequences of my actions.
- Support the concept of fairness and the value of diverse thoughts and opinions.
- Avoid situations that would adversely affect the credibility or public perception of the fire service profession.
- Be truthful and honest at all times and report instances of cheating or other dishonest acts that compromise the integrity of the fire service.
- Conduct my personal affairs in a manner that does not improperly influence the performance of my duties, or bring discredit to my organization.
- Be respectful and conscious of each member's safety and welfare.
- Recognize that I serve in a position of public trust that requires stewardship in the honest and efficient use of publicly owned resources, including uniforms, facilities, vehicles and equipment and that these are protected from misuse and theft.
- Exercise professionalism, competence, respect and loyalty in the performance of my duties and use information, confidential or otherwise, gained by virtue of my position, only to benefit those I am entrusted to serve.
- Avoid financial investments, outside employment, outside business interests or activities that conflict with or are enhanced by my official position or have the potential to create the perception of impropriety.
- Never propose or accept personal rewards, special privileges, benefits, advancement, honors or gifts that may create a conflict of interest, or the appearance thereof.
- Never engage in activities involving alcohol or other substance use or abuse that can impair my mental state or the performance of my duties and compromise safety.
- Never discriminate on the basis of race, religion, color, creed, age, marital status, national origin, ancestry, gender, sexual preference, medical condition or handicap.
- Never harass, intimidate or threaten fellow members of the service or the public and stop or report the actions of other firefighters who engage in such behaviors.
- Responsibly use social networking, electronic communications, or other media technology opportunities in a manner that does not discredit, dishonor or embarrass my organization, the fire service and the public. I also understand that failure to resolve or report inappropriate use of this media equates to condoning this behavior.

Developed by the National Society of Executive Fire Officers

A Student Guide to End-of-course Evaluations

Ten Things You Can Do to Improve the National Fire Academy

The National Fire Academy takes its course evaluations very seriously. Your comments and suggestions enable us to improve your learning experience.

Unfortunately, we often get end-of-course comments like these that are vague and, therefore, not actionable. We know you are trying to keep your answers short, but the more specific you can be, the better we can respond.

Actual quotes from student evaluations:	Examples of specific, actionable comments that would help us improve the course:
1 "Update the materials."	• The (ABC) fire video is out-of-date because of the dangerous tactics it demonstrates. The available (XYZ) video shows current practices. • The student manual references building codes that are 12 years old.
2 "We want an advanced class in (fill in the blank)."	• We would like a class that enables us to calculate energy transfer rates resulting from exposure fires. • We would like a class that provides one-on-one workplace harassment counseling practice exercises.
3 "More activities."	• An activity where students can physically measure the area of sprinkler coverage would improve understanding of the concept. • Not all students were able to fill all ICS positions in the exercises. Add more exercises so all students can participate.
4 "A longer course."	• The class should be increased by one hour per day to enable all students to participate in exercises. • The class should be increased by two days so that all group presentations can be peer evaluated and have written abstracts.
5 "Readable plans."	• The plans should be enlarged to 11 by 17 and provided with an accurate scale. • My plan set was blurry, which caused the dotted lines to be interpreted as solid lines.
6 "Better student guide organization," "manual did not coincide with slides."	• The slide sequence in Unit 4 did not align with the content in the student manual from slides 4-16 through 4-21. • The instructor added slides in Unit 4 that were not in my student manual.
7 "Dry in spots."	• The instructor/activity should have used student group activities rather than lecture to explain Maslow's Hierarchy. • Create a pre-course reading on symbiotic personal relationships rather than trying to lecture on them in class.
8 "More visual aids."	• The text description of V-patterns did not provide three-dimensional views. More photographs or drawings would help me imagine the pattern. • There was a video clip on NBC News (date) that summarized the topic very well.
9 "Re-evaluate pre-course assignments."	• The pre-course assignments were not discussed or referenced in class. Either connect them to the course content or delete them. • The pre-course assignments on ICS could be reduced to a one-page job aid rather than a 25-page reading.
10 "A better understanding of NIMS."	• The instructor did not explain the connection between NIMS and ICS. • The student manual needs an illustrated guide to NIMS.

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UNIT 1:
FIRE OFFICER OBSERVATIONS

TERMINAL OBJECTIVE

The students will be able to observe and properly record critical information gathered during all phases of fire ground observations.

ENABLING OBJECTIVES

The students will be able to:

1. *Identify critical observations made en route to the fire and explain their importance.*
2. *Identify critical observations made during the size-up of the fire and explain their importance.*
3. *Identify critical observations made during fire suppression and explain their importance.*
4. *Identify critical observations made during and after the overhaul phase of the fire and explain their importance.*

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KNOWLEDGE CHECK

Answer the following to the best of your ability. This check is to help identify your entry level of knowledge. It will not count toward course completion.

1. What is the best time for a company officer (CO) and firefighters to make observations that could help later in determining fire origin and cause?

   _____

   _____

   _____

2. List six very specific pieces of information about the fire scene a CO and firefighters should try to obtain as part of their contribution to making a proper fire origin and cause determination.

   _____ _____

   _____ _____

   _____ _____

3. List three specific building construction characteristics or features a CO and firefighters might look for to help establish fire spread.

   _____

   _____

   _____

4. The **fire triangle** consists of **fuel**, **sufficient heat** to vaporize and ignite the fuel, and **oxygen**. The **fire tetrahedron** consists of the same three items plus

   _____

5. Flashover is _____

   _____

   _____

   _____

6. Name the four stages of a fire. _____

_____

7. Name four to six items or events that could endanger the CO and firefighters during overhaul and origin and cause determination.

_____ _____

_____ _____

_____ _____

8. List some of the steps a fire officer should take before letting a person who has a legitimate right to do so re-enter the structure after fire suppression.

_____

_____

_____

_____

_____

_____

9. The proper way to conduct an origin and cause determination is to proceed

   a. from the inside to the outside and from the least burned parts to the most burned parts.
   b. from the outside to the inside and from the least burned parts to the most burned parts.
   c. from the inside to the outside and from the most burned parts to the least burned parts.
   d. from the outside to the inside and from the most burned parts to the least burned parts.

10. Name at least five **nonstructural** building components or elements that can help the fire officer and firefighters in making an origin and cause determination.

_____ _____

_____ _____

_____ _____

11. Name some common causes of accidental fires.

_____ _____

_____ _____

_____ _____

12. List some common incendiary devices.

_____ _____

_____ _____

_____ _____

13. List six basic motives or reasons for firesetting.

_____ _____

_____ _____

_____ _____

14. Should an officer and firefighters proceed any differently during origin and cause determination at a fatal fire than at a nonfatal fire? Why or why not?

_____

_____

_____

_____

_____

_____

15. If an officer or firefighter were called to testify in court on a suspected arson fire, what are a few of the preparatory steps that person should take?

_____

_____

_____

_____

_____

16. What do you most expect to get out of this course?

_____

_____

_____

_____

_____

UNIT 1: FIRE OFFICER OBSERVATIONS

Slide 1-1

ENABLING OBJECTIVES

- Identify critical observations made en route to the fire and explain their importance.
- Identify critical observations made during the size-up of the fire and explain their importance.

Slide 1-2

ENABLING OBJECTIVES (cont'd)

- Identify critical observations made during fire suppression and explain their importance.
- Identify critical observations made during and after the overhaul phase of the fire and explain their importance.

Slide 1-3

RESPONSIBILITIES

- The responsibilities of the fire officer begin when units are dispatched.
- Responsibility is defined as:
  – Making a determination as to the cause of all fires.
  – Recognizing and documenting the indicators of intentionally set fires.
  – Preserving and protecting all potential items of evidence until investigators arrive.
  – Notifying investigators when circumstances warrant it.

Slide 1-4

I. RESPONSIBILITIES

A. Fire cause determination responsibilities of fire service personnel begin when units are initially dispatched to the scene.

1. The origin and cause of all fires must be accurately and properly determined to not only identify fires of incendiary origin but to also document unsafe equipment and materials for the purpose of fire prevention.

2. Successful fire cause determination is based on recognizing and documenting the indicators of incendiary fires, preserving and protecting evidence, and notifying investigators if there are any questions concerning the origin and cause of the fire.

RESPONSIBILITIES (cont'd)

- First responders can gain valuable information during their approach to and arrival at the scene and during and after on-scene operations.
  – First responders have the opportunity to observe the scene in its most pristine condition.
  – First responders can affect the integrity of the scene and its evidence through their actions and inactions.

Slide 1-5

B. Fire service personnel can obtain valuable information for investigators during all on-scene operations.

1. Since investigators usually arrive at the scene after the fact, first responders are often in the best position to observe things that prove valuable for investigators when attempting to reconstruct the events related to the fire.

2. The actions or inactions of first responders play a key role in the investigation and can hinder the efforts of investigators unless proper procedures are followed.

RESPONSIBILITIES (cont'd)

- First responders should:
  – Refrain from the use of excessive water or other activities that could destroy evidence.
  – Delay thorough salvage and overhaul work until the area of origin has been identified and the cause has been determined.

Slide 1-6

C. Personnel should refrain from the use of excessive water and any other activities that could destroy evidence until the origin and cause has been determined.

RESPONSIBILITIES (cont'd)

- First responders should (cont'd):
  – Perform salvage and overhaul carefully and not move or disturb more debris than is necessary.
  – Write down observations as soon as possible after the incident using the "Quick Reference Card" and the "Fire Incident Response Data Sheet" as guides for what observations to record.

Slide 1-7

D. It is important that first responders exercise extreme care when performing salvage or overhaul to avoid disturbing or destroying potential evidence. All observations should be recorded as soon as possible using a standard guideline.

RESPONSIBILITIES (cont'd)

- First responders should (cont'd):
  - Establish one point of ingress and egress.
  - Log personnel in and out.
  - Establish a perimeter outside the scene and keep civilians out.

Slide 1-8

E. First responders should perform the following tasks at all incidents:

1. Establish a **single** point of entry and exit to control access.

2. Keep and maintain a log of **all** persons who enter and leave the controlled area.

3. Establish and maintain a secure perimeter around the entire scene to prevent unauthorized access and contamination of evidence.

RESPONSIBILITIES (cont'd)

- First responders should (cont'd):
  - Cordon off deceased victims and their belongings for later processing by investigators.
  - Avoid any activities that may unnecessarily disturb or contaminate the scene.

Slide 1-9

F. At fatal fire scenes, personnel should cordon off the area to prevent persons and activities from disturbing the body and destroying or contaminating possible evidence until investigators arrive to process the scene.

RESPONSIBILITIES (cont'd)

- First responders should (cont'd):
  – Know your department policy and chain of command.
  – Report your observations and actions to the officer in charge (OIC)/incident commander (IC) or investigators.

Slide 1-10

G. First responders should be thoroughly familiar with their department policy and chain of command with respect to fire cause determination and comply with it at all times. First responders should report all information they have about the circumstances surrounding the incident to the officer in charge (OIC)/incident commander (IC) or investigators as soon as practical.

OBSERVATIONS RESPONDING AND ARRIVING AT THE SCENE

- Dispatch and response.
  – Note the time of day.
  – Note the weather conditions.
  – Note any obstructions.
  – Multiple emergency calls received at the same time.
  – People leaving the scene.
  – Vehicles leaving the scene.

Slide 1-11

II. OBSERVATIONS RESPONDING AND ARRIVING

A. Information that may be unusual or unlikely, or observations of persons leaving the scene.

1. Dispatch information.

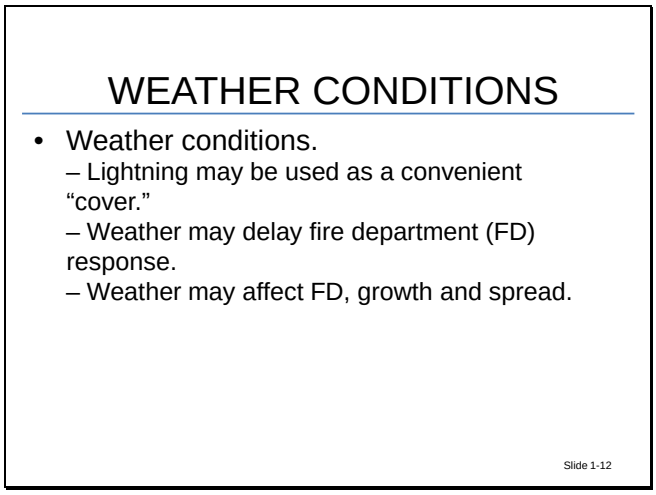
   a. Who reported the fire?

   b. When was it reported?

c. Were there any unusual background noises?

d. Was the address the exact location of the fire?

e. Did the caller appear calm or excited?



2. Weather conditions.

a. Temperature, humidity.

b. Wind direction and speed.

c. Precipitation.

- Rain, freezing rain, sleet.
- Snow.
- Fog.

OBSERVATIONS UPON ARRIVAL

- Who called in the alarm?
  - What information did they provide?
  - Was it very specific?
  - Did it include information that was overly detailed?
  - Would the average person know that type of information?

Slide 1-13

3. Time of day and day of week.

   a. Was the timing arranged to slow the response?

   b. Limited availability of resources (10 a.m. versus 8 p.m.)?

   c. Protection afforded under cover of darkness?

OBSERVATIONS UPON ARRIVAL (cont'd)

- Arrival and size-up.
  - Compare the dispatcher's information with actual fire conditions.
  - Note the appearance of any vehicles and people on or leaving the scene.
  - Note any unusual conditions or circumstances.

Slide 1-14

4. Immediately upon arrival the first responder should:

   a. Compare the dispatcher's information with actual fire conditions.

   b. Note the appearance of any vehicles or people on or leaving the scene.

   c. Note any other unusual conditions or circumstances.

OBSERVATIONS UPON ARRIVAL (cont'd)

- Fire characteristics and behavior.
  - Unusual color and volume of smoke and flames.
  - Flame height.
  - Multiple locations.
  - Unusual sounds.
  - Odors.

Slide 1-15

5. Smoke.
   a. Distantly visible?
   b. Unusual color?
   c. Rate of rising?
   d. Density?
6. Flames.
   a. Height?
   b. Unusual color?
   c. Intensity (major involvement)?

OBSERVATIONS UPON ARRIVAL (cont'd)

- Delayed response to scene.
  - False alarm called in.
  - Small fires (e.g., trash).
  - Man-made barriers.
  - Hydrants tampered with and/or disabled fire detection and/or suppression systems.

Slide 1-16

7. Response route delays.

   a. Train at grade crossing.

   b. Drawbridge open.

   c. Tree down.

   d. Construction.

OBSERVATIONS UPON ARRIVAL (cont'd)

- Crowd scan.
  – "Familiar faces."
  – Individuals who look away as you approach.
  – Individuals who are "a little too eager" to help.
  – Individuals who are hindering firefighting activities.
  – Individuals taking pictures or videotaping or asking a lot of questions.

Slide 1-17

8. Bystanders (crowd).

   a. Individuals present who had been observed at other fires?

   b. Individuals who look away or act strangely when approached?

   c. Individuals overly anxious to assist with fire suppression?

   d. Individuals hindering firefighting activities?

   e. Individuals taking pictures or videotaping fire department activities or asking a lot of questions?

OBSERVATIONS UPON ARRIVAL (cont'd)

- Owner's/Victim's demeanor and behavior.
  - Unusually calm.
  - Inappropriately dressed for the time of day or season.
  - Account of events appears "rehearsed."
  - Appears evasive in response to questions.

Slide 1-18

B. Owner's/Victim's demeanor and behavior.

1. Is their dress normal for the time of day?
2. Did family members seem to have special items with them?
   a. Toys, pets.
   b. Fur coats, jewelry.
   c. Insurance policy and other important papers.
3. Was behavior normal?
   a. Excessive calmness may result from shock or from a planned event.
   b. Excitement or incoherence can indicate apprehension.
   c. Did they proceed immediately to the area of origin?
   d. Not answering or avoiding questions.
4. Were there signs of a narrow escape or an attempt to fight the fire?
   a. Burns or singed hair?
   b. Soot around the nose or mouth?
   c. Carbon stains on clothing?
5. Did they try to help by telling where the fire was located?

a. Does their account of the events make sense?

b. Do their stories sound rehearsed?

OBSERVATIONS UPON ARRIVAL (cont'd)

- Are there any items that appear out of place or "don't belong"?
  - Ignitable liquid containers.
  - Matches.
  - Lighters.
  - Chemicals.

Slide 1-19

6. Are there any items that appear out of place or don't belong in the area such as ignitable liquid containers, chemicals, matches, lighters, etc.?

OBSERVATIONS UPON ARRIVAL (cont'd)

- Areas of collapse.
- Fire venting points.
- Smoke stained areas.
- Entrance and exit points.
- Contents that are out of place or unusual for the area/building.

Slide 1-20

7. Does the building contain any areas that show signs of collapse, fire venting points, areas of significant damage, etc.?

OBSERVATIONS UPON ARRIVAL (cont'd)

- Building contents.
  – Appropriate for the location?
  – Missing contents.
  – "For Sale" signs.
  – Structure in disrepair.

Slide 1-21

8. Is the property for sale?

   a. How long has it been for sale?

   b. Is the building a residential structure in an area zoned for commercial?

   c. Would the property be worth more without the structure?

   d. Is the property in disrepair or has it been condemned?

   e. Is the property located in an area where people are not normally out and about at the time of the fire?

      - Warehouse area?

      - Industrial park?

      - Waterfront or riverfront?

      - Depressed area?

OBSERVATIONS UPON ARRIVAL (cont'd)

- Actions taken to help spread the fire.
  - Doors/Windows propped open.
  - Holes in floors.
  - Holes in walls.
  - Trailers.

Slide 1-22

9. Location of fire.
   a. Was fire found where it was expected?
   b. Anything unusual about the location?
   c. Evidence of unusual fire travel?
   d. Evidence of trailers?
   e. Holes in floors or walls?
   f. Any evidence of separate fires?
10. Windows or doors intentionally covered to hide fire?
    a. Shades completely drawn at 10 a.m. may be unusual.
    b. Doors boarded up or covered to block view from the outside?
11. Means of egress blocked or locked?

    Occupants who just escaped may not have locked a door behind them.
12. Any fire detection or suppression equipment present?
    a. Smoke/heat detection equipment functional and working?
    b. Suppression equipment functional and working?
    c. Any evidence of tampering with the equipment?

OBSERVATIONS UPON ARRIVAL (cont'd)

- Vehicles leaving the scene.
  - Most people remain to watch a fire.
  - Note description of vehicle and driver.
  - Tag number.
  - Direction of travel.

Slide 1-23

13. Vehicles or pedestrians leaving the scene.

    a. People are curious about fires and usually go **toward** the scene.

    b. Unusual vehicular aspects: lights off, running a stop sign, occupants crouching down in the car, etc.

OBSERVATIONS UPON ARRIVAL (cont'd)

- Previous fires.
  - Prior responses to same location.
  - Types of fires and causes.
  - Consider time frame of previous fires compared to time of current incident.

Slide 1-24

14. Is there any evidence of prior fire department or police department responses to the location? If so, when was the last time someone responded and for what purpose?

    a. Is the area prone to a great deal of fire or criminal activity?

    b. Did the fire occur around the same time as previous fires in the same area or surrounding area?

OBSERVATIONS UPON ARRIVAL (cont'd)

- Signs of forced entry.
  – Look for evidence of any prior entry around doors and windows.
  – Note specific location within the building.
  – If forced entry made by FD personnel, document names and provide to fire investigator.

Slide 1-25

III. OBSERVATIONS DURING SIZE-UP

A. Entry.

1. Forcible entry necessary?
2. Any signs of forced entry prior to arrival?
3. Who performed entry operations?

OBSERVATIONS UPON ARRIVAL (cont'd)

- Condition of the doors.

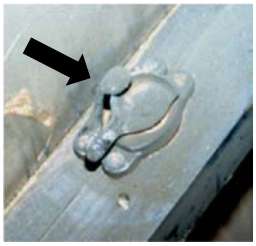
Slide 1-26

B. Condition of doors and windows.

1. Normal for doors to be unlocked or open?

OBSERVATIONS UPON ARRIVAL (cont'd)

- Condition of the windows.



Locked position

Unlocked position

Slide 1-27

2. How many doors and windows did they force open?

OBSERVATIONS UPON ARRIVAL (cont'd)

- Burglar/Fire alarms.
  - Are any alarms sounding?
  - Are the alarms local or monitored by central station?
  - Evidence of tampering with fire/burglar alarm systems?
  - History of prior alarms or recent fire/burglar alarm activations?

Slide 1-28

3. Any intrusion alarms activated during entry?
4. Any guard animals present?
5. Other security devices in use?

OBSERVATIONS DURING FIRE SUPPRESSION

- Fire suppression.
  – Can affect the patterns and evidence left behind for fire investigators.
  – Excessive suppression can destroy potential evidence.

Slide 1-29

IV. OBSERVATIONS DURING SUPPRESSION ACTIVITIES

A. Unnecessary fire suppression activities can adversely affect the indicators that are often used to determine the fire's origin and cause and can destroy valuable evidence.

B. Other observations.

Structure.

1. Building features that may have allowed fire or smoke to spread.

   a. Open stairways.

   b. Vents (clothes dryer, kitchen, bathroom).

   c. Pipe or electrical shafts.

   d. Heat ducts.

   e. Laundry chutes.

2. Abnormalities that may have caused fire spread.

OBSERVATIONS DURING FIRE SUPPRESSION (cont'd)

- Fire suppression (cont'd).
  – Observe behavior of fire and how it reacts when water is applied.
  – Note the presence of incendiary devices trailers, and accelerants.
  – Note the condition of the fire alarm or suppression systems.

Slide 1-30

C. Structure and location of fire.

1. Type of structure on fire?

2. Does fire spread seem normal for this type of building?

   a. Vertical fire spread in a fire-resistive building is usually slow.

   b. Vertical fire spread on dry wooden porches is usually fast.

   c. Is this fire very different from others observed before for this type of structure?

3. On what level/floor is the fire?

4. Had the fire been burning for a long period of time or spread to other areas before firefighters arrived?

5. Was there a delayed alarm?

6. Are structural members weakened or have they collapsed?

7. Are there any signs of occupant attempts to escape?

   a. Ladders placed against building.

   b. Escape ladders hanging from the windows.

   c. Broken windows.

   d. Ropes or bed sheets tied together.

8. Are there exposures involved?

   a. Which side of the structure?

   b. Proximity to fire?

OBSERVATIONS DURING FIRE SUPPRESSION (cont'd)

- Fire suppression (cont'd).
  – Note whether obstacles were present to hinder fire suppression efforts.
  – Note anything unusual about the contents of the building.
  – Note charring in unusual places.

Slide 1-31

D. Signs of burglary.

   1. Rifled drawers.

   2. Opened or overturned files.

   3. Papers or files strewn about.

   4. Broken furniture.

   5. Forced entry into closets.

   6. Pictures removed from walls?

   7. Clothes removed from closets and dressers?

   8. Anything unusual placed on the beds?

      a. Clothing of a spouse, lover.

      b. Treasured items of spouse or someone else (photos, records, tapes or videos, collectibles, etc.).

E. Difficulty of extinguishment.

   1. Did the fire darken when water was applied?

2. Did the amount of water normally used for similar fires extinguish the fire?

3. Any unusual reactions when water was applied?

4. Did fire rekindle as soon as the water application ended?

F. Unusual signs of fire activity.

1. Any unusual burn patterns?

   a. Running type.

   b. Holes burned downward.

   c. Narrow or tapered "V" patterns.

2. Any unusual odors?

3. Any significant ceiling or floor damage?

   a. Does it correspond with fire damage below?

   b. Consistent with the fuel load in the area?

OBSERVATIONS DURING FIRE SUPPRESSION (cont'd)

- Scene examination.
  – Consider location and extent of the fire.
  – Note whether circuit breakers were tripped.
  – Note the identity and location of any people found in the building.

Slide 1-33

4. Utilities.

   a. Electrical panel.

      - Fuses or breakers.
      - Condition of protection.
      - Signs of tampering?

   b. Gas service: on or off?

      - Natural gas.
      - Propane or butane.
      - Did the fire department turn it off?

   c. Electrical equipment in the area of fire origin.

      - Signs of malfunction or overheating?
      - Cause or a "victim" of the fire?

OBSERVATIONS DURING FIRE SUPPRESSION (cont'd)

- Fire patterns.
  – May be valuable to identify potential ignition sources such as appliances or incendiary devices.
  – Many of these patterns are difficult to observe especially after flashover has occurred.

Slide 1-34

G. Fire patterns can be very helpful in attempting to identify the fire's origin and cause; however, their usefulness can significantly diminish after flashover.

OBSERVATIONS DURING FIRE SUPPRESSION (cont'd)

- Fire patterns (cont'd).
  – These patterns may include thermal effects on materials such as charring, oxidation, smoke and soot deposits, color changes, and melting.

Slide 1-35

1. Fire patterns consist of thermal effects on materials such as charring, oxidation, smoke and soot deposits, color changes, and melting.

OBSERVATIONS DURING FIRE SUPPRESSION (cont'd)

- Artifacts.
  – Can be the remains of the material first ignited, the ignition source, or other items related to fire ignition, development and spread.

Slide 1-36

2. Artifacts can include the initial materials ignited, ignition sources, or other items related to fire ignition, development and spread.

3. Furniture or equipment moved or placed conveniently for a fire?

   a. Piled up or pulled close together?

   b. Drawers opened?

4. Evidence of items that may have caused fire or spread fire?

   a. Items missing or moved that should be present (covers over electrical outlets, switches, etc.).

   b. Doors braced in an open position.

   c. Windows open on a cold day.

OBSERVATIONS DURING FIRE SUPPRESSION (cont'd)

- Overhaul.
  – Evidence located during overhaul should be left where it is found and undisturbed until the investigator examines it.
  – Avoid discarding materials until the origin and specific fire cause is known.

Slide 1-37

H. Any evidence located during overhaul should be left where it is found and protected until investigators can arrive and properly examine and collect it. Nothing should be discarded until the fire origin and cause has been determined.

OBSERVATIONS DURING FIRE SUPPRESSION (cont'd)

- Overhaul (cont'd).
  – Watch for evidence that was shielded from the fire and is lying beneath burned debris.
  – These items should be documented and protected for fire investigators.

Slide 1-38

I. Any items that are located under fire debris that were not initially visible should be preserved until they can be properly examined and documented by investigators.

OBSERVATIONS DURING FIRE SUPPRESSION (cont'd)

- Injuries and fatalities.
  – Document location and position of any victims.
  – Clothing removed from any victim should be preserved as evidence.
  – Document what may be lying under the victim's body after it is moved or removed.

Slide 1-39

J. Any victims who are injured or deceased need to be properly protected and documented, including any clothing and/or personal belongings found on or near them, until investigators arrive on scene.

OBSERVATIONS DURING AND AFTER THE FIRE

- Individuals, including the demeanor, dress, location, injuries and behavior of:
  - Victims.
  - Occupants.
  - Witnesses.
  - Bystanders.

Slide 1-40

V. OBSERVATIONS DURING AND AFTER THE FIRE

A. The demeanor, dress and behavior of all victims, occupants, witnesses and bystanders need to be observed and documented for investigators.

1. Eager to enter the structure after the fire is declared under control?

2. Pointing or steering investigators away from suspected room/area of origin?

3. Inappropriately dressed for the time of day/time of year?

4. Conflicting statements about how, where or when the fire started?

OBSERVATIONS DURING AND AFTER THE FIRE (cont'd)

- Video surveillance and security cameras.
  - Document existence and location of any video surveillance cameras.
  - Information obtained from these systems can be very helpful to investigators.

Slide 1-41

B. Video surveillance and security cameras are increasingly playing a key role in many cases.

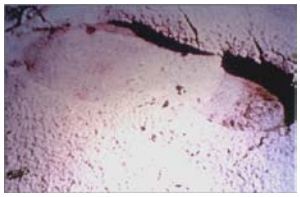
1. The presence of these systems needs to be documented.

2. They can capture prefire activities, as well as activities during and after the fire that can help in the process of determining the fire's cause.

3. Can aid in identifying potential suspects.

OBSERVATIONS DURING AND AFTER THE FIRE (cont'd)

- Shoe prints.
- Tire impressions.



Protect this evidence from destruction by personnel or vehicles working in the area.

Slide 1-42

C. Personnel also need to be mindful of physical evidence such as shoe prints or tire impressions that may be present at the scene that can be easily destroyed unless proper precautions are taken to recognize and preserve them.

OBSERVATIONS DURING AND AFTER THE FIRE (cont'd)

- Exterior burn patterns.

Slide 1-43

D. Any visible exterior burn patterns on the structure should be noted since in many cases they can narrow down the general area of origin within a building (unless the building has sustained significant fire damage).

OBSERVATIONS DURING AND AFTER THE FIRE (cont'd)

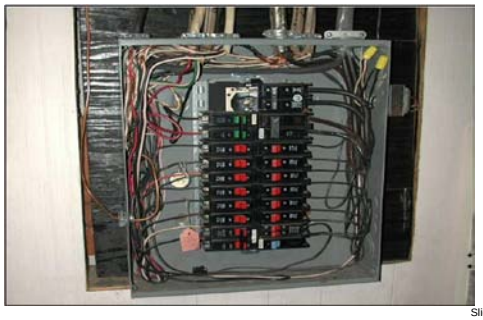
- Interior burn patterns.

Slide 1-44

E. Any interior burn patterns should be noted since in many cases they can narrow down the room of origin; however, as previously indicated, these patterns become less useful if flashover has occurred.

OBSERVATIONS DURING AND AFTER THE FIRE (cont'd)

- Utilities.



Slide 1-45

F. All components of the electrical system, especially the load center, should be checked to see if any circuit breakers were tripped or fuses were blown.

1. Prior to examining any electrical components, testing should be done to ensure that the power is off and all circuits are de-energized.

2. The position of any circuit breakers/fuses as well as any signs of electrical activity related to the cause of the fire should be carefully documented with photographs.

OBSERVATIONS DURING AND AFTER THE FIRE (cont'd)

- First responders should remember to:
  - Treat all scenes as potential crime scenes.
  - Stay mentally alert at all times and be good witnesses.
  - Note and document any unusual circumstances.
  - Notify investigators if there is **any** doubt as to the fire's origin and cause.
  - Point out potential witnesses to investigators.

Slide 1-46

G. All fire scenes should be treated as potential crime scenes until proven otherwise.

1. Personnel should note and document all unusual circumstances and provide the information to investigators as soon as possible.

2. Investigators should be notified if there is any question about the fire's origin and cause.

3. Personnel should point out any potential witnesses to the investigators when they arrive on scene.

ACTIVITY 1.1
Observations of First-Arriving Company Officer

Slide 1-47

OBSERVATION ONE

Slide 1-48

OBSERVATION TWO

Slide 1-49

OBSERVATION THREE

Slide 1-50

OBSERVATION FOUR

Slide 1-51

OBSERVATION FIVE

Slide 1-52

ACTIVITY 1.1

Observations of First-Arriving Company Officer

Purpose

To reinforce your observation skills.

Directions

1. You should make observations that focus on at least the following bits of information:
   a. The type of construction.
   b. The location and intensity of the fire.
   c. The color and size of the flame and smoke.
   d. The exposures affected.
2. The observations should be those seen through the eyes of the first-arriving company officer (CO). Keep the answers focused on this perspective.

Slide 1-48 (Observation One: Two-story dwelling)

You are the first-arriving CO. What do you observe?

_____

_____

_____

_____

Slide 1-49 (Observation Two: Interior view of a dwelling; bedroom fire)

_____

_____

_____

_____

Slide 1-50 (Observation Three: Interior view of a dwelling; living room fire)

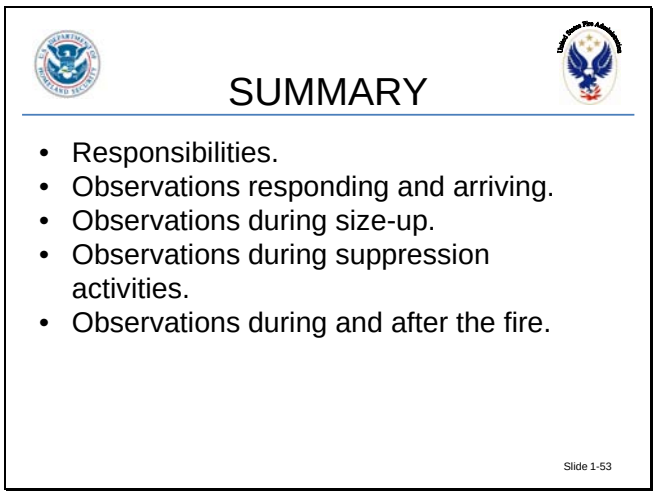
You are the fire suppression officer. What do you observe?

Slide 1-51 (Observation Four: Inside a dwelling; kitchen fire)

You are the first-arriving officer at a fire in a home under renovation, and you are the officer on the fire suppression line. What do you observe?

Slide 1-52 (Observation Five: Inside a dwelling; dining area/kitchen fire)

You are the first-arriving fire officer at a reported dwelling fire. What do you observe?


SUMMARY
• Responsibilities.
• Observations responding and arriving.
• Observations during size-up.
• Observations during suppression activities.
• Observations during and after the fire.
Slide 1-53

VI. SUMMARY

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APPENDIX A

QUICK REFERENCE CARD

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The First Responder's Role in Fire Investigation Quick Reference Card

OBSERVE

Fire characteristics and behavior:

- Color of smoke and flames
- Velocity of smoke
- Light push or heavy push
- Height and level of flames
- Any odors
- Fire behavior

Individuals, including the demeanor, dress, location, injuries, smells, behavior and statements of:

- Victims
- Witnesses
- Crowd members
- People leaving the scene

Response:

- Whether burglar and smoke alarms were sounding
- Fire attack pattern
- Suppression tactics
- Overhaul actions
- Moving furniture and contents
- Changing the position of any items

Entry and exit points:

- Condition of doors and windows upon arrival
- Were doors closed/open? Locked/ Unlocked?
- Whether or not door had to be forced to make entry
- Condition of utilities upon arrival
- Who or what broke windows

Strange:

- Any item, condition, or absence of an item or condition that seems unusual, out of the ordinary, unexpected, or out of place
- Poor housekeeping
- Evidence of a possible crime

PRESERVE

Suppression:

- Tactics that preserve walls, contents and patterns, including combination fog nozzles and hitting ceiling above fire instead off base of fire
- Only use as much water as necessary

Overhaul:

- Use thermal cameras to pinpoint hotspots
- Leave objects in place or as close to in place as possible
- Do not throw contents out of the room
- Do not break windows unless absolutely necessary
- Extinguish furnishings in place
- Do not remove sheetrock unless absolutely necessary
- Refrain from flooding floor with water
- Stop overhaul when reach a nonburned section
- Avoid using gasoline-powered tools

Control:

- Establish a perimeter
- Establish one point of ingress and egress and log in and out
- Limit scene access to only necessary personnel
- Keep civilians out of the fire scene
- Cordon off deceased victims

DOCUMENT

- Witness contact information
- Observations
- Written report preservation

COMMUNICATE

- To supervisor or fire investigator

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APPENDIX B

FIRE INCIDENT RESPONSE DATA SHEET

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The First Responder's Role in Fire Investigation

Fire Incident Response Data Sheet

The responses on this data sheet can be attached to your standard fire report and/or communicated verbally to the fire investigator. They will provide additional important detail for the fire investigator.

1. Incident address:

2. Date and time of incident:

3. Weather:

4. Incident Commander (IC):

5. First-In Unit Members:

6. Engineer:

7. What was the condition of doors and windows upon arrival? Was the entry door closed and/or locked? Which doors, if any, had to be forced?

8. What door was used for entry?

9. What door was used as secondary egress?

10. Were smoke or burglar alarms sounding?

11. Describe the smoke and fire conditions upon arrival.

12. How did the fire react to the application of water?

13. What, if any, smells were noted?

14. What fire suppression tactics were employed?

15. What, if any, objects were moved, and where were they moved to during suppression and overhaul?

16. What individuals were noted (victims, witnesses, crowd members), and what were their conditions? Please list any contact information taken.

17. What, if any, unusual items or conditions were noted or expected and absent?

18. What safety concerns were observed/noted during the suppression? Relay this information to the fire investigator(s) and/or command.

UNIT 2: COLLECTION AND DOCUMENTATION OF INFORMATION

TERMINAL OBJECTIVES

The students will be able to:

1. *Explain the types of information necessary to properly document a fire and file a basic Fire Incident Report.*

2. *Explain the impact that various types of building construction and fire protection systems may have on fire origin and cause determination.*

ENABLING OBJECTIVES

The students will be able to:

1. *Identify and describe the kinds of information necessary to effectively document a fire scene.*

2. *Explain the link between building construction principles and fire protection systems related to fire origin and cause determination.*

3. *Collect information to complete a basic Fire Incident Report when given information regarding a fire incident.*

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UNIT 2: COLLECTION AND DOCUMENTATION OF INFORMATION

Slide 2-1

ENABLING OBJECTIVES

- Identify and describe the kinds of information necessary to effectively document a fire scene.
- Explain the link between building construction principles and fire protection systems related to fire origin and cause determination.

Slide 2-2

ENABLING OBJECTIVES (cont'd)

- Collect information to complete a basic Fire Incident Report when given information regarding a fire incident.

Slide 2-3

IMPORTANCE OF FIRE-RELATED INFORMATION

- The fire officer is responsible for gathering and recording pertinent facts and data about all aspects of an incident to assist investigators in the investigation to determine responsibility.

Slide 2-4

I. IMPORTANCE OF FIRE-RELATED INFORMATION

A. Often the fire officer is responsible for gathering data and facts pertinent to the fire incident.

IMPORTANCE OF FIRE-RELATED INFORMATION (cont'd)

- Preparation of the official basic Fire Incident Report.
- Information prepared for other sources.
- Permanent record.

Slide 2-5

B. This information may be used for several purposes over the hours, days, months or even years following the incident.

1. Preparation of the official basic Fire Incident Report.

2. Information prepared for other sources.

   a. Media.

   b. Insurance companies.

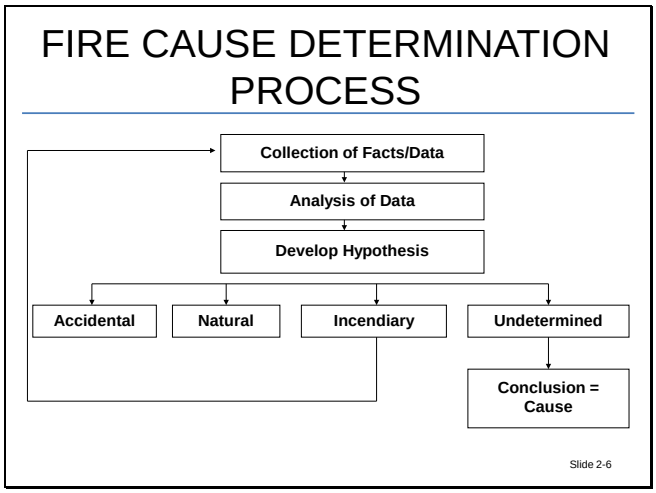
   c. Fire/Arson investigators.

3. Permanent record of the circumstances of the fire.

   a. May be used later in criminal court for an arson trial.

   b. May be used later in civil court for an insurance settlement trial.

   c. May protect the fire department if involved in a lawsuit.



C. Fire cause determination involves a systematic process based on the following basic steps:

   1. Collection of facts/data.

   2. Analysis of data.

   3. Develop hypothesis.

   This process provides the framework to accurately classify the fire as accidental, natural, incendiary or undetermined.

FORMS OF INFORMATION

- Verbal.
- Written.
- Visual.
- Electronic.

Slide 2-7

II. COLLECTION AND DOCUMENTATION OF INFORMATION

A. There are four basic sources of information:

1. Verbal.
2. Written.
3. Visual.
4. Electronic.

VERBAL

- Limited to the spoken word.
- Verbal statements during interviews.
- Telephone conversations.
- Recordings of 911 calls.
- Recordings of radio transmissions.

Slide 2-8

B. Verbal information can include witness statements, 911 recordings and radio transmission. This information can be valuable to the investigative process.

WRITTEN

- Written reports.
- Reference materials.
- Documents.

Slide 2-9

C. Written information can be obtained from reports, reference materials and various documents (i.e., previous fire and police reports, code violations, etc.).

VISUAL

- Sense of sight.
- Photographs.
- Videos.

Slide 2-10

D. Visual information is obtained from personal observations, photographs, and videotapes that may be available from bystanders, media representatives, fire officials, etc.

ELECTRONIC

- Internet — websites that contain incident-related information such as social networking sites (e.g., Facebook, Twitter).
- Organization sites such as National Institute of Standards and Technology (NIST), Consumer Product Safety Commission (CPSC), and Factory Mutual (FM) that provide fire-related research information and data.

Slide 2-11

E. Data pertinent to the incident can be researched using the Internet and efforts should be made to specifically check social networking sites (i.e., YouTube, MySpace, Facebook, Twitter, etc.) that contain incident-related information uploaded by various sources.

DATA COLLECTION

- Identification of fuel packages, ignition sources and circumstances.
- Data may need to be collected from sources away from the scene.
- Data on circumstances which brought the fuel, ignition source and oxidizer together.

Slide 2-12

F. A key part of the data collection process is the identification of the materials that burned, the ignition source, and the actions or circumstances that brought them together. This is known as the ignition sequence as outlined in National Fire Protection Association (NFPA) 921, *Guide for Fire and Explosion Investigations*.

IDENTIFY FUELS IN THE AREA OF ORIGIN

- The type, quantity and specific location of structural and content fuels.
- Construction details about the floor, ceiling and wall coverings, type of doors, type of windows, etc.
- Age of construction or materials.

Slide 2-13

G. Personnel also note specific details about the building that include age of the structure, construction type, and contents and openings (i.e., doors, windows, elevator shafts, heating, ventilating and air conditioning (HVAC), etc.).

1. What was building/area used for?

2. What type of work was performed there?

3. What was commonly stored there?

   a. Were there any special storage arrangements such as the use of flammable liquid cabinets?

   b. How was it stored?

4. Who secured the building/area?

IDENTIFY SOURCE AND FORM OF HEAT IGNITION

- Identify and document all heat-producing items in the area of origin.
- Include items that are not normally heat producing but may produce enough heat for ignition through misuse or malfunction.

Slide 2-14

H. All heat-producing items in or around the area of origin must be carefully evaluated to determine their potential role in the fire (i.e., portable heaters, curling irons, coffee makers, etc.).

1. What type of machinery was in the area/room?

2. Was the machine on or off at the time of the fire?

3. Who normally operates the machine in that area, turns it off and on?

4. Were there any sources of heat in the machinery?

IDENTIFY ITEMS AND ACTIVITIES IN THE AREA OF ORIGIN

- Recent activities in the area of origin and what heat-producing items were present.
- New or used, how or when they were used, repair history, and problems.

Slide 2-15

I. Any recent work such as minor or major construction, renovations or remodeling that may have involved the use of heat-producing equipment (i.e., welding, ironing, etc.).

COLLECTION AND DOCUMENTATION OF INFORMATION

- Facts observed about the owner/ occupant while operating at the scene.

Slide 2-16

J. Owner and/or occupant(s).

1. Name of owner of property (if company, name of firm).

2. Contact manager for names for large buildings with multiple occupants.

3. Get names of occupants in the area where the fire damage is the greatest or where the fire appears to have originated.

   a. Names of all occupants.

   b. Relationships of all occupants.

4. Get telephone numbers (home, work and cellphone numbers).

5. If occupancy is uninhabitable, note where the occupants will be staying.

   a. Name, address and phone number of host.

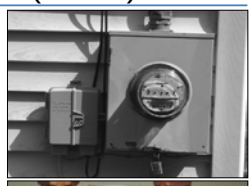
   b. Relationship to host.

   c. If fire victim(s) are unsure where they will stay, provide a number for them to phone you with the information later.

6. Have owner sign consent form to permit a fire investigation.

COLLECTION AND DOCUMENTATION OF INFORMATION (cont'd)

- Utilities.
  – Electrical, gas, telephone?
  – Status prior to the event?
  – Status during the event?
  – Any evidence of tampering, repairs or maintenance?
  – Was meter removed by utility company?



Slide 2-17

K. The status of all utility services must be evaluated and documented to determine if they were functioning properly prior to and during the fire or if they were tampered with in any way to prevent them from operating as designed.

   1. Were all utility services and equipment operating properly at the time of the fire?

   2. Had any fuses blown or circuit breakers tripped recently?

COLLECTION AND DOCUMENTATION OF INFORMATION (cont'd)

- Interviews.
  - Gather useful and **accurate** information.
  - Witnesses can provide information even if they were not eyewitnesses to the event.
  - Identify ignition sequence factors as soon as possible.

Slide 2-18

L. Information about fire origin.

1. Owner's, occupant's or calling party's opinion about the origin and cause of the fire.

   a. Listen.

   b. Do not interrupt.

   c. Do not ask technical questions.

   d. Let them answer the question completely before asking another question and take notes.

   e. Ask for explanations when needed.

2. If they have pertinent information, commit it to writing.

3. Both you and the person making the statement should sign and date it.

COLLECTION AND DOCUMENTATION OF INFORMATION (cont'd)

- Witnesses.
  - Bystanders.
  - Neighbors.
  - Contractors.
  - Utility workers.
  - Family members.
  - Delivery persons.

Slide 2-19

M. All potential witnesses must be identified and their statements recorded to help investigators reconstruct the events that led up to the fire.

1. Any information obtained by fire service personnel should be relayed to investigators immediately upon their arrival on the scene.

2. The initial information obtained from witnesses often plays a critical role in the investigation.

   a. Eyewitness(es) who may have seen or heard anything associated with the fire.

   b. Person(s) who were on scene prior to arrival.

   c. Person(s) who may have information pertinent to circumstances surrounding the fire cause.

   d. Person(s) who may have knowledge of the neighborhood (i.e., U.S. Postal Service mail carriers, UPS/FedEx delivery persons, trash collectors, etc.).

COLLECTION AND DOCUMENTATION OF INFORMATION (cont'd)

- Persons reporting/discovering fire.

Slide 2-20

N. All persons reporting and/or discovering the fire must be identified and their information recorded.

1. Who discovered the fire?

2. Where was that person physically located when the fire was discovered?

3. Did that person call 911?

4. Did that person hear any warning and/or detection equipment sounding?

5. Where were the smoke/flames first discovered?

   a. What appeared to be on fire?

   b. How tall were the flames?

   c. Was there more than one room/area on fire?

6. Who was the last person in the room or area where the fire was discovered?

7. How long had it been since someone was in the room or area?

8. Did anyone see how the fire spread?

   a. Where did it spread?

   b. Did anyone see any windows/doors open prior to the fire?

9. Did anyone leave windows/doors open?

10. Obtain complete address of fire building and occupancy (i.e., full street address, apartment number, etc.).

COLLECTION AND DOCUMENTATION OF INFORMATION (cont'd)

- Changes in the daily routine of the occupants.
- Description of the building.
- Conversations.

Slide 2-21

O. What was done differently on the day of the incident?

1. Many accidental fires will be explained by the events prior to the fire.

2. Determine if the owner or occupant did anything different (i.e., ironed in the evening instead of the morning).

COLLECTION AND DOCUMENTATION OF INFORMATION (cont'd)

- Injuries to owner or occupants.

Slide 2-22

P. Injuries to owner or occupants.

1. Ask if there were injuries.
2. Obtain name(s), age(s) and relationships of injured.
3. Determine treatment the injured received.
   a. On scene, by other than fire or emergency medical services (EMS) personnel.
   b. Name and address of person providing treatment.
   c. Fire or EMS treatment at scene.
   d. Medical facility and name of the doctor.
4. Find out current location of injured persons.
5. Note any evidence of injury or exposure to fire or products of combustion.
   a. Burns, singed hair, eyebrows, etc.
   b. Smoke stains around nose and/or mouth.
   c. Cuts, bleeding, bruises.
   d. Fresh bandages.

COLLECTION AND DOCUMENTATION OF INFORMATION (cont'd)

- Type of building.

Slide 2-23

Q. The type of building can provide valuable information regarding potential flammable or combustible materials that may have played a role in the fire.

1. What was building/area used for?

2. What was commonly stored there?

3. Were there any special storage arrangements required, such as the use of flammable liquid cabinets?

4. How was it stored?

COLLECTION AND DOCUMENTATION OF INFORMATION (cont'd)

- The type of occupancy and use of the structure (e.g., a residential occupancy being used as a business).
- Conditions of the structure (e.g., lights turned on; fire through the roof; walls standing; open, closed, or broken windows and doors).
- Conditions surrounding the scene (e.g., blocked driveways, debris, damage to other structures).

Slide 2-24

R. There may be several conditions that aid in fire growth and spread throughout a building that must be considered and documented to assist investigators.

1. Type and classification of building.

2. Penetrations and voids.

3. Condition of the building prior to the fire.

COLLECTION AND DOCUMENTATION OF INFORMATION (cont'd)

- Problems before the fire.

Slide 2-25

S. There may be a number of conditions that existed prior to the fire that need to be identified to help determine their potential role in fire causation.

1. Were all equipment and building systems operating properly prior to the fire?

2. Were any incidences of malfunctions, repairs or problems noted that may have contributed to the cause of the fire?

3. Did anyone check the controls of stoves, appliances, etc., to see if they were on or still had the fuel turned on?

4. Was anyone making repairs at the time of the fire? If so, who, where and what specific work was being done?

COLLECTION AND DOCUMENTATION OF INFORMATION (cont'd)

- Equipment or item in the room/area of origin such as:
  – Portable heating equipment.
  – Welding equipment.
  – Heat guns.
  – Glue guns.
  – Roofing equipment.

Slide 2-26

T. All heat-producing items in and around the area/room of origin must be identified. These may include:

1. Portable (space) heaters.

2. Cutting or wielding equipment.

3. Heat guns to strip paint.

4. Glue guns.

5. Roofing equipment.

   a. Were they in use at the time of the fire? If not, when were they last used?

   b. Who was using them?

COLLECTION AND DOCUMENTATION OF INFORMATION (cont'd)

Get facts to reconstruct the scene.

Slide 2-27

U. The person or persons most knowledgeable about prefire conditions and the layout of the structure can provide valuable information to investigators in their efforts to reconstruct the scene.

1. Emergency services personnel need to provide investigators with any information they obtained during suppression and overhaul activities related to the origin of the fire.

2. This information can be gleaned from firsthand knowledge or information obtained from the building owner(s), occupants, bystanders or any other witness to the circumstances surrounding the fire.

CHARACTERISTICS CRITICAL TO FIRE INVESTIGATION

- Building construction type.
- Occupancy classifications.
- Structural loads.
- Fire travel predictions.
- Fire protection systems.

Slide 2-28

III. BUILDING CONSTRUCTION FEATURES AND FIRE SPREAD

A. There are several building construction features that may impact fire growth, development and spread that are critical to fire cause determination.

BUILDING CONSTRUCTION FEATURES AND FIRE SPREAD

- Understanding building construction features will help in determining fire growth and spread.
- Development, spread and control of a fire within a structure often depend on the type of construction and the ability of structural elements to remain intact.

Slide 2-29

B. Understanding building construction features will help in determining several factors.

1. Determine how heat, smoke and fire may have traveled through the structure.

2. Identify the role that voids, renovations, alterations and vertical openings in structures play in fire causation.

FIRE LOADING

- Measurement of the maximum heat that would be produced if all combustibles in the fire area were consumed.
- Varies with the type of occupancy and structural features.
- May override sprinkler capabilities and provide access problems for firefighters.

Slide 2-30

C. Fire loading refers to the maximum amount of heat that would be generated if all combustible materials are consumed.

1. Fire loading varies with occupancy type and structural features.

2. Structures with excess fire loads may override fire protection systems' capabilities and present access and life safety issues.

LARGE, OPEN SPACES

- Found in warehouses, churches, large atriums and theaters.
- Contribute to fire spread.
- Vertical ventilation is key factor in onset of flashover.

Slide 2-31

D. Large, open spaces are found in various types of buildings and can play a factor in the onset of flashover due to the impact of ventilation.

FIRE, SMOKE AND HEAT MOVEMENT

- Determined by:
  - Building construction and layout.
  - Fuel load.
  - Built-in fire protection and heating, ventilating and air conditioning (HVAC) systems.
  - Fire department ventilation efforts.
- Contributes to fire spread from floor to floor and room to room.

Slide 2-32

E. Fire, smoke and heat movement are determined by a number of factors that include:

1. Building construction and layout.
2. Fuel load.
3. Fire protection and building services systems.
4. Fire department suppression and ventilation efforts.

BUILDING CONSTRUCTION TYPES

- Fire-resistive (Type I).
- Noncombustible (Type II).
- Ordinary (Type III).
- Heavy timber (Type IV).
- Wood-frame (Type V).

Slide 2-33

F. There are five primary types (classifications) of building construction.

1. Fire-resistive (Type I).
2. Noncombustible (Type II).
3. Ordinary (Type III).

4. Heavy timber (Type IV).

5. Wood-frame (Type V).

   a. Post-and-beam.

   b. Platform.

   c. Balloon.

FIRE-RESISTIVE TYPE I CONSTRUCTION

Slide 2-34

G. Fire-resistive Type I construction.

   1. No structural steel is exposed, and all vertical openings are protected with approved doors.

FIRE-RESISTIVE TYPE I CONSTRUCTION (cont'd)

- Typically concrete and steel.
- Noncombustible structural members (walls, floor and roof).
- Members protected from fire effects by encasement or sprayed-on materials.

Slide 2-35

   2. Bearing walls may be made of steel with a fire-resistive covering applied. Structural steel often is protected by encasement, sprayed-on protection, or membrane ceilings (three-hour rating).

FIRE-RESISTIVE CONSTRUCTION ISSUES

- Contents of structure are primary fuel load.
- Penetrations in floor/ceiling assemblies.
- Spaces and/or voids between floors.
- HVAC, electrical, plumbing chases.
- Damage to protected structural members.

Slide 2-36

3. Exterior walls generally will be curtain walls and not load bearing.

   a. May be precast, lightweight concrete, aluminum, glass or other construction material.

   b. Exterior wall supports may also be made of reinforced concrete.

   c. Windows may be made of plastic or have a plastic sun shield attached.

4. Exterior or interior nonbearing walls will have a varying degree of fire resistance.

5. Stairwells are enclosed in fire-resistive materials.

6. Floors may be poured-in-place concrete, prefabricated slabs, or other material providing fire resistance.

7. Roof construction may be similar to that used for floors.

8. Fire spread via the exterior of a building is a primary concern.

   a. From window to window above.

   b. Through the gap between floors and exterior curtain walls.

   c. Air-handling equipment (HVAC) may service several floors.

9. Typically fire-resistive (high-rise) buildings are constructed with center core design.

a. This allows the outside walls to be used for offices, apartments or other revenue-producing areas.

b. In office buildings, there generally is little compartmentation, and open floor plans are common.

c. Fire, heat and smoke spread.

- Elevator shafts.
- Electrical, telephone and other communications shafts.
- Stairwells with doors blocked open.
- Mail chutes.
- Ventilation shafts.
- HVAC.
- Plumbing shafts.

NONCOMBUSTIBLE TYPE II CONSTRUCTION

Slide 2-37

H. Noncombustible Type II construction.

1. A noncombustible building in which structural steel is often exposed to the effects of fire.

a. Totally noncombustible refers only to structural materials, not to interior finish and contents.

NONCOMBUSTIBLE TYPE II CONSTRUCTION (cont'd)

- Noncombustible structural steel or concrete framework.
- Often exposed steel and concrete.
- Members unprotected or limited protection from fire effects.

Slide 2-38

b. Structural framework is steel bolted, riveted or welded together.

NONCOMBUSTIBLE TYPE II CONSTRUCTION (cont'd)

- Contains only noncombustible materials.
- No or limited fire-resistance ratings (one hour).

Slide 2-39

c. It is susceptible to expansions, distortion, or relaxation of steel members from heat, resulting in early distortion.

2. Members are unprotected or have limited protection from fire effects (no or limited fire-resistance ratings — one hour).

3. Once wall coverings are in place, it may be difficult to determine if structural elements are exposed or protected.

NONCOMBUSTIBLE CONSTRUCTION ISSUES

- Most of the same considerations as Type I.
  - Contents of structure are primary fuel load.
  - Penetrations in floor/ceiling assemblies for building services.
  - Spaces and/or voids between floors.
- Unprotected structural members.
- Possible lightweight construction.

Slide 2-40

4. The floor and roof support systems often will be lightweight bar joists, trusses or other lightweight steel.

5. Structure may be multiple-story with fire spread behavior similar to fire-resistive construction.

6. Fire, heat and smoke spread via:

   a. Elevator shafts.

   b. Electrical, telephone and other communications shaft.

   c. Stairwells with doors blocked open.

   d. Mail chutes.

   e. Ventilation and plumbing shafts and HVAC systems.

ORDINARY TYPE III CONSTRUCTION

Slide 2-41

ORDINARY TYPE III CONSTRUCTION (cont'd)

- Noncombustible walls, typically load-bearing concrete or brick.
- Floors, structural framework, roof are typically wood.
- Members unprotected or limited protection from fire effects.
- Often exposed concrete, brick or wood.

Slide 2-42

I. Ordinary Type III construction.

1. Generally, the building will not exceed six stories; most often it will be two or three stories (Main Street, USA).

2. The building will have masonry exterior walls (usually concrete or brick) and wooden interior structural members.

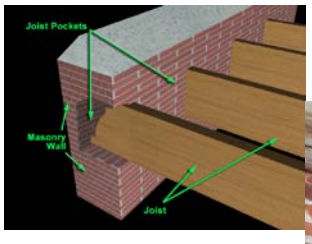
3. Features.

   a. Floor and roof supports are usually wood; other materials, such as steel bar joists, may be found.

   b. Typically, floor joists and roof rafters inserted in wall sockets are cut on an angle called a fire cut. This allows the structural member to fall out of the wall socket without toppling the entire wall.

4. Floor and roof decking most frequently will be wooden boards, tongue-and-groove boards, plywood or composition board.

ORDINARY TYPE III CONSTRUCTION (cont'd)



Slide 2-43

5. Common wall between two buildings may share wall sockets for floor joists and roof rafters.

6. Parapet walls, cornices, overhangs, loads on walls, signs and marquees, or other heavy items must be considered for the safety of those working underneath.

ORDINARY CONSTRUCTION ISSUES

- Interior structural members are fuel.
- Combustible concealed spaces between floors, ceilings and partition walls.
- Safety (integrity) of floors, walls and roof.
- Possible lightweight construction.

Slide 2-44

7. Prefire planning should indicate critical construction features.

   a. Signs of deterioration.

   b. Floor loading and fire load.

   c. Structural modifications and remodeling work.

HEAVY TIMBER TYPE IV CONSTRUCTION

Slide 2-45

J. Heavy timber (mill-type) Type IV construction.

   1. Consists of masonry (noncombustible) exterior walls and structural members of substantial timber construction.

a. Minimum dimension of structural wood supports; 8 inches for columns, beams, girders and arches.

b. All exposed wood has a minimum dimension of 2 inches.

c. Commonly found in older factories and mills.

HEAVY TIMBER TYPE IV CONSTRUCTION (cont'd)

- Sometimes referred to as "mill construction."
- Noncombustible walls, typically load-bearing concrete or brick.
- Structural members are unprotected (exposed) concrete, brick and wood with large cross-sectional areas.
- Members unprotected or limited protection from fire effects.

Slide 2-46

2. Wood floors generally will be a minimum thickness of 3 inches and may be oil soaked from years of supporting heavy machinery with lubricating oils.

3. Roof supports will be wood with a minimum dimension of 4 inches by 6 inches, and a minimum roof decking thickness of 1 1/8 inch.

HEAVY TIMBER TYPE IV CONSTRUCTION (cont'd)

- Structural members are unprotected wood with large cross-sectional areas.
- Fire resistance comes from physical sizes of construction elements.
- No specific fire-resistance ratings.
- Exterior walls noncombustible.

Slide 2-47

4. Exterior walls constructed of masonry, usually brick. As walls rise, they diminish in size since they will be carrying a lesser load.

5. Support timbers of large mass will burn a long time before being compromised by fire.

HEAVY TIMBER TYPE IV CONSTRUCTION (cont'd)

- Includes balloon-frame and platform-frame construction.
- Many modern multifamily buildings are constructed this way.
- Almost all turn-of-the-century homes fall into this category.
- These type structures are in **everybody's** area.

Slide 2-48

6. Prefire planning should indicate critical construction features.

   a. Heavy floor loads.

   b. Fire load.

   c. Capacity of stock for water absorption.

   d. Building modifications.

HEAVY TIMBER CONSTRUCTION ISSUES

- Interior structural members are fuel.
- Combustible concealed spaces between floors, ceilings and partition walls.
- Safety (integrity) of floors, walls and roof.

Slide 2-49

7. Once initial fire suppression efforts are unsuccessful, fires in this classification tend to cause significant damage.

   a. Large, open interior area.

   b. Unprotected vertical shafts.

   c. Potential for rapid fire development.

WOOD-FRAME TYPE V CONSTRUCTION

Slide 2-50

K. Wood-frame Type V construction.

1. Primary type of construction used in the United States. Walls, floors and roof structure are made of wood framing.

WOOD-FRAME TYPE V CONSTRUCTION (cont'd)

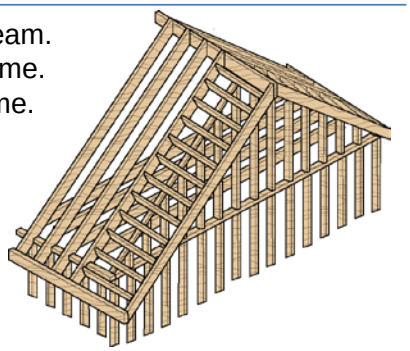
- Combustible walls typically wood.
- Floors and roofs are typically wood.
- Members unprotected or limited protection from fire effects.

Slide 2-51

2. Structural members are usually wood and are unprotected or have limited protection from fire effects.

WOOD-FRAME CONSTRUCTION

- Post-and-beam.
- Platform-frame.
- Balloon-frame.



Slide 2-52

3. Wood-frame construction can include post-and-beam, platform- and balloon-frame construction.

4. **Post-and-beam** construction has a frame of substantial dimension wood and is sided with a lightweight covering (wood boards).

   a. Commonly used for barns, sheds and storage buildings.

   b. Also may be used in dwellings and other occupancies.

PLATFORM-FRAME CONSTRUCTION

Slide 2-53

5. In **platform-frame** construction, the walls of each successive story are built on a platform formed by the preceding floor.

   a. Modern wood-frame construction.

   b. The joists for the deck may be full-dimension lumber or lightweight construction.

c. Once the floor/deck is in place, walls are placed on it with a sill at the bottom of the wall and a plate at the top.

d. Platform-frame construction provides a natural fire barrier for vertical extension within walls.

6. Openings in walls for water, plumbing, ventilation or heating/air conditioning pipes can create a void for fire extension.

7. Multifamily dwellings frequently will have extensive vertical openings and void spaces.

a. Kitchen, bath and dryer vents; plumbing, electrical and heating/air conditioning ducts.

b. Double walls for deadening sound between dwelling units.

BALLOON-FRAME CONSTRUCTION

Slide 2-54

8. In **balloon-frame** construction, studs run from the foundation to the attic.

a. Used extensively in many parts of the country until the late 1930s for residential and light commercial buildings.

BALLOON-FRAME CONSTRUCTION (cont'd)

Slide 2-55

b. Floor joists are tied into the wall allowing for fire extension in any direction.

VIEW LOOKING DOWN INTO WALL "STUD CAVITY"

Slide 2-56

9. Fire stopping is not a common practice and is rarely found.

WOOD-FRAME CONSTRUCTION ISSUES

- Extensive combustible concealed spaces.
- No fire stopping in framing members.
- Heavy fuel load.
- Safety (integrity) of floors, walls and roof.
- Possible lightweight construction.

Slide 2-57

10. Emergency services personnel must be aware of the extensive combustible concealed spaces, lack of fire stopping, heavy fuel load and potential safety issues related to the loss of structural integrity.

LIGHTWEIGHT CONSTRUCTION

Slide 2-58

L. Lightweight design can be found in many construction types.

1. Lightweight wood or metal supporting members provide a substantial clear floor area when used to support floor and/or roof assemblies. These lightweight supporting members usually consist of:

   a. Steel bar joists.

   b. Wood trusses with metal connectors.

LIGHTWEIGHT CONSTRUCTION (cont'd)

- Can be used in all types of construction but usually in Type II, Type III and Type V.
- Lightweight metal in wood trusses can fail after five to 10 minutes of fire exposure.

Slide 2-59

2. Lightweight construction can be used for all types of construction, but it is typically found in Type II, Type III and Type V construction.

LIGHTWEIGHT CONSTRUCTION (cont'd)

Slide 2-60

3. The lightweight metal that is used in wood trusses can fail after five to 10 minutes of fire exposure.

METAL CONNECTORS

Slide 2-61

4. This is another example of lightweight wood trusses common in this type of construction.

FLOOR PENETRATIONS

Slide 2-62

5. Floor penetrations and other void spaces commonly used for piping and duct work can provide a pathway for rapid fire spread throughout the structure.

DANGERS OF ENGINEERED WOOD I-BEAM FLOORS

- Used in nearly 50 percent of today's residential construction.
- Rising cost of lumber makes the wood I-beam affordable.
- Ease of installation reduces labor cost.

Slide 2-63

6. Lightweight laminated wood I-beams or I-joists are typically constructed of 3/8-inch plywood sandwiched into 2-by-3-inch top and bottom chords. This assembly typically is used for floor joist and roof rafters.

DANGERS OF ENGINEERED WOOD I-BEAM FLOORS (cont'd)

- Structural components comprised of top and bottom flanges, which may be solid or laminated wood, united with a plywood or Oriented Strand Board (OSB) web of various depths.

Slide 2-64

7. Floor-joist hangers attached to the bottom chord of parallel chord trusses may experience early failure under fire conditions.

8. Floor joist is toe-nailed into position. Entire load is being supported by three or four nails.

WOODEN I-BEAMS

Slide 2-65

9. Floor joists or roof rafters held by metal joist hangers could be subject to early collapse under fire conditions. Entire load is supported by lightweight metal bracket.

DANGERS OF ENGINEERED WOOD I-BEAM FLOORS (cont'd)

- The collapse potential of engineered wood I-beams exposed to fire presents an extreme danger to firefighters.

Slide 2-66

10. Lightweight construction is subject to early collapse when structural supports are involved.

ACTIVITY 2.1
Building Construction Impact on Fire Cause Determination

Slide 2-67

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ACTIVITY 2.1

Building Construction Impact on Fire Cause Determination

Purpose

To identify the impact and safety concerns that the various types of building construction can have on fire growth, development and spread.

Directions

1. In groups, you should identify the concerns you have for fire, heat and smoke travel in each type of construction.

2. Your group will discuss your concerns and select a representative to debrief your concerns to the class.

Fire-Resistive Type I Construction

_____

_____

_____

_____

_____

Noncombustible Type II Construction

_____

_____

_____

_____

_____

Ordinary Type III Construction

Heavy Timber Type IV Construction

Wood-Frame Type V Construction (Four Types of Structures)

1. Wood-frame, post-and-beam-type structure.

2. Wood-frame, ballon-type structure.

3. Wood-frame, platform-type structure.

4. Wood-frame, lightweight-type structure.

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IV. FIRE PROTECTION SYSTEMS

A. Personnel need to have a basic understanding of the various fire protection systems installed in residential and commercial structures and their impact on fire cause determination.

1. Automatic sprinkler systems.

2. Standpipe systems.

3. Automatic alarm and detection systems.

4. Single and multiple station detectors.

B. Automatic sprinkler systems are commonly found in many commercial buildings and are becoming more common in residential dwellings.

AUTOMATIC SPRINKLER SYSTEMS (cont'd)

- Network of pipes that deliver water through a series of nozzles which open when they are heated to their operating temperature.
- A major advantage of a sprinkler system is that it can function as both a fire detection system and a fire suppression system.

Slide 2-70

1. Automatic sprinkler systems are a network of pipes ready to deliver water through a series of regularly spaced nozzles (heads). Water is released when the sprinkler heads' fusible link is heated to a specified temperature.

2. Sprinkler systems can function as both a fire detection and a fire suppression system.

PURPOSE OF SPRINKLERS

- Detect.
- Report.
- Confine.
- Control.
- Extinguish.

Slide 2-71

C. The purpose of sprinklers is to detect, report, confine, control and extinguish fires.

WET SYSTEMS

Slide 2-72

D. There are two primary types of sprinkler systems. The first system is a wet system.

WET SYSTEMS (cont'd)

- Most common and least expensive type of automatic sprinkler system.
- Piping always filled with water; therefore, it cannot be used in areas where temperatures drop below freezing.
- As sprinkler head activates, water is immediately discharged onto the fire.

Slide 2-73

1. Wet systems are the most common and least expensive.

2. Piping contains water under pressure at all times; therefore, it cannot be used in below freezing environments.

DRY-PIPE SYSTEMS

Slide 2-74

E. The second type of sprinkler system is a dry-pipe system.

DRY-PIPE SYSTEMS (cont'd)

- Operate much like wet sprinkler systems, except that the pipes are filled with pressurized air instead of water.
- A dry-pipe valve keeps water from entering the pipes until the air pressure is released.

Slide 2-75

1. Dry-pipe systems operate similar to wet systems except that the pipes are filled with pressurized air instead of water.

2. These systems are commonly installed in unheated environments where temperatures routinely are below freezing.

PRE-ACTION SPRINKLER SYSTEMS

- Similar to a dry sprinkler system with one key difference:
  – A secondary device must be activated before water is released into the sprinkler piping.
  – When the system is filled with water, it functions as a wet sprinkler system.

Slide 2-76

F. Pre-action sprinkler systems are similar to dry systems except that a secondary device must be activated before water is released.

SPRINKLER PIPE

- Depending on building use, may be:
  – Iron.
  – Copper.
  – Plastic.
  – Combination.
- Check for evidence of damage or obstruction.

Slide 2-77

G. Sprinkler pipe may be made of iron, copper, plastic or a combination of these materials. Personnel should check for any evidence of damage, obstruction or intentional tampering that would prevent normal operation.

RESIDENTIAL SPRINKLER SYSTEMS

- Relatively new, but many homes now being built include them.
- Typically use smaller piping and sprinkler heads with smaller orifices and less water discharge.

Slide 2-78

H. Residential sprinkler systems are now commonly being required in many jurisdictions for new construction.

RESIDENTIAL SYSTEMS

Slide 2-79

DVD PRESENTATION

"Marble Mountain"

Slide 2-80

FIRE PROTECTION SYSTEMS

Slide 2-81

I. Fire protection systems play a critical role in the detection, notification and control of fire. Personnel need to understand the basic operations of the systems and their impact with respect to fire cause determination.

AUTOMATIC ALARM AND DETECTION SYSTEMS

- Intended to indicate and warn of abnormal conditions.
- Recognizes when a fire is occurring and activates the fire alarm system.
  - Alerts occupants.
  - May alert the fire department.
  - May automatically activate fire suppression systems.

Slide 2-82

J. Automatic alarm and detection systems are intended to warn of potential fire-related emergencies.

1. Alert occupants.

2. Alert fire department.

3. Automatically activate fire suppression systems.

SIX GENERAL COMPONENTS

1. Initiating devices and circuits.
2. Notification appliances.
3. Control panel.
4. Primary power.
5. Secondary power.
6. Trouble signal.

Slide 2-83

K. Fire suppression systems generally have six components:

1. Initiating devices and circuits.
2. Notification appliances.
3. Control panel.
4. Primary power.
5. Secondary power.
6. Trouble signal.

NOTIFICATION APPLIANCES

Horn

Bell

Strobe

Voice

Slide 2-84

L. Notification appliances typically consist of horns, bells, strobes and voice.

FIRE ALARM CONTROL PANEL

- Fire Alarm Control Unit.
- Specific power requirements including backup power.
- May be connected to monitoring service.

Slide 2-85

M. A fire alarm control panel may be connected to a monitoring service which can provide information helpful in establishing a timeline related to the fire. These units should be inspected to ensure they were operating properly at the time of the fire.

PURPOSE OF SMOKE AND HEAT DETECTORS

- Detect.
- Warn.
- Notify.
  – Did the devices activate as intended? If not, why not?

Slide 2-86

N. Smoke and heat detectors are designed to detect, warn and notify occupants and/or the fire department in the event of a fire-related emergency. Personnel need to check to see if these devices activated as intended. If not, why not?

SMOKE DETECTORS

- Ionization.
  – Generally more responsive to flaming fires.
  – Small amount of radioactive material between two electrically charged plates which ionizes the air and causes current to flow. Disrupted when smoke enters chamber.

Slide 2-87

O. There are two basic types of smoke detectors. The first one is ionization. Ionization detectors operate using a small amount of radioactive material and a sensing chamber.

SMOKE DETECTORS (cont'd)

- Photoelectric.
  – Generally more responsive to fires that begin with a long period of smoldering.
  – Aims a light source into a sensing chamber away from a sensor. Light is reflected onto the sensor when smoke enters the chamber.

Slide 2-88

P. The second one is photoelectric. Photoelectric detectors operate using a light source and a sensing chamber.

HEAT DETECTORS

- Generally used in situations where smoke detectors cannot be used.
- Often installed in unheated areas.
- Generally very reliable and less prone to false alarms than smoke detectors.

Slide 2-89

Q. Heat detectors are less prone to false alarms and are used in cases where smoke detectors cannot be used (i.e., often installed in unheated areas).

DOCUMENTATION

- Did it perform as designed? Why or Why not?
- Proper installation?
- Evidence of alteration or tampering?
- Changes in nature of contents or occupancy?
- Sources of technical assistance — **Designer, Installer, Code Official.**

Slide 2-90

R. The documentation of fire protection (smoke and heat detection) systems is important to the investigation of the fire origin and cause.

1. Did these systems perform as designed? If not, why not?

2. Were the systems properly installed in accordance with applicable standards and regulations?

3. Is there any evidence of tampering?

4. Were there any recent changes in the use/occupancy of the building that warranted modification to the fire protection systems?

DOCUMENTING THE FIRE SCENE

- Every fire investigation demands that the scene be fully documented through:
  - Photographs.
  - Sketches/Diagrams.
  - Notes.
  - Reports.

Slide 2-91

S. Every fire scene investigation requires complete and thorough documentation:

1. Photographs.
2. Sketches and/or diagrams.
3. Notes.
4. Reports.

DOCUMENTING THE FIRE SCENE (cont'd)

- Documentation is a critical function for both firefighters and investigators, especially in the investigation of incendiary fires that may go to trial.
- Documentation should follow a systematic protocol.

Slide 2-92

T. Documentation is a critical function for both fire service personnel and investigators that should be done following a systematic protocol.

DOCUMENTING THE FIRE SCENE (cont'd)

- Exterior.
  - Photograph and sketch exterior.
  - Establish extent of damage.
  - Include surroundings.
  - Use aerial view to help identify potential area of origin.

Slide 2-93

U. Documentation should begin on the exterior of the structure using both photographs and a sketch that clearly shows the extent of damage and any potential items of evidence that are found.

DOCUMENTING THE FIRE SCENE (cont'd)

- Interior.
  - Photograph and record.
    - -- Fire patterns.
    - -- Fuel loads.
    - -- Detectors, alarms, sprinklers.
    - -- Dimensions of rooms and ventilation sources.

Slide 2-94

V. Once the exterior has been thoroughly documented, documentation of the interior should commence. Key elements that should be noted include:

1. Fire patterns.
2. Fuel load.
3. Suppression and detection systems.
4. Dimensions of rooms and sources of ventilation.

DOCUMENTING THE FIRE SCENE (cont'd)

- Scene examination.
  - Clearance of debris.
  - Possible sources of ignition.
  - Evidence.
    - -- Condition/Location found.
    - -- Prior to and after collection.
  - Evidence of other crimes.

Slide 2-95

W. The scene examination to uncover potential sources of ignition and evidence is done after each layer of debris in the area is carefully examined for the presence of these items. Let investigators know what you moved or damaged.

DOCUMENTING THE FIRE SCENE (cont'd)

- Photography.
  - Most of the evidence of origin and cause is established through photographic evidence.
  - From all angles.
    - -- Exterior, then interior before excavation starts.
    - -- Area/Point of origin.
    - -- Documentation of evidence.

Slide 2-96

X. The majority of evidence related to the fire's origin and cause is documented using photography. This is typically done using point-and-shoot digital cameras which can later be used to easily produce exhibits for legal proceedings as required.

DOCUMENTING THE FIRE SCENE (cont'd)

- Sketches.
  – Fire scene sketches should be considered an important supplement to photographs and depict the following:
    -- The outline and dimensions of the areas of interest (e.g., room of origin, points of entry).
    -- The locations and relative positions of pertinent evidence found.

Slide 2-97

Y. Photographs should be supplemented by sketches and diagrams which can highlight important features captured in photographs or show things that may not be readily apparent in photographs.

NATIONAL FIRE INCIDENT REPORTING SYSTEM

- U.S. Fire Administration (USFA)-sponsored program.
- State and local participation is voluntary.
- Jurisdictions need to document fire activity accurately.
- Report changes if additional information becomes available.

Slide 2-98

V. NATIONAL FIRE INCIDENT REPORTING SYSTEM

A. A U.S. Fire Administration (USFA)-sponsored program to collect, analyze and publish fire data.

1. It helps identify problem areas and trends.

2. It points out areas needing study or research.

3. It can be a basis for financial help to needy areas.

4. It can point out the need for public education activities.

B. State and local participation is voluntary.

1. Reporting procedures at the state and local levels need to be consistent.

2. The incident and casualty forms can be modified at the local and state levels to add more information.

C. Jurisdictions taking part need to properly document the fire activity they are reporting.

1. Someone at the scene needs to be responsible for completing the form.

2. It should be done as soon as possible.

3. The recorder should consult others to guarantee exactness and completeness.

4. Form to be reviewed.

a. By officer in charge (OIC) of incident.

b. By person completing form.

5. Report is filed with local department.

6. A copy is sent to the state.

D. Report changes.

1. If additional information becomes available, a change report should be made.

2. If errors are found later, a change report should be made.

E. A standard form is available to record fire data.

1. For all incidents.

2. For casualties.

3. For all fires.

4. For structure fires.

SUMMARY

- Importance of fire-related information.
- Collection and documentation of information.
- Building construction features and fire spread.
- Fire protection systems.
- National Fire Incident Reporting System (NFIRS).

Slide 2-99

VI. SUMMARY

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APPENDIX

INCIDENT REPORT

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INCIDENT REPORT

FILL IN THIS REPORT
IN YOUR OWN WORDS

_____ FIRE DEPARTMENT

NFIRS 1
1 ☐ DELETE
2 ☐ CHANGE

COMPLETE FOR ALL INCIDENTS

A	FDID	INCIDENT NO	EXP. NO	MO	DAY	DAY OF WEEK	ALARM TIME	ARRIVAL TIME	TIME IN SERVICE
B	TYPE OF SITUATION FOUND		TYPE OF ACTION TAKEN				MUTUAL AID 1 ☐ REC'D 2 ☐ GIVEN		
C	FIXED PROPERTY USE			IGNITION FACTOR					
D	CORRECT ADDRESS					ZIP CODE		CENSUS TRACT	
E	OCCUPANT NAME (LAST, FIRST, MI)					TELEPHONE		ROOM OR APT.	
F	OWNER NAME (LAST, FIRST, MI)		ADDRESS					TELEPHONE	
G	METHOD OF ALARM FROM PUBLIC			DISTRICT	SHIFT			NO. ALARMS	
H	NUMBER FIRE SERVICE PERSONNEL RESPONDED		NUMBER ENGINES RESPONDED		NUMBER AERIAL APPARATUS RESPONDED			NUMBER OTHER VEHICLES RESPONDED	

COMPLETE IF CASUALTY

I	NUMBER OF INJURIES FIRE SERVICE	OTHER	NUMBER OF FATALITIES FIRE SERVICE	OTHER

COMPLETE FOR ALL FIRES

J	COMPLEX		MOBILE PROPERTY TYPE
K	AREA OF FIRE ORIGIN		EQUIPMENT INVOLVED IN IGNITION
L	FORM OF HEAT OF IGNITION	TYPE OF MATERIAL IGNITED	FORM OF MATERIAL IGNITED
M	METHOD OF EXTINGUISHMENT	LEVEL OF FIRE ORIGIN	ESTIMATED LOSS (DOLLARS ONLY) , ,

COMPLETE IF FIRE STRUCTURE

N	NUMBER OF STORIES		CONSTRUCTION TYPE
O	EXTENT OF FLAME DAMAGE		EXTENT OF SMOKE DAMAGE
P	DETECTOR PERFORMANCE		SPRINKLER PERFORMANCE
Q	IF SMOKE SPREAD BEYOND ROOM OF ORIGIN	TYPE OF MATERIAL GENERATING MOST SMOKE	AVENUE OF SMOKE TRAVEL
R		FORM OF MATERIAL GENERATING MOST SMOKE	

S	IF MOBILE PROPERTY	YEAR	MAKE	MODEL	SERIAL NO.	LICENSE NO.
T	IF EQUIPMENT INVOLVED IN IGNITION	YEAR	MAKE	MODEL	SERIAL NO.	

☐ **CHECK IF COMMENTS ON REVERSE SIDE**

U	OFFICER IN CHARGE (NAME, POSITION, ASSIGNMENT)	DATE
	MEMBER MAKING REPORT (IF DIFFERENT FROM ABOVE)	DATE

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UNIT 3: BEHAVIOR OF FIRE

TERMINAL OBJECTIVE

The students will be able to explain the fundamental principles of combustion and the influence that the fire triangle/fire tetrahedron have on fire behavior and fire origin and cause determination.

ENABLING OBJECTIVES

The students will be able to:

1. *Identify and describe the major principles of combustion that affect the ignition, growth, development, spread and extinguishment of fire.*
2. *Explain the significance of the fire tetrahedron on fire behavior and its impact on fire causes.*
3. *Identify and describe three methods of heat transfer and their relationship to fire development.*
4. *Identify and describe the stages of fire and their importance to determining fire cause.*
5. *Differentiate between flashover and backdraft.*
6. *Distinguish among the five fire classifications.*
7. *Identify and describe the three phases of burning.*

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UNIT 3:
BEHAVIOR OF FIRE

Slide 3-1

ENABLING OBJECTIVES

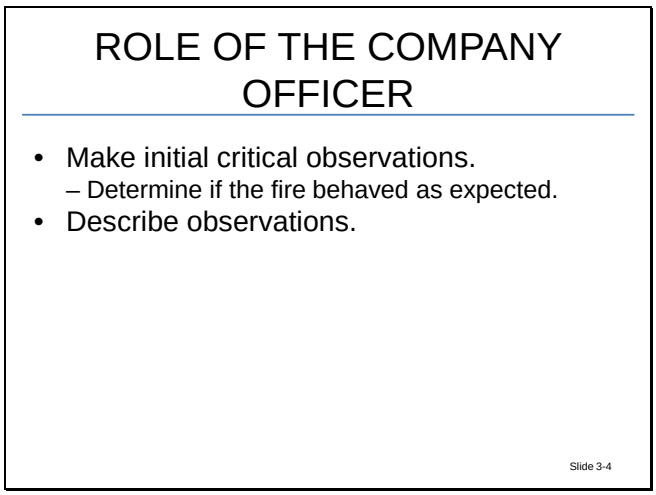
- Identify and describe the major principles of combustion that affect the ignition, growth, development, spread and extinguishment of fire.
- Explain the significance of the fire tetrahedron on fire behavior and its impact on fire causes.
- Identify and describe three methods of heat transfer and their relationship to fire development.

Slide 3-2

ENABLING OBJECTIVES (cont'd)

- Identify and describe the stages of fire and their importance to determining fire cause.
- Differentiate between flashover and backdraft.
- Distinguish among the five fire classifications.
- Identify and describe the three phases of burning.

Slide 3-3



I. ROLE OF THE COMPANY OFFICER

A. Make initial critical observations.

1. As one of the first to arrive at the scene of a fire, the officer may see things critical to determining the area of fire origin and the fire cause.

2. Determine if the fire behaved as expected.

   a. Color of the flames or smoke?

   b. Location of the heaviest fire damage?

   c. Has flashover occurred?

   d. Two separate, noncommunicating fires?

3. Careful observation will help discriminate between normal and abnormal fire growth and behavior.

   a. The fire reacted violently when water was applied.

   b. The fire appeared to spread rapidly from one floor to another with no combustible material in between.

   c. There was excessive heat damage to the structural elements with limited combustible materials (fuel load) present.

B. Describe observations.

1. Carefully noting observations, and describing them later to a fire investigator or jury, may be critical to a successful fire investigation and criminal prosecution in arson cases.

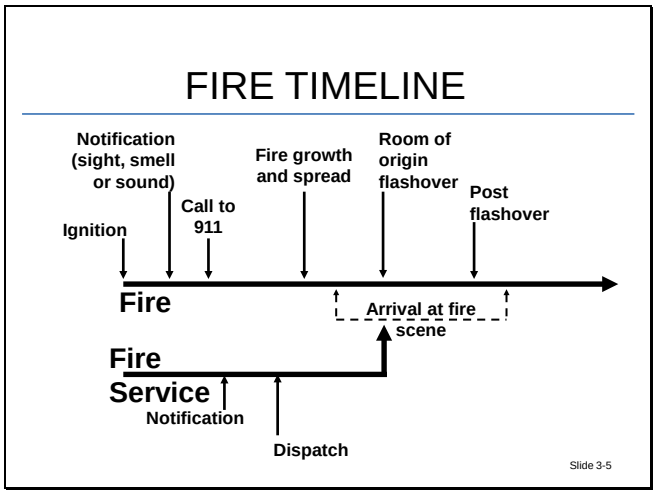
2. Examples of critical observations.

   a. Explaining to a jury observations on how the fire reacted when water was applied.

   b. Explaining to a fire investigator that the fire was in the decay phase upon arrival and a backdraft occurred soon after arrival.

   c. Explaining to a fire investigator how ventilation tactics affected fire spread.

II. FIRE BEHAVIOR



A. Fire timeline.

   1. Establishing a timeline for the fire is a critical step in any fire investigation.

      a. Can be used to support or disprove statements or hypotheses.

      b. Helpful to identify conflicts or discrepancies during the data collection process.

FIRE BEHAVIOR

Fire behavior is a complex phenomena that must be understood to formulate scientifically valid opinions and conclusions.

Slide 3-6

2. Fire behavior is a complex phenomena that must be understood to formulate scientifically valid opinions and conclusions.

DVD PRESENTATION

"SFPE Chemistry of Fire"

Slide 3-7

B. Basic fire concepts.

DEFINITION OF FIRE

"Fire is a rapid oxidation process, which is a chemical reaction resulting in the evolution of heat and light in varying intensities."

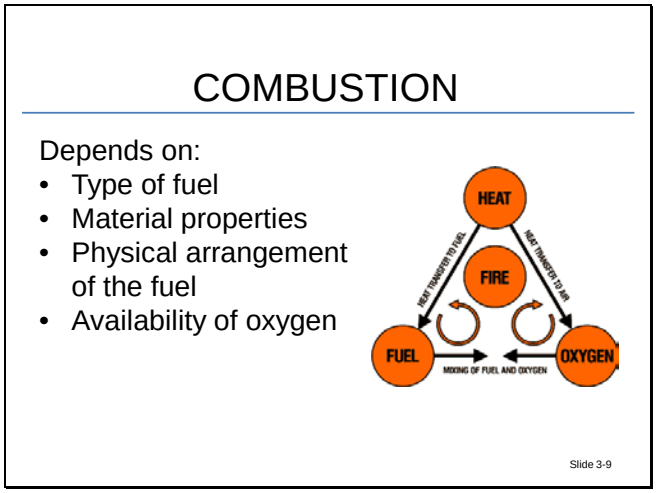
- NFPA 921, *Guide for Fire and Explosion Investigations*

Slide 3-8

1. Definition of fire.

   a. Fire is a rapid oxidation process which is a chemical reaction resulting in the evolution of heat and light in varying intensities (NFPA 921, *Guide for Fire and Explosion Investigations*).

   b. A fundamental understanding of fire and its related chemical reactions are essential in successfully determining the origin and cause of a fire.



   c. The amount of heat, the color of the light, smoke production and the toxicity of the products of combustion depend upon four factors:

      - Type of fuel.

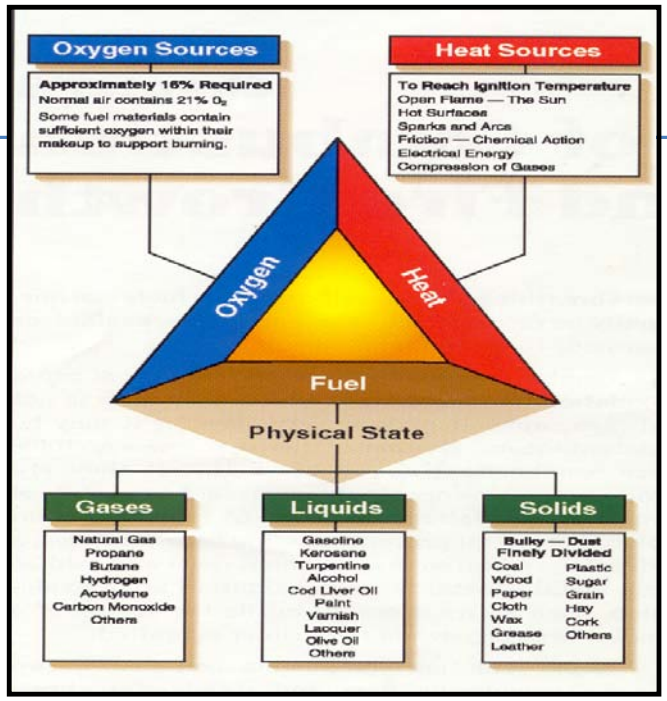
      - Material properties.

      - Physical arrangement of the fuel.

      - Oxygen available to support combustion.

2. Principles of combustion.

FIRE TRIANGLE



Slide 3-10

a. Fire triangle elements.

- **Fuel** in the form of a gas; can change from a solid or liquid to a gas.

- **Sufficient heat** to vaporize the material and ignite the vapor.

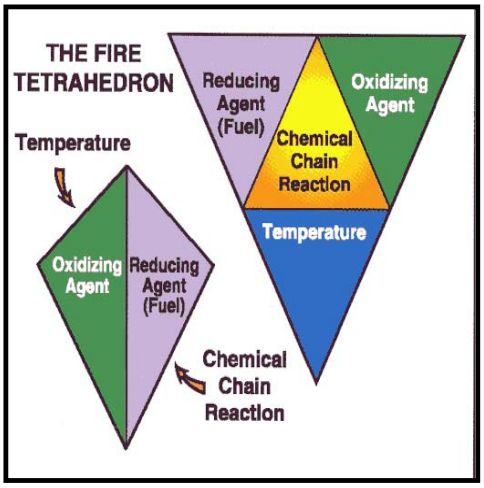
- **Oxygen** above the minimum levels needed to sustain combustion.

-- Air is an oxidizer.

-- Air is about 21 percent oxygen.

FIRE TETRAHEDRON

- In addition to fuel, heat, and oxygen, a chemical chain reaction is required to continue flaming combustion.
- If any one of the four elements are removed, the fire is extinguished.



Slide 3-11

b. Fire tetrahedron.

- The fourth element is the **uninhibited chain reaction** that allows the continuous heating of the fuel mass and the continuous production of flammable gases, which then are ignited by the flame.

FACTORS THAT IMPACT FIRE DEVELOPMENT

- Size, number and arrangement of ventilation openings.
- Thermal properties of the compartment.
- Ceiling height of the compartment.
- Size, composition and location of the fuel package first ignited.
- Availability and locations of additional fuel(s).

Slide 3-12

3. Factors that impact fire growth, development and spread.

   a. Size, number and arrangement of ventilation openings.

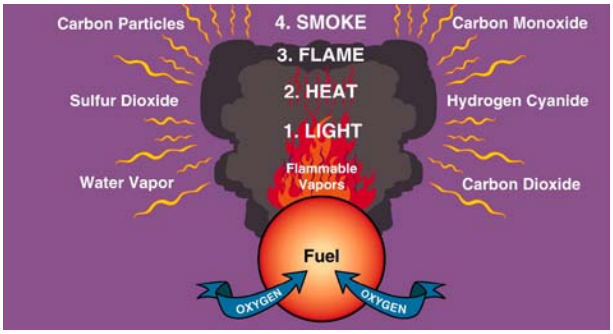
   b. Thermal properties of the compartment.

   c. Ceiling height of the compartment.

   d. Size, composition and location of the fuel package first ignited.

   e. Availability and location of additional fuel(s).

FIRE CHEMISTRY



Slide 3-13

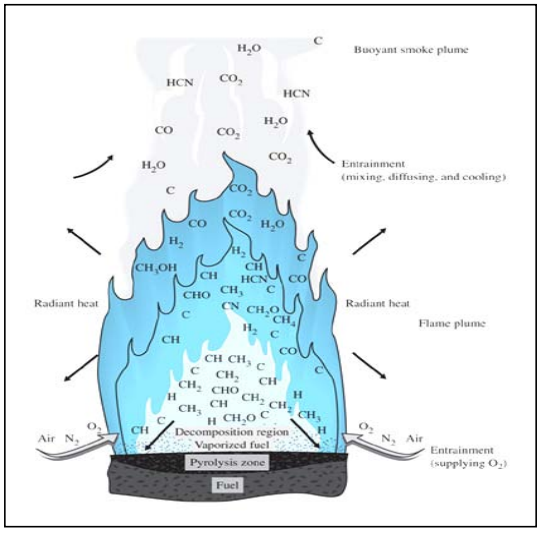
4. Fire chemistry.

   a. Fire is a complex series of chemical reactions that emit a variety of combustion products.

b. Besides carbon dioxide and water vapors, there are many other byproducts produced that may be harmful to fire service personnel and occupants. These include carbon monoxide and hydrogen cyanide.

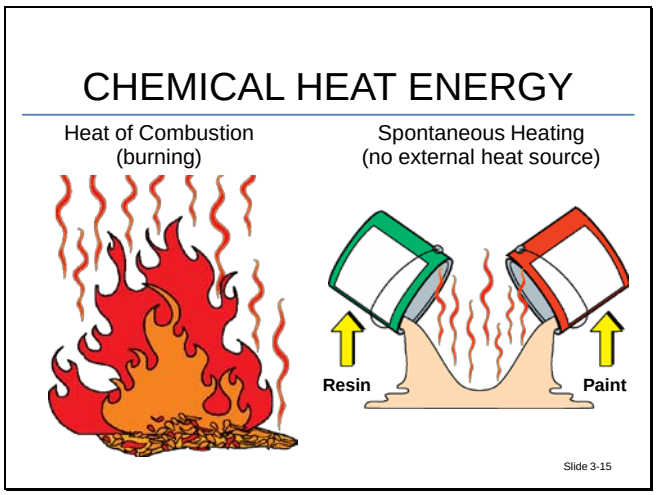
COMBUSTION PRODUCTS

- Heat.
- Gases.
- Flame.
- Smoke (soot).



Slide 3-14

c. Fire is a combination of heat, gases, flames, and smoke (soot).

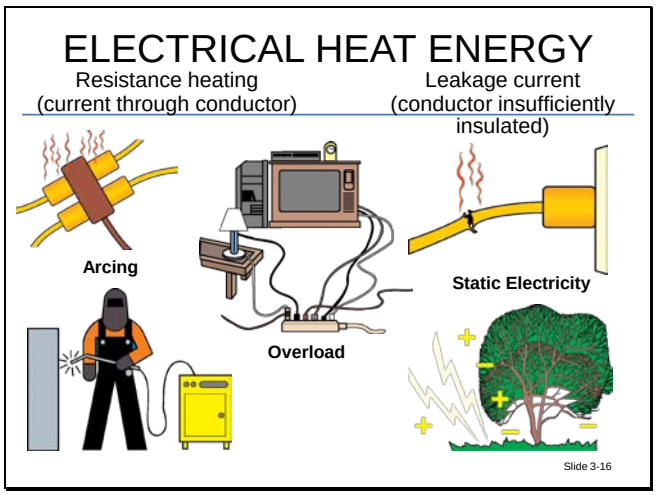


C. Common types of heat energy.

1. Chemical.

a. Heat of combustion.

b. Spontaneous heating.



2. Electrical.

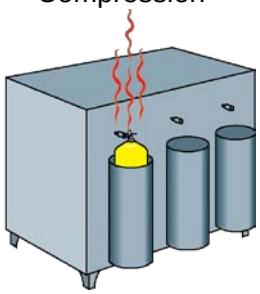
a. Resistance heating (current through conductor).

b. Leakage current (conductor not well insulated).

MECHANICAL HEAT ENERGY

Friction

Compression



Slide 3-17

3. Mechanical.

   a. Friction (applying breaks on a car).

   b. Compression (heat pump).

FLASH POINT OF A LIQUID

The lowest temperature of a liquid, as determined by specific laboratory tests, at which the liquid gives off vapors at a sufficient rate to support a momentary flame across its surface.

Examples:

-45 ºF (-43 ºC) for gasoline
+100 ºF (38 ºC) for fuel oil No. 2

- NFPA 921, *Guide for Fire and Explosion Investigations*

Slide 3-18

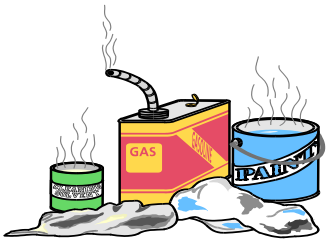
D. Flash point — The lowest temperature of a liquid, as determined by specific laboratory tests, at which the liquid gives off vapors at a sufficient rate to support a momentary flame across its surface.

   1. Gasoline has a flash point of about -45 °F (-43 °C).

   2. Fuel oil No. 2 (home heating oil) has a flash point of 100 °F (38 °C) or greater.

FLAMMABLE LIQUIDS

Flammable liquids have a flash point below 100 °F (38 °C).



Slide 3-19

E. Flammable and combustible liquids.

1. The flash point of a product determines if the product is classified as flammable or combustible.

   a. A flammable liquid has a flash point below 100 °F (38 °C).

COMBUSTIBLE LIQUIDS

Combustible liquids have a flash point at or above 100 °F (38 °C).

Slide 3-20

   b. A combustible liquid has a flash point of 100 °F (38 °C) or above.

2. The ability to discriminate between flammable and combustible liquids is critical with respect to their possible role in fire causation.

IGNITION TEMPERATURE

- Minimum temperature a substance should attain in order to ignite under specific test conditions.
- Auto-ignition is combustion by heat without the assistance of a spark or a flame.
- Piloted ignition is combustion by heat with the assistance of a spark or a flame.

- NFPA 921, *Guide for Fire and Explosion Investigations*

Slide 3-21

F. Ignition temperature.

1. The minimum temperature a substance should attain in order to ignite under specific test conditions.

2. Auto-ignition is combustion by heat without the assistance of a spark or flame.

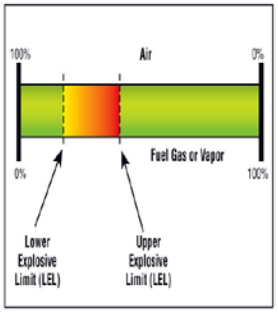
3. Piloted ignition is combustion by heat with the assistance of a spark or a flame.

4. Common ignition temperatures (°F; °C in parentheses).

Newspaper	392 ° (200 °)
Kerosene	410 ° (210 °)
Paraffin	473 ° (245 °)
Gasoline	650 ° (343 °)
Ethyl alcohol	689 ° (365 °)
Acetone	869 ° (465 °)

FLAMMABLE OR EXPLOSIVE LIMITS

- Lower explosive limits (LEL) lowest concentration of **vapors** in the air that will burn.
- Upper explosive limits (UEL) highest concentration of **vapors** in the air that will burn.



Slide 3-22

G. Flammable or explosive limits.

1. Lower explosive limits (LEL) — lowest concentration of vapors in the air that will burn.

2. Upper explosive limits (UEL) — highest concentration of vapors in the air that will burn.

3. Common flammable limits:

Gasoline	1.4 to 7.6 percent
Kerosene	0.7 to 5.0 percent
Ethyl alcohol	3.3 to 19.0 percent
Acetylene gas	2.5 to 99.9 percent

SPECIFIC GRAVITY OF LIQUID OR SOLID

- Ratio of the mass of a given volume of a substance to the mass of an equal volume of water at a temperature of 4 °C (39 °F).
- Water has a given value of 1.

- NFPA 921, *Guide for Fire and Explosion Investigations*

Slide 3-23

H. The specific gravity of a product is the ratio of the mass of a given volume of a substance to the mass of an equal volume of water at a temperature of 4 °C (39 °F). Water has a given value of 1.

1. Products with a specific gravity of less than 1 float on water.

Gasoline	0.73
Acetone	0.93

2. Products with a specific gravity greater than 1 sink in water.

Asphalt	1.39
Brick	1.79

SPECIFIC GRAVITY (AIR) VAPOR DENSITY

- Ratio of the average molecular weight of a gas or vapor to the average molecular weight of air.
- Air has a given value of 1.
  - <1 product will rise
  - >1 product will settle

- NFPA 921, *Guide for Fire and Explosion Investigations*

Slide 3-24

I. Specific gravity (air) vapor density is the ratio of the average molecular weight of a gas or vapor to the average molecular weight of air. Air has a given value of 1.

1. Products with a vapor density of less than 1 will rise (natural gas is 0.8).

2. Products with a vapor density of more than 1, such as liquefied petroleum gas (LPG), will settle to low-lying areas.

Gasoline	3.5
Acetone	2.0
LPG	1.6

VAPORIZATION

Slide 3-25

J. Vaporization.

1. Phase transition from the liquid or solid phase to gas phase.

2. The combustion process involves the ignition of gases or vapors that are given off by burning fuels.

SOLUBILITY

- Ability of a product to dissolve in water.
  – **Acetone** and **ethyl alcohol** may dissolve readily in water.
  – **Gasoline** and **kerosene** will float or sink in water.

Slide 3-26

K. Solubility is the ability of a product to dissolve in water.

1. Some products, such as acetone and ethyl alcohol, may dissolve readily in water.

2. Others, such as gasoline and kerosene, simply will float on the top or sink to the bottom of the water.

PYROLYSIS

- A process in which material is decomposed, or broken down, into simpler molecular compounds by the effects of heat alone; pyrolysis often precedes combustion.
- Generally applies to solid fuel.
- The effect on wood is **charring**.

- NFPA 921, *Guide for Fire and Explosion Investigations*

Slide 3-27

L. Pyrolysis.

1. The chemical decomposition of matter through the action of heat.

2. Process begins when fuel is heated and generally applies to solid fuels.

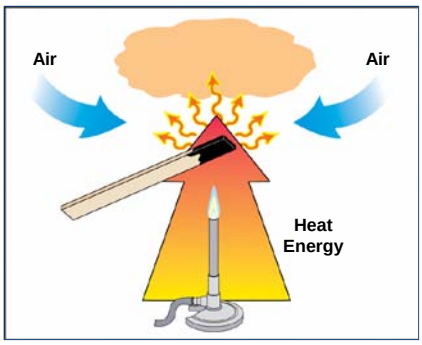
3. Continues through specified stages.

   a. Various gases form during decomposition.

   b. Combustibility of gases increases decomposition.

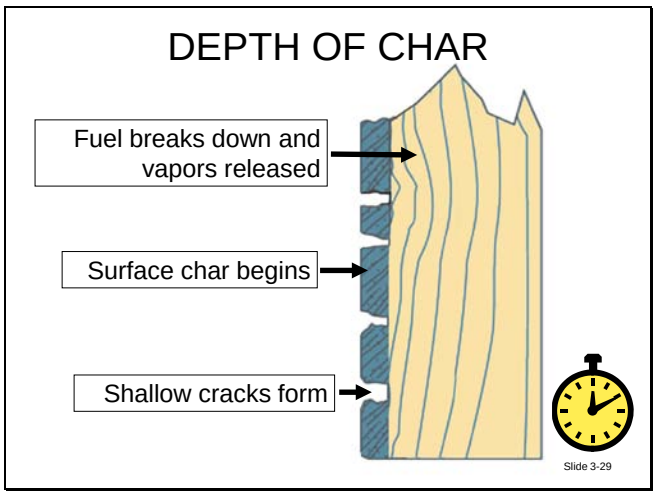
PYROLYSIS (cont'd)

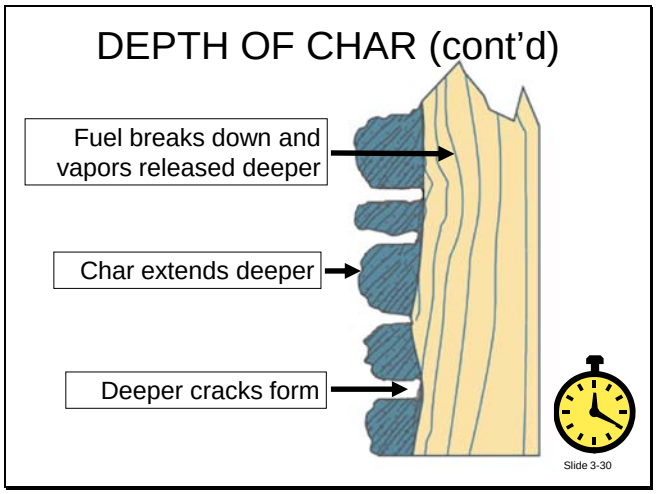
Ignitable mixture of burnable gases and air

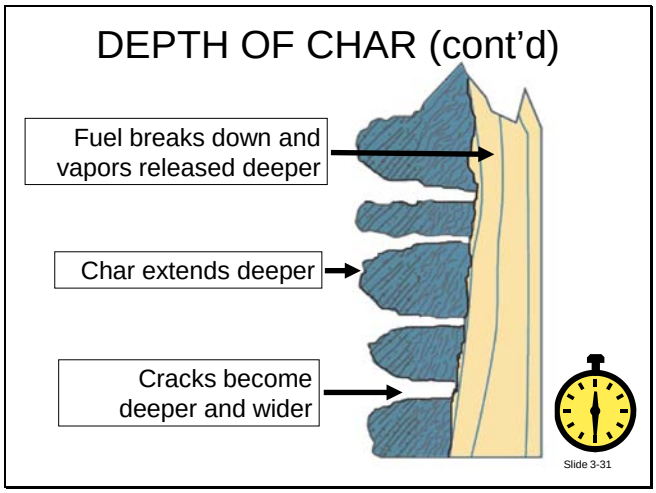


Slide 3-28

   c. Decomposition moves deeper into material (wood) and charring begins.


DEPTH OF CHAR
Fuel breaks down and vapors released
Surface char begins
Shallow cracks form
Slide 3-29


DEPTH OF CHAR (cont'd)
Fuel breaks down and vapors released deeper
Char extends deeper
Deeper cracks form
Slide 3-30


DEPTH OF CHAR (cont'd)
Fuel breaks down and vapors released deeper
Char extends deeper
Cracks become deeper and wider
Slide 3-31

FIRE BEHAVIOR

Heat Release Rate (HRR) — the rate at which heat energy is generated by burning.

- NFPA 921, *Guide for Fire and Explosion Investigations*

Slide 3-32

M. Heat Release Rate (HRR).

1. The rate at which heat energy is generated by burning.

2. The heat released from a burning material may correlate directly to the amount of resulting fire damage.

DVD PRESENTATION

"NIST Potato Chip Rack Fire"

Slide 3-33

DVD PRESENTATION

"UL/NIST New Versus Old Furnishings"

Slide 3-34

PEAK HEAT RELEASE RATE

Peak Heat Release Rate	
Burning cigarette	5 W
Burning match	80 W
Small trash can fires	50 to 300 kW
Burning upholstered chair	80 kW to 2.5 MW
Burning upholstered sofa	3,000 kW or 3 MW
Burning Christmas tree	1.6 MW to 5.2 MW

kW = 1,000 watts MW = 1 million watts

Slide 3-35

3. In typical fires, as the fire grows in size, the HRR will become limited by either the amount of fuel or the amount of oxygen that is available; this is referred to as peak HRR.

4. It is important to understand the amount of energy that materials burning in a compartment can generate so the peak HRR can be helpful in determining fire growth and spread.

BRITISH THERMAL UNIT

- British thermal unit (Btu).
  – Amount of heat **energy** required to raise the temperature of one pound of water 1 °F (-17 °F).
  – Measured in Btu/second.
- HRR.
  – Rate at which heat **energy** is released by burning.
  – Measured in kilowatts (kW).

Slide 3-36

5. Today the fire load (amount of heat produced) has altered fire behavior dramatically, so that fire damage patterns are becoming increasing difficult to use as indicators.

   a. Heat is measured in British thermal units (Btu).

   b. One Btu is the amount of heat required to raise one pound of water 1 °F (-17 °C) at a temperature of 60 °F (16 °C).

6. Reaction of fire to application of water.

   a. The initial fire attack team is in the best position to observe the reaction of the fire when water is applied.

   b. If the initial attack team is unsuccessful in extinguishing the fire, some unusual circumstance may be responsible such as the presence of hazardous chemicals or an incendiary device.

   c. Water hitting a pool of flammable liquid may cause the liquid to splatter and spread.

   d. Water contacting burning metals may cause a violent reaction with brilliant white flame.

HEAT FLUX

The measure of the rate of heat transfer to a surface (expressed in kW/m^2).

Sunny day	**1.2 kW/m^2**
Skin pain	**3-5 kW/m^2**
Floor at flashover	**20-25 kW/m^2**
Flames over surface	**120 kW/m^2**

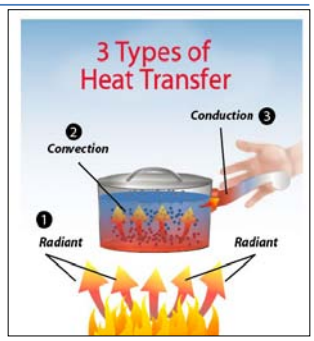
Slide 3-37

N. Heat flux is the amount of heat energy transferred to a surface via radiant heat and is expressed in kilowatts. These values range from 1.2 kW/m^2 (sunny day) to 20 kW/m^2 (during flashover).

III. METHODS OF HEAT TRANSFER

HEAT TRANSFER

- Heat transfer affects fire suppression activities and fire cause identification.
- Often helps explain how fire spreads from one location to another.



Slide 3-38

A. Heat transfer.

1. Heat transfer from one location to another affects fire suppression activities and fire cause determination.

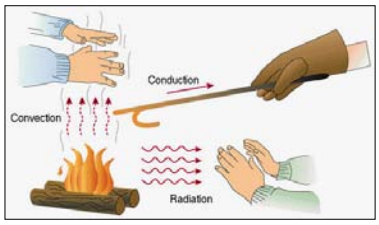
2. It also explains why a fire often spreads from one location to another.

3. Observing fire spread may be vital to reconstructing where the fire started and how and why it traveled to other locations.

4. Certain fire travel predictions also can be made for some classifications of buildings.

THREE METHODS OF HEAT TRANSFER

- Convection
- Conduction
- Radiation (radiant heat)

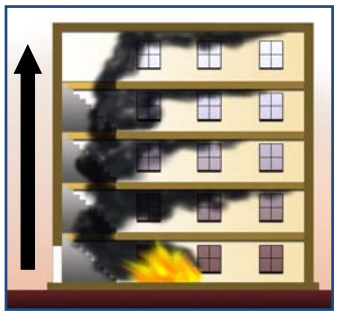


Slide 3-39

5. Three methods of heat transfer.

CONVECTION IS THE RISING OF HEATED AIR

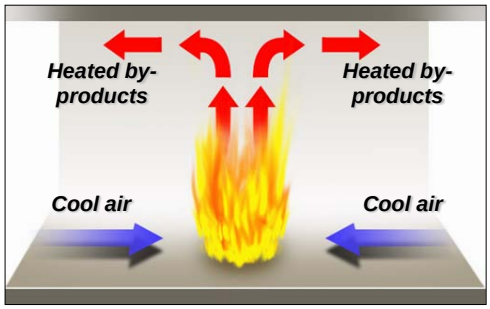
Upward travel of hot gases, for example, an open stairwell



Slide 3-40

a. **Convection** is the rising of heated air.

CONVECTION



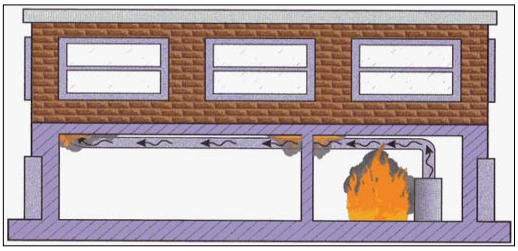
Slide 3-41

- The air at the top of a room is usually warmer than the air near the floor.

- Cool air drawn into the base of the fire helps the hotter gases rise due to buoyancy.

CONDUCTION

Transfer of heat through a solid medium such as building materials (e.g., brick, metal, etc.)

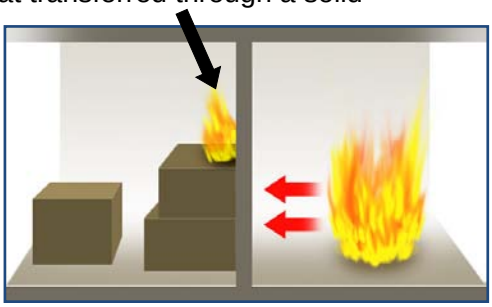


Slide 3-42

b. **Conduction** is the transfer of heat through a solid medium such as metal or brick.

CONDUCTION (cont'd)

Heat transferred through a solid



Slide 3-43

- When heat is applied to one side of a brick, the brick will warm and the opposite side will be heated.

- If this brick is located too close to combustible materials it could cause a fire.

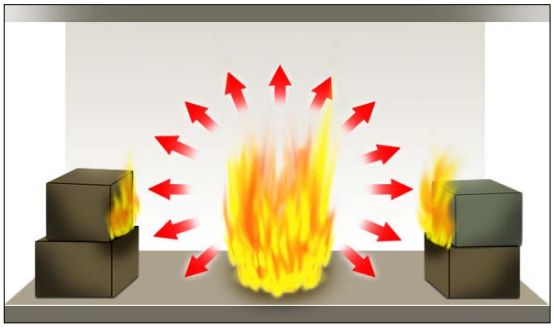
RADIATION

Transfer of heat energy by electromagnetic waves

Slide 3-44

c. Radiation (**radiant heat**) is the transfer of heat energy by electromagnetic waves that are transmitted through the air.

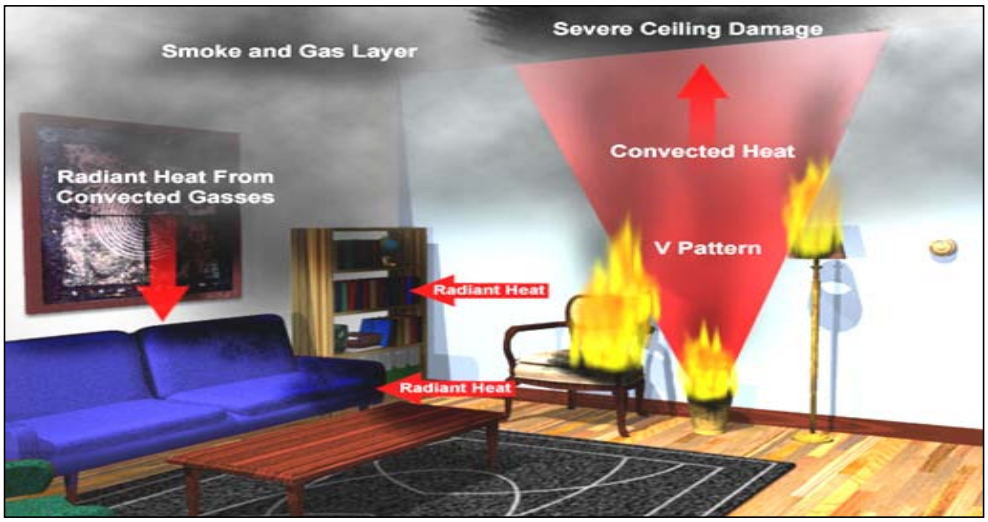
RADIATION (cont'd)



Slide 3-45

- The person sitting in front of a roaring fireplace feels radiant heat.

RADIATION (cont'd)



Slide 3-46

- The onset of flashover is dependent upon several factors one of which is the formation of a ceiling jet that contains a tremendous amount of radiant heat energy.

- This hot gas layer radiates energy back to the unburned fuels in the space causing them to increase in temperature.

FLASHOVER

- Transition phase from a fire in a room to a room on fire.
- As the fire continues to burn, all the contents of the fire area are gradually heated to their ignition temperatures.
- Simultaneous ignition occurs, and the area becomes fully involved.

Slide 3-47

B. Flashover.

1. The stage of fire when a room becomes heated such that flames flash over the entire surface and all combustible materials reach their ignition temperature simultaneously (i.e., fire in a room to a room on fire).

2. As a fire starts, convection carries the heated gases upward and outward from the fire.

3. This results in thermal stratification, which may cause other combustibles in the room to be heated to their ignition temperature.

4. At this time, in approximately 15 to 30 seconds, the entire upper portion of the room may ignite.

5. Flashover can occur while firefighters are in the room.

6. Because of the amount of heat and smoke generated in only a few seconds, it may appear that an ignitable liquid (accelerant) was present.

7. This phase of burning often is reported by observers as an explosion.

8. Careful examination should help discriminate between flashover effects and flammable liquid fires.

   a. Burning over the surfaces of materials.

   b. Lack of normal fire spread from the area/point of fire origin.

   c. Lack of accelerant residue.

   d. Demarcation line of burning or high heat damage appears to be consistent around the room.

DVD PRESENTATION

"NIST Flashover" and "NFA Flashover Demonstration"

Slide 3-48

BACKDRAFT

- In the hot smoldering phase, burning is incomplete because of insufficient oxygen.
- As soon as the needed oxygen enters the smoldering compartment, combustion resumes at a violent (explosive) rate.

Slide 3-49

C. Backdraft.

1. The phenomenon resulting from:

   a. A structure remaining closed during a fire.

   b. Incomplete combustion due to a lack of air entering the structure.

   c. The fire consuming large amounts of oxygen, and depleting the oxygen supply and the fire smolders.

   d. A sudden supply of O_2 may cause a violent reaction.

2. Also referred to as a smoke explosion.

3. The fire continues to produce large amounts of heat and carbon monoxide.

4. Carbon monoxide (flammable limits of 12.5 to 74.0 percent and ignition temperature of 1,128 °F (609 °C)) can become a highly volatile fuel.

5. The missing component of the fire triangle is oxygen.

   a. A window can break and allow oxygen to enter.

   b. A person can open a door and allow oxygen to enter.

   c. The fire can burn through the structure and allow oxygen to enter.

6. The seat of the fire or the lowest level of burning is a critical factor in the backdraft potential.

   a. The area above the fire will be in a positive pressure mode.

      - If an opening is made, the heated fire gases will push outward.

   b. The area below the fire will be in a negative pressure mode.

      - If an opening is made, the air will rush in.

   c. When a fire burns through the roof or exterior walls and fresh oxygen is provided, the fire usually returns to a free-burning fire.

   d. Occasionally, this will occur in the negative pressure area (below the seat of the fire) and a backdraft may occur.

   e. Witnesses may report that the building was just smoking (puffing) and then it exploded.

7. Careful examination should help discriminate between a backdraft and an explosion.

   a. Window glass broken just prior to or during the backdraft normally will be heavily sooted on the inside.

   b. Normally, the backdraft will not cause the localized structural damage anticipated from other types of explosions.

DVD PRESENTATION

"New Brighton, Pa., Backdraft"

Slide 3-50

IV. CLASSIFICATION AND STAGES OF FIRE

FIRE CLASSIFICATIONS

CLASSES OF FIRES	TYPES OF FIRES	PICTURE SYMBOL
A	Wood, paper, cloth, trash & other ordinary materials.	
B	Gasoline, oil, paint and other flammable liquids.	
C	May be used on fires involving live electrical equipment without danger to the operator.	
D	Combustible metals and combustible metal alloys.	D
K	Cooking media (Vegetable or Animal Oils and Fats)	

Slide 3-51

A. Fire classifications.

1. Class A — ordinary combustible materials such as wood, paper, cloth (natural fiber or synthetic fiber).

2. Class B — flammable or combustible liquids.

3. Class C — electrical energized equipment such as an electric motor when it is operating.

4. Class D — combustible metals and combustible metal alloys (aluminum, magnesium, and even steel).

5. Class K — Combustible cooking media — vegetable or animal oils and fats.

B. Normal fire behavior.

STAGES OF FIRE

Slide 3-52

Normally fires go through at least two and possibly four stages of burning.

INCIPIENT OR BEGINNING STAGE

The incipient phase is the earliest phase of a fire, beginning with the actual ignition.

Slide 3-53

1. Stage 1 — incipient or beginning stage.

   a. All fires start with the ignition of a fuel package with access to sufficient oxygen to support combustion.

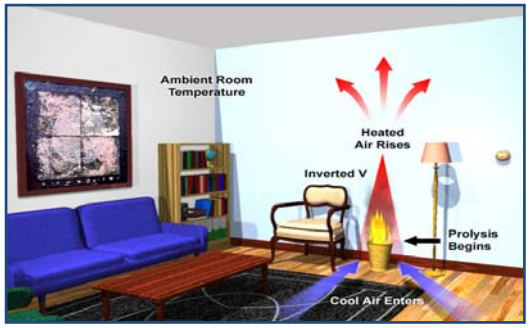
   b. As the fire burns, it also produces a wide variety of fire gases.

      - Carbon monoxide.

        -- Not the most toxic but the most abundant. As the oxygen level goes down, the production of carbon monoxide goes up.

      - Every fire produces carbon dioxide.

GROWTH STAGE



Slide 3-54

2. Stage 2 — growth stage.

   a. The growth stage is where the fire load and oxygen are used as fuel for the fire. Additional fuel packages may become involved due to radiation and convection.

   b. There are numerous factors affecting the growth stage including where the fire started, what combustibles are near it, ceiling height and the potential for "thermal layering".

   c. It is during this shortest of the four stages when a deadly "flashover" can occur; potentially trapping, injuring or killing firefighters.

FULLY DEVELOPED STAGE

Slide 3-55

3. Stage 3 — fully developed stage.

a. When the growth stage has reached its maximum, and all combustible materials ignite, the fire is considered to be fully developed.

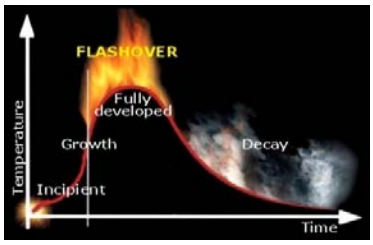
b. Stage three follows flashover of the area or building, which now appears to be fully involved.

c. Normally, in accidental fires, this stage will occur in about three to five minutes from the time of ignition.

d. The type of fuel or arrangement of the fuel may affect the time it takes for the fire to develop fully.

DECAY STAGE

When a fire has passed through the first three stages, it will likely decay if the area or building is closed and all available fuels have been consumed.



Slide 3-56

4. Stage 4 — decay stage.

a. When a fire has passed through the first three stages, it will likely decay **if the area or building is closed and all available fuels have been consumed.**

b. The oxygen level is lowered to 16 percent, or even less.

c. Results.

- Carbon monoxide production rises.

- The temperature of the area or building rises.

- Large amounts of heavy, black carbon are deposited on the walls and windows.

- Moisture may appear on the inside of the window glass as the glass is cooled by the cool air outside.

- The building may appear to be "puffing."

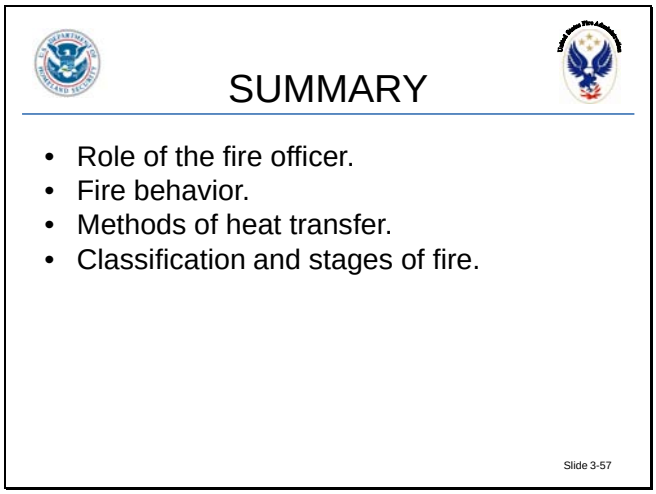
- The level of the structure where the smoke stops puffing is where the seat of the fire may be located.

  -- If there is puffing smoke on the second floor, but none on the first, the area of fire origin may be located on the second floor.

d. If the area or building remains tightly closed, the fire eventually will suffocate from a lack of oxygen.

- In some instances fire departments have responded to an apparently significant fire that has gone out by itself after causing considerable heat and smoke damage.

- As buildings become more tightly insulated, the potential for stage-three fires increases.



V. SUMMARY

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APPENDIX

FIRE BEHAVIOR CHECKLIST

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Fire Behavior Checklist

This checklist is provided to help the fire officer and firefighters evaluate various aspects of fire behavior that may be critical to the fire cause and origin determination.

1. What material first ignited? _____

2. Complete the following if the materials involved a **liquid**.

   Flash point of material: _____

   Vapor density compared to air: _____

   Specific gravity compared to water: _____

   Solubility in water: [ ] yes [ ] no

   Flammable limits: _____

   Flammable or combustible liquid: [ ] yes [ ] no

   Ignition temperature of material: _____

3. Should the flammable or combustible liquid have been where it was at the time of the fire? [ ] yes [ ] no

4. Was the heat released from the burning material what you would have anticipated for this type of occupancy? [ ] yes [ ] no

5. How did the fire react when water was applied? _____

   _____

   _____

   _____

6. Was the fire extinguished with the amount of water normally applied for similar fires in similar occupancies? [ ] yes [ ] no

   If no, how much more was needed? _____

   _____

7. Is the path of fire travel clearly and obviously defined or is there evidence of fire progression upward and outward from the area of fire origin? [ ] yes [ ] no

8. What stage was the fire upon your arrival?

[ ] Stage 1: incipient fire
[ ] Stage 2: free-burning
[ ] Stage 3: smoldering

9. Did a backdraft occur or is there any evidence of a backdraft? [ ] yes [ ] no [ ] unsure

10. Was there anything that appeared different at this fire than at other fires you have responded to recently? [ ] yes [ ] no

If yes, explain. _____

_____

_____

11. Were there any eyewitness accounts of the fire origin or cause? [ ] yes [ ] no

If yes, does this appear to be consistent with your observations about the origin and cause of the fire? [ ] yes [ ] no

Explain. _____

_____

_____

Fire Scene Observation Notes

Sketch of the Fire Building

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UNIT 4: SECURING THE FIRE SCENE

TERMINAL OBJECTIVES

The students will be able to:

1. *Describe various safety and security measures that should be followed when conducting an inquiry into the cause of a fire.*

2. *Explain the procedures that should be followed to allow the building owner, occupant or investigators to enter into fire damaged structures.*

ENABLING OBJECTIVES

The students will be able to:

1. *Explain the importance of preserving and protecting the fire scene.*

2. *Describe the basic steps that should be taken to preserve and protect evidence.*

3. *Explain how fire scene hazards affect the ability to make a fire cause determination.*

4. *Describe the procedure to allow the owner, the occupant or the building manager to re-enter the burned structure.*

5. *Describe the process of turning the property over to the building owner or fire investigator.*

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UNIT 4: SECURING THE FIRE SCENE

Slide 4-1

ENABLING OBJECTIVES

- Explain the importance of preserving and protecting the fire scene.
- Describe the basic steps that should be taken to preserve and protect evidence.
- Explain how fire scene hazards affect the ability to make a fire cause determination.

Slide 4-2

ENABLING OBJECTIVES (cont'd)

- Describe the procedure to allow the owner, the occupant or the building manager to re-enter the burned structure.
- Describe the process of turning the property over to the building owner or fire investigator.

Slide 4-3

SCENE SAFETY

- First responders must continually assess the hazards and risks during fire scene operations.
  – First responders must assess potential threats to the safety of personnel and take appropriate action.

Slide 4-4

I. SCENE SAFETY DURING OPERATIONAL PHASES

A. First responders must continually assess the hazards and risks that may be present at the scene.

1. Any hazards that are identified must either be controlled or eliminated before proceeding.

SCENE SAFETY (cont'd)

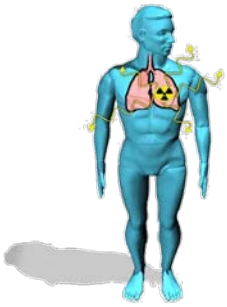
- First responders must continually assess the hazards and risks during fire scene operations (cont'd).
  – Fire service personnel and investigators may be exposed to smoke, soot and fumes from fires that contain many substances classified as known or suspected human carcinogens, primarily caused by burning synthetic materials (plastics).

Slide 4-5

2. Personnel may be exposed to smoke, soot and other respiratory hazards (some of which are cancer-causing) during all phases of on-scene operations.

SCENE SAFETY (cont'd)

- Chemical hazard exposure.
  - – Routes of entry include inhalation, absorption, ingestion and injection.
  - – Exposures may be acute or chronic.
  - – Proper protective measures should be followed at all times.



Slide 4-6

B. Chemical hazard exposure.

1. Personnel may be subject to exposure from a variety of chemicals while engaged in on-scene activities.

2. The primary routes of exposure include inhalation, absorption, ingestion and injection.

3. Proper protective measures including the use of positive-pressure self-contained breathing apparatus (SCBA) must be followed at all times.

SCENE SAFETY (cont'd)

- Chemical hazard exposure (cont'd).
  - – Atmospheric (respiratory) hazards.
    - -- Carbon monoxide.
    - -- Hydrogen cyanide.
    - -- Benzene.
    - -- Acrolein.
    - -- Asbestos.
    - -- Formaldehyde.

Slide 4-7

4. Fire scene atmospheres may be contaminated with several respiratory hazards that include:

   a. Carbon monoxide.

   b. Hydrogen cyanide.

c. Benzene.

d. Acrolein.

e. Asbestos.

f. Formaldehyde.

SCENE SAFETY (cont'd)

- Hydrogen cyanide production in a fire.
  – Hydrogen cyanide is produced by incomplete combustion of nitrogen and carbon containing substances (wool, silk, cotton, paper, synthetic rubber, and resins).
- Phoenix, Ariz. fire department study on firefighters overhaul exposures.

Slide 4-8

C. Hydrogen cyanide production in a fire.

1. Hydrogen cyanide is produced by incomplete combustion of substances that contain nitrogen and carbon such as wool, silk, cotton and paper.

2. Hydrogen cyanide is increasingly becoming one of the leading hazards encountered by personnel while working at fire scenes.

D. Phoenix, Ariz. fire department study on firefighter exposures during overhaul.

1. In 1998, the Phoenix Fire Department conducted a study in conjunction with the National Institute of Occupational Safety and Health (NIOSH).

SCENE SAFETY (cont'd)

- Phoenix, Ariz. fire department study on firefighters overhaul exposures (cont'd).
  – Air monitoring study of 25 fire scenes.
  – 22 scenes determined to have potentially harmful substances present.

Slide 4-9

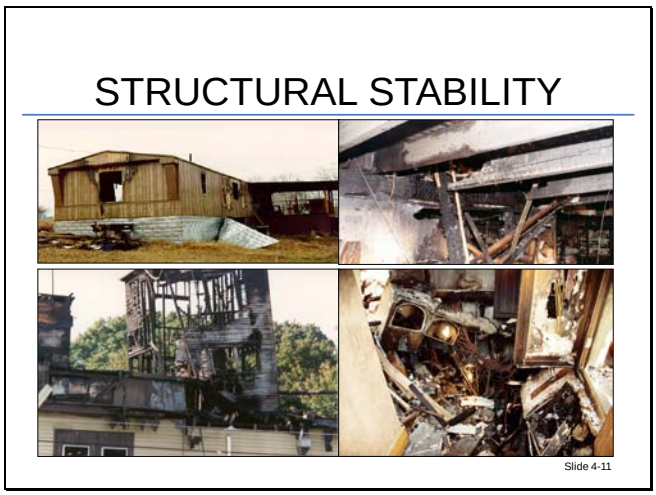
2. The study involved conducting air monitoring at 25 fire scenes to characterize the nature of any respiratory hazards present.

SCENE SAFETY (cont'd)

- Phoenix, Ariz. fire department study on firefighters overhaul exposures (cont'd).
  – Firefighters should maintain use of positive-pressure self-contained breathing apparatus (SCBA) during overhaul.

Slide 4-10

3. Based on the results of the study, NIOSH recommended that firefighters maintain the use of positive-pressure SCBA during overhaul.



E. Structural stability issues.

1. Are the walls safe to work near?

a. Are the bearing walls stable?

- Deterioration of bearing walls may have shifted weight to nonbearing walls.

b. Have the lintels over doors and windows been weakened or damaged?

- Loads above openings may not have support.

- Large spans over picture windows and French doors are stressed easily.

2. Have the roof support members been compromised?

a. Light weight truss and wooden I-beam elements are most vulnerable and gusset plates can fail due to exposure to heat.

Slide 4-13

b. Has the roof been burned through?

c. Was the roof opened for ventilation during the fire?

- Were structural members cut or severed?

- Was heavy roofing material (tile) stacked in one area, increasing the roof load?

3. Is the roof secure and still able to support heavy equipment?

a. Heating and air conditioning units.

b. Refrigeration units.

c. Water storage tanks.

4. Basements.

a. Is there water in the basement?

b. Can it be pumped out?

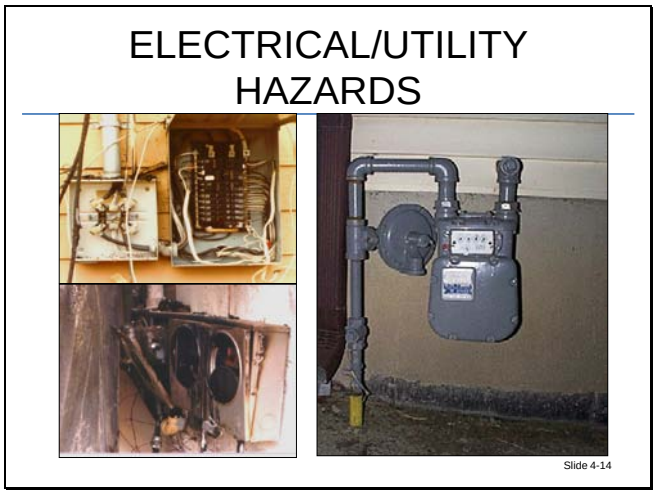
c. Is there unstable stock or equipment? Are (Is) there:

- Wet and unstable cardboard boxes?

- Unbalanced shelving?

d. Are energized electrical appliances or services under water?

e. Are there unexpected sumps, open shafts, or hidden openings?



F. Have utilities been turned off, de-energized and secured?

1. Electricity.

a. Has service to structure been terminated?

b. Have the main fuses been removed or the circuit breakers been turned off?

c. If there is more than one service, has the correct one been terminated?

d. If there was a small fire, have branch circuits for the fire area been terminated?

2. Natural, propane or butane gas.

a. Has service been terminated by a utility company at the street or at a service connection?

b. Has the service valve been locked out of service?

c. Has the master service for multiple services been closed?

d. If fuel is supplied from a tank, has the tank valve been closed?

e. For small fires, has the shut-off valve for the affected appliance in the fire area been closed?

G. Fuel oil tanks.

1. Supplies from aboveground oil tanks may need to be shut off.

   a. Fire may have damaged the fuel oil line or the appliance. As a result, oil may leak into the structure.

   b. Most tanks are equipped with a shut-off valve at their lowest point, usually near the oil filter.

2. Underground tanks usually do not have an accessible shut-off valve. If no shut-off valve is found, it may be possible to squeeze, crimp or bend the line to shut off the flow.

BROKEN GLASS/NAILS

Slide 4-15

H. Personnel should always be mindful of various other physical hazards that may be present at the scene such as broken glass, nails and other related items.

HANGING LIGHT FIXTURES

Slide 4-16

I. Structures that have sustained significant fire damage are likely to have unsecured light fixtures, piping (conduit), wiring and other components that can cause serious injury unless they are observed and properly secured.

1. Any electrical equipment must be evaluated.

2. A qualified person with the appropriate test equipment should ensure that any equipment is de-energized before examining and/or handling.

J. Other safety considerations during the fire origin and cause determination process:

HOLES IN FLOORS

Slide 4-17

1. Are floors safe to work on?

   a. How much burning of supports took place?

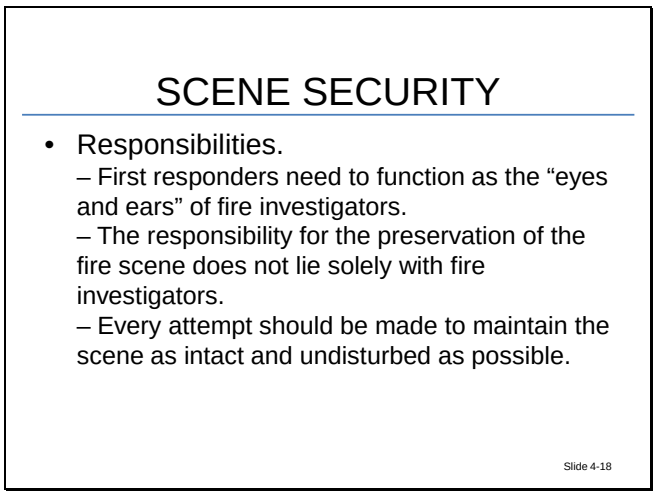
   b. What is the floor load? Are (Is) there:

      - Heavy loads?

      - Water or water-soaked contents?

      - Extra loads from other portions being burned away?

2. Possibility of impact loads from items falling on weakened parts.



II. RESTRICTING ENTRY INTO THE FIRE SCENE

A. Post-suppression reasons to re-enter the fire scene.

1. Owners, occupants, building managers or others with an interest in the building may need to enter after suppression.

2. Assess fire damage.

3. Retrieve personal items.

   a. Jewelry or other valuables.

   b. Medicine, glasses and/or prosthetic devices.

   c. Insurance documents.

   d. Items that may help children feel secure.

      - Favorite toy or book.

      - Favorite blanket or stuffed animal.

   e. Clothing.

4. Examine the fire scene for possible appliances left on.

SCENE SECURITY (cont'd)

- Responsibilities (cont'd).
  – Initially, the fire officer and incident commander (IC) should secure or ensure the security of the fire scene from unnecessary and unauthorized access.
  – Limit fire suppression activities to only those that are necessary.

Slide 4-19

B. The scene must be secured to prevent unnecessary and unauthorized access.

1. Fire suppression activities should be limited to only those that are absolutely necessary to extinguish the fire.

2. Excessive fire suppression activities can destroy valuable evidence that can be used to help determine the fire origin and cause.

SCENE SECURITY (cont'd)

- Responsibilities (cont'd).
  – Begins with first-arriving fire service and law enforcement personnel.
  – Lack of scene security and control may result in the destruction, contamination, loss or unnecessary movement of critical evidence.

Slide 4-20

3. Establishing scene security begins with the arriving fire department or law enforcement personnel.

   a. Lack of adequate security and control of the scene can result in the destruction, contamination or loss of critical evidence.

   b. Investigators rely on the help of fire department personnel to maintain the integrity of the fire scene until their arrival.

SCENE SECURITY (cont'd)

- Responsibilities (cont'd).
  – If an investigator is not immediately available, the fire department or other lawful authority should keep control of the premises until all evidence has been collected.

Slide 4-21

4. If investigators are not immediately available to respond to the scene, fire or police department units must maintain control until all evidence can be collected and properly processed.

SCENE SECURITY (cont'd)

- Responsibilities (cont'd).
  – Until the investigator arrives on the scene, personnel should: suspend salvage and overhaul.
    -- Keep **all** nonessential personnel out of the area.
    -- Photograph the fire scene extensively. If weather, traffic or other factors could damage and/or destroy evidence, take steps to preserve and document it in the best way possible.

Slide 4-22

5. If investigators have been called to respond to the scene, personnel should suspend all overhaul activities until their arrival.

   a. All nonessential personnel should be restricted from entering the room and/or area of origin.

   b. If weather or other environmental factors may damage or destroy evidence, appropriate steps should be taken to document and preserve it.

SCENE SECURITY (cont'd)

- Responsibilities (cont'd).
  – Establish a secure perimeter.
  – Establish one point of ingress and egress.
  – Limit access to authorized personnel — **including only essential firefighters and emergency medical services personnel.**

Slide 4-23

C. Restrict entry until officials are ready to release the property.

1. Officer in charge (OIC) or Incident commander (IC) has a further responsibility to determine the cause of the fire.

2. Restrict entry to those who need to be present. Suggested methods:

   a. Place barrier tape around the structure.

   b. Post a guard to restrict entry.

   c. If firefighters are on the scene to assist, keep them on standby at Staging Area until needed.

      - For lifting, shoveling, sifting, etc.

      - For providing lighting.

SCENE SECURITY (cont'd)

- Responsibilities (cont'd).
  – Postpone operations until evidence can be properly documented and collected.
  – Keep civilians out of scene.

Slide 4-24

3. Procedures for allowing authorized entry.

   a. Verify individuals have a right to access the building or fire area.

   b. Determine their purpose for entry.

   c. State that you are still working in the building.

   d. For their own safety and that of firefighters, escort them the entire time.

   e. Assist them as much as possible to find what they need.

SCENE SECURITY (cont'd)

- Responsibilities (cont'd).
  – Cordon off fire fatalities or victims to prevent damage or contamination of body.
  – Ensure that the structure and contents remain in their prefire locations and condition.

Slide 4-25

4. Instructions for those who enter.

   a. Do not tamper with items that may be evidence.

   b. Do not move controls of appliances, change the position of switches, etc.

   c. Do not remove any items that may be critical to the investigation.

5. Record what is removed.

   a. By whom.

   b. Time.

   c. Date.

   d. Where was it removed from and where is it going to?

PRESERVATION AND PROTECTION OF EVIDENCE

- Reasons for lost or compromised evidence.
  - Premature or unnecessary overhaul.
  - Excessive use of water.
  - Contamination by improper or no preservation.
  - Failure to notify investigators.

Slide 4-26

III. PRESERVATION AND PROTECTION OF EVIDENCE

A. There may be several reasons for lost or compromised evidence at fire scenes.

1. Premature or unnecessary overhaul.
2. Excessive use of water.
3. Contamination by improper or no preservation.
4. Failure to notify investigators.

PRESERVATION AND PROTECTION OF EVIDENCE (cont'd)

- Evidence includes:
  - The physical structure.
  - Contents.
  - Any material or equipment ignited and on which fire patterns and/or damage appear.

Slide 4-27

B. Evidence that may be of value at fire scenes include:

1. The physical structure itself (or vehicle).
2. Contents of building (or vehicle).

3. Any material or equipment that displays fire pattern or shows evidence of damage.

PRESERVATION AND PROTECTION OF EVIDENCE (cont'd)

- Physical evidence.
  - Cigarette butts.
  - Cloth and tape.
  - Matches.
- Tool marks.
- Shoe impressions.
  - May provide leads regarding suspect(s).
- Latent fingerprints.
  - Assist in identifying suspect(s).

Slide 4-28

C. There is a variety of physical evidence that may survive the fire and may be collected and processed by investigators.

1. Matches, lighters or other ignition sources.

2. Latent fingerprints.

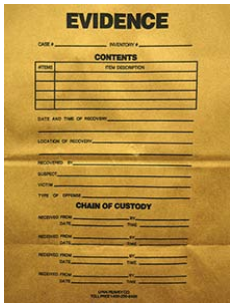
3. Tool marks.

4. Shoe or tire impressions.

5. Trace evidence (hairs and fibers).

PRESERVATION AND PROTECTION OF EVIDENCE (cont'd)

- Chain of custody.
  - A record of individuals who have had physical possession of evidence.
  - Documentation is critical to maintaining the integrity of the chain of custody and normally requires signatures.



Slide 4-29

D. Chain of custody.

1. Refers to records of individuals that had physical possession of evidence during its life cycle.

2. Complete and accurate documentation is critical to maintain the integrity of the chain of custody at all times.

PRESERVATION AND PROTECTION OF EVIDENCE (cont'd)

- Chain of custody (cont'd).
  – Every person who had possession of the item(s) must be able to attest to the fact that it has not been lost, contaminated or altered in any way.

Slide 4-30

3. Every person who had possession of any items of evidence must be able to demonstrate that it was not lost, contaminated or altered in any way during the entire time it was in their possession.

PRESERVATION AND PROTECTION OF EVIDENCE (cont'd)

- Fire department has the authority to deny access to any building.
  – During firefighting operations.
  – For a reasonable length of time after fire suppression is terminated.

Slide 4-31

E. Fire department has the authority to deny access to any building.

1. During firefighting operations.

2. For a reasonable period of time after fire suppression activities are terminated to determine the origin and cause of the fire.

PRESERVATION AND PROTECTION OF EVIDENCE (cont'd)

- Methods to protect evidence.
  - Post firefighter or police officer to act as a sentry.
  - Use police tape, rope, traffic cones or other markers/barriers.
  - Cover areas with salvage covers prior to overhaul.

Slide 4-32

F. There are a variety of methods available to protect evidence from damage and destruction.

1. Posting firefighters or police officers at all entrances and exits.

2. Using police tape, ropes, sawhorses or traffic cones as barricades.

3. Using salvage covers or tarps to cover evidence prior to and during overhaul.

PRESERVATION AND PROTECTION OF EVIDENCE (cont'd)

- Windows and building contents.
  - Refrain from breaking out windows unless absolutely necessary.
  - Do not move items or change positions of knobs and controls of appliances or building equipment and/or systems.

Slide 4-33

G. Windows and building contents.

1. Personnel should refrain from breaking out windows unless absolutely necessary for life safety or ventilation.

2. Do not move any items or change positions of knobs or controls of any appliances or equipment that may be located in the area of origin.

PRESERVATION AND PROTECTION OF EVIDENCE (cont'd)

- Tools and equipment.
  – Avoid using gasoline- or diesel-powered tools in or around the area of origin.
  – Refueling should be done outside the perimeter of the scene to prevent potential contamination.

Slide 4-34

H. Tools and equipment.

1. Personnel should avoid using any gasoline- or diesel-powered tools or equipment in or around the area of origin.

2. Any refueling that is required should be done outside the perimeter of the scene to prevent contamination of any evidence that may be present.

PRESERVATION AND PROTECTION OF EVIDENCE (cont'd)

- Fire attack.
  – Implement fire attack methods that preserve evidence.
  – Use fog streams.
  – Avoid aiming directly at base of the fire.
  – Limit the amount of water used.

Slide 4-35

I. Fire attack.

1. Use fire suppression methods that help preserve any potential evidence that may be present at the scene.

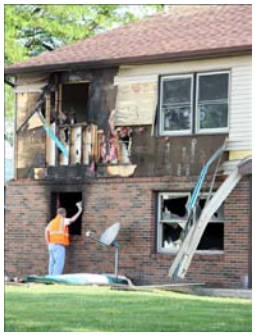
2. These include using fog streams, avoiding aiming straight streams at the base of the fire, and limiting the amount of water necessary to fully extinguish the fire.

What caused these patterns?

Slide 4-36

PRESERVATION AND PROTECTION OF EVIDENCE (cont'd)

- Overhaul.
  – The premature removal of items from a fire scene can make reconstruction efforts extremely difficult.
  – Keep in mind that investigators attempt to identify prefire locations of items to help determine the fire's origin and cause.



Slide 4-37

J. Overhaul.

1. Removing items prior to the arrival of investigators can severely hamper their ability to reconstruct the scene and identify the fire cause.

2. The prefire locations of the building contents are extremely important to successfully determine the origin and cause of the fire.

PRESERVATION AND PROTECTION OF EVIDENCE (cont'd)

- Overhaul (cont'd).
  - Use thermal imaging cameras to pinpoint hot spots.
  - Make small holes with poles.
  - Minimize drywall removal.
  - Do not move/remove items from the room unless directed to do so.

Slide 4-38

3. Personnel should consider the use of thermal imaging cameras to help identify locations of hot spots.

4. When pulling ceilings and walls, personnel should make small holes to minimize the need for complete drywall removal.

PRESERVATION AND PROTECTION OF EVIDENCE (cont'd)

- Overhaul (cont'd).
  - Excessive overhaul prior to the documentation and analysis of fire patterns and evidence can affect the determination of the origin and cause of the fire.
  - Care should be exercised when pulling ceilings and walls to check for extension.

Slide 4-39

5. Excessive overhaul prior to examining and documenting the area and/or point of origin can adversely affect the ability to successfully determine the fire's origin and cause.

6. Extreme care should be used when pulling ceilings and walls when checking for fire extension since evidence can be damaged or destroyed.

Slide 4-40

PRESERVATION AND PROTECTION OF EVIDENCE (cont'd)

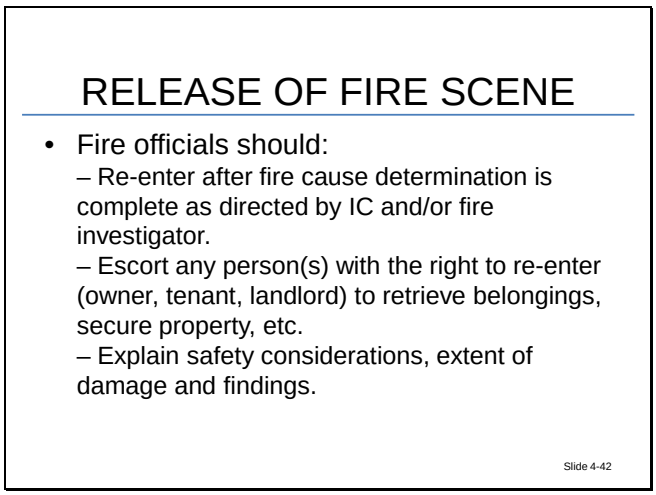
- Evidence identification.
  – Take proper steps to protect any potential evidence.
  – The person(s) making the discovery should notify the IC or investigators immediately upon their arrival.

Slide 4-41

K. Evidence identification.

1. Personnel should take proper steps to protect any potential evidence they observe or suspect may be important to investigators.

2. The OIC or IC should notify investigators of the locations of any evidence that they discovered immediately upon their arrival.



IV. RELEASE OF FIRE SCENE

A. Accidental fire.

1. Release the scene to the owner or occupant only after origin and cause of the fire has been identified.

2. Escort the owner or occupant as necessary.

3. Explain any relevant safety considerations regarding the building and its contents.

4. Explain the extent of the fire damage.

5. Explain fire suppression efforts.

   a. Ventilation holes in the roof.

   b. Broken windows.

   c. Forced entry.

6. Explain findings on fire origin and cause.

   a. Explain the reasoning and conclusions.

   b. Point out the methodology used.

      - Burn patterns.

      - Fire spread.

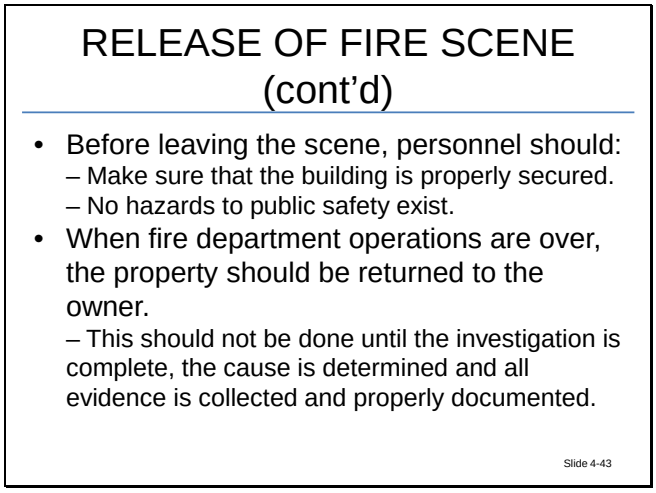
- Conclusions reached based on evidence collected during the fire scene examination.

7. State that you will be preparing an official report.

   a. Available to owner or occupant.

   b. Available to insurance company.

8. State that information is available to property owners to assist in making the property habitable and to salvage personal items.



B. Undetermined fires.

1. Need to evaluate fires whose cause you cannot determine using generally accepted investigative practices.

   a. Fires with inexplicable burn patterns.

   b. Fires whose cause has no logical explanation.

   c. Fires that lack sufficient data and evidence to be classified as either accidental or incendiary.

2. Call for a fire investigator.

   a. Secure the scene until the investigator's arrival.

   b. If arrival is delayed, designate someone to secure the scene and ensure that no one enters.

   c. Leave barrier tape in place.

d. Inform owner or occupant of actions taken.

e. Do not offer opinions about the fire cause to anyone.

3. Arrival of fire investigators.

a. Brief on all the facts and information documented while working at the scene.

b. Explain observations.

- En route.
- Upon arrival.
- During suppression.
- During overhaul.
- During fire scene examination.

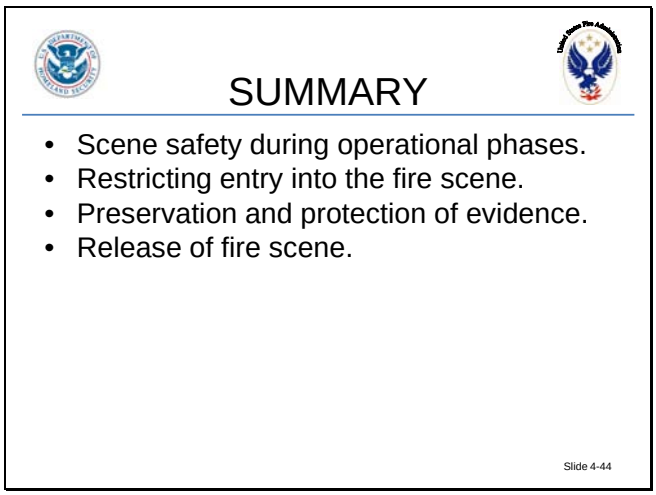
c. Explain fire suppression efforts that may have changed normal fire or smoke patterns.

- Ventilation tactics.
- Hoseline tactics.
- Defensive or offensive operations.

4. Provide a copy of your report.

a. Helps investigators compare their findings with initial observations and statements recorded by fire service personnel.

b. Helps to ensure that any contradictory issues are resolved.


SUMMARY
• Scene safety during operational phases.
• Restricting entry into the fire scene.
• Preservation and protection of evidence.
• Release of fire scene.
Slide 4-44

V. SUMMARY

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APPENDIX

FIRE AND ARSON SCENE EVIDENCE GUIDE

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National Institute of Justice
June 2000-Section A/Pages 13-20
Establishing the Role of 1st Responders

Opinions or points of view expressed in this document represent a consensus of the authors and do not necessarily reflect the official position of the U.S. Department of Justice.

The National Institute of Justice is a component of the Office of Justice Programs, which also includes the Bureau of Justice Assistance, the Bureau of Justice Statistics, the Office of Juvenile Delinquency Prevention, and the Office for Victims of Crime.

Establishing the Role of First Responders

Note: *The actions of public safety personnel providing emergency services at a fire scene are critical not only to lifesaving and fire suppression efforts but also to any subsequent investigation of the incident.*

1. Observe the Fire and Scene Conditions

Principle: Public safety personnel responding to a fire should observe conditions and activities at or near the scene so they can give investigators arriving later an accurate and complete description. First responders can gain information valuable to the fire investigation during their approach to and arrival at the scene.

Procedure: While approaching a fire scene, first responders should observe and mentally note the following conditions and activities and, as soon as conditions permit, initiate permanent documentation of the information (e.g., written notes, voice recordings, videotapes):

A. The presence, location, and condition of victims and witnesses.

B. Vehicles leaving the scene, bystanders, or unusual activities near the scene.

C. Flame and smoke conditions (e.g., the volume of flames and smoke; the color, height, and location of the flames; the direction in which the flames and smoke are moving).

D. The type of occupancy and use of the structure (e.g., a residential occupancy being used as a business).

E. Conditions of the structure (e.g., lights turned on; fire through the roof; walls standing; open, closed, or broken windows and doors).

F. Conditions surrounding the scene (e.g., blocked driveways, debris, and damage to other structures).

G. Weather conditions.

H. Unusual characteristics of the scene (e.g., the presence of containers, exterior burning or charring on the building, the absence of normal contents, unusual odors, fire trailers).

I. The fire suppression techniques used, including ventilation, forcible entry, and utility shutoff measures.

J. The status of fire alarms, security alarms, and sprinklers.

Summary: First responders' initial observations provide investigators with information pertinent to the investigation. As the investigation unfolds, these observations may provide the starting point for evidence collection and preservation efforts.

2. Exercise Scene Safety

Principle: Safety overrides all other concerns: Ensuring the safety of victims, bystanders, and public safety personnel is the first responders' foremost concern at a fire scene. First responders must take steps to identify and remove or mitigate safety hazards that may further threaten victims, bystanders, and public safety personnel. They must exercise due caution to avoid injuries to themselves and others.

Procedure: Upon arrival at the scene, first responders should:

A. Evaluate the scene for safety hazards (e.g., structural collapse of the building; smoke; electrical, chemical, or biological hazards; other health risks).

B. Establish safety/hazard zones.

C. Communicate hazards to other personnel arriving at the scene.

D. Use tools and personal protective equipment appropriate to the task during all operations.

Summary: Safety is the overriding concern during emergency operations and the subsequent investigation. To ensure the safety of civilians and public safety personnel, first responders should take steps to identify, evaluate, and mitigate scene hazards, and they should communicate those hazards to other public safety personnel arriving at the scene. Necessary safety zones should be established to receive victims as they are evacuated. Personal protective equipment and other measures should be used to ensure the safety of all persons at the scene. The scene should continually be reassessed to evaluate safety hazards that may change due to fire conditions or suppression efforts.

3. Preserve the Fire Scene

Principle: Evidence at a fire scene takes many different forms, some of which are transient (i.e., they are not permanent and may disappear quickly, such as impressions in snow or evaporating liquids). First responders must understand how rescue, medical, fire suppression, overhaul, and salvage efforts can adversely affect different forms of evidence and take steps to preserve

evidence accordingly. First responders should assess the fire scene to identify potential evidence, take preliminary steps to preserve it, and notify appropriate authorities about its existence.

Procedure: To preserve evidence, first responders should:

A. Observe and mentally note evidence that may be present at the scene, such as:

- Fire patterns (including multiple fire locations).
- Burn injuries to victims and fire patterns on clothing.
- Trailers, ignitable liquids, or other unusual fuel distribution (e.g., piles of newspapers, furniture pushed together).
- Incendiary/ignition/explosive devices (e.g., lighters, matches, timing devices).
- Shoe prints and tire impressions.
- Broken windows and doors.
- Distribution of broken glass and debris.
- Indications of forced entry (tools and tool marks).
- The process of opening concealed spaces to find pockets of fire and removing smoldering materials.
- The process of protecting, moving, or removing items.
- Containers.
- Discarded clothing.
- Trace evidence (e.g., hairs, fibers, fingerprints, blood, other body fluids).
- Evidence of crimes in addition to the possible arson (e.g., weapons, bodies, drugs, clandestine drug laboratory equipment).
- Witnesses, bystanders, and victims.
- Any other unusual items or the absence of normal contents or structural components.

B. Recognize threats to evidence (i.e., its movement, removal, contamination, or destruction) from any of the following sources:

- Fire suppression activities, such as a straight stream applied at the point of origin or deluge applications that may wash away or dilute potential evidence.
- Overhaul activities that destroy fire patterns.
- Salvage activities that involve moving or removing potential physical evidence.
- Use of a tool in any manner that causes destruction of evidence.
- Movement of knobs, switches, and controls on appliances and utilities.
- Weather conditions that affect transient evidence (i.e., wind, precipitation, or temperature changes).
- Personnel walking through the scene.
- Witnesses and victims leaving the scene.
- Medical intervention and treatment of victims (e.g., by damaging evidence at the scene or destroying victims' clothing).
- Premature removal or movement of bodies.
- Vehicles at the scene (e.g., that introduce fluid to the scene through vehicle leaks or destroy other evidence, including shoe prints and tire impressions).
- Contamination from external sources, such as fuel-powered tools or equipment.

C. Protect evidence by:

- Limiting excessive fire suppression, overhaul, and salvage.
- Avoiding needless destruction of property.
- Leaving bodies undisturbed.
- Flagging items of evidence with cones or markers.
- Recording observations through written notes or voice recordings.
- Covering items or areas containing evidence with objects that will not contaminate the evidence (e.g., clean boxes or tarpaulins).
- Isolating items or areas containing evidence with rope, barrier tape, barricades, or sentries.
- Retaining and securing clothing items removed from victims and suspects.
- Obtaining information about victims and witnesses (i.e., their names, addresses, and telephone numbers).
- Preserving transient evidence (e.g., trace evidence, shoe prints, tire impressions).
- Removing evidence at risk of imminent destruction by the fire or the structural collapse of the damaged building.
- Ensuring that later arriving investigators are fully apprised of the evidence discovered.

Summary: First responders should recognize items that may have evidentiary value in a subsequent investigation and take steps to protect them from damage that could result from the fire, fire suppression, or rescue efforts.

4. Establish Security and Control

Principle: Fire suppression and rescue efforts can be performed more efficiently and effectively if only essential authorized personnel are permitted access to the area. Restricting access also ensures the safety of civilians and helps to preserve the scene for subsequent investigation. First responders should immediately establish control of the scene. Then, as soon as conditions permit, first responders should initiate documentation of the scene to aid in the investigation.

Procedure: To establish security and control, first responders should:

A. Set up a security perimeter (e.g., using barrier tape, fire line, and sentry).

B. Control access into the scene through the security perimeter.

C. Initiate documentation of the scene. (See “Section C: Documenting the Scene.”)

Summary: The actions of first responders at a fire scene are not only critical to saving lives and suppressing fires; they also set the stage for the investigators arriving to process the scene by establishing a controlled security perimeter and initiating documentation of the scene.

5. Coordinate Activities

Principle: Emergency operations at the fire scene may involve many different agencies and organizations, each having a different focus and performing different activities. These activities must be well coordinated to accomplish emergency operations efficiently and to preserve the integrity of the scene. Upon arrival at the scene, first responders must establish an incident command system, which allows for a systematic flow and transfer of critical scene information.

Procedure: To coordinate activities at the scene, first responders should:

A. Establish a command post and implement an incident command system (i.e., a point of contact and line of communication and authority for public safety personnel).

B. Establish staging areas to ensure that emergency and support vehicles have access into the area.

C. Request additional personnel resources, such as firefighters, EMS personnel, law enforcement officers, investigators, and representatives of utility companies.

D. Inform authorities about the status of the incident, hazards, injuries, witnesses, the location of evidence, and other pertinent facts.

Summary: First responders must establish an incident command system to coordinate activities at the scene and communicate information to responsible authorities.

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UNIT 5: DETERMINATION OF AREA OF FIRE ORIGIN

TERMINAL OBJECTIVES

The students will be able to:

1. *Conduct a systematic fire scene examination by following the scientific method to effectively determine the origin and cause of a fire.*

2. *Describe the various myths and legends relating to a fire scene investigation.*

3. *Discuss the roles and responsibilities of the fire officer and fire investigators related to fire cause determination.*

ENABLING OBJECTIVES

The students will be able to:

1. *Examine a structure from the exterior to interior in a systematic manner to identify indicators that may help in the determination of the area of fire origin and cause.*

2. *Explain the significance of various fire patterns and fire spread issues.*

3. *List the most common building elements that may help pinpoint origin and cause.*

4. *Understand various myths and legends related to fire investigation.*

5. *Define the scientific method.*

6. *Name the steps in the scientific method.*

7. *Apply the scientific method to a fire scene investigation.*

8. *Understand the difference between the role of the fire officer and fire investigator.*

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UNIT 5: DETERMINATION OF AREA OF FIRE ORIGIN

Slide 5-1

ENABLING OBJECTIVES

- Examine a structure from the exterior to interior in a systematic manner to identify indicators that may help in the determination of the area of fire origin and cause.
- Explain the significance of various fire patterns and fire spread issues.

Slide 5-2

ENABLING OBJECTIVES (cont'd)

- List the most common building elements that may help pinpoint origin and cause.
- Understand various myths and legends related to fire investigation.
- Define the scientific method.

Slide 5-3

ENABLING OBJECTIVES (cont'd)

- Name the steps in the scientific method.
- Apply the scientific method to a fire scene investigation.
- Understand the difference between the role of the fire officer and fire investigator.

Slide 5-4

ROLE OF THE FIRE OFFICER IN FIRE INVESTIGATION

- National Fire Protection Association (NFPA) 1021, *Standard for Fire Officer Professional Qualifications*.
- Job performance requirements (JPRs) specifically related to fire investigation.

Slide 5-5

I. COMPANY OFFICER ROLE

A. National Fire Protection Association (NFPA) 1021, *Standard for Fire Officer Professional Qualifications*, outlines several job performance requirements (JPRs) related to fire cause determination responsibilities.

COMPANY OFFICER ROLE

- Often first person on the fire scene, and is in best position to observe critical information.
- Often the person who decides to request a fire scene investigator.
- Often decides if overhaul operations should be delayed.

Slide 5-6

B. The company officer (CO) is often the first person on the scene, and can observe and collect critical information.

1. Specific location of the fire.

2. Type and quantity of materials burning.

3. Impact of fire suppression efforts on fire behavior.

C. The CO or incident commander (IC) decides when to delay overhaul until fire origin and cause determination is completed.

1. Overhaul may require removing furniture, moving equipment, and opening walls and ceilings to check for hidden fire.

2. If overhaul is done before fire investigation is completed, the CO must ask:

a. Is there critical evidence that may be altered, lost or destroyed?

b. Is the area or room of fire origin clearly defined?

c. Should overhaul in the area or room of origin be delayed?

D. Considerations for the delay of overhaul.

1. Opening walls, pulling ceilings, and shoveling debris outside may destroy or conceal evidence.

2. Evidence may be contaminated or destroyed as it is removed.

E. Precautions to take if overhaul occurs before origin and cause determination is made.

1. Make a photographic or video record of the scene and position of potential clues or evidence.

2. Collect and safeguard evidence.

   a. Only if it will be altered or destroyed.

   b. If an incendiary fire is suspected, secure the scene and notify fire investigators.

3. Avoid exposing (and causing evaporation of) hidden pockets of ignitable liquid residue before the scene can be processed.

FIRE OFFICER I

- Performing a preliminary investigation to determine cause.
- Secure the scene to preserve and protect evidence from further damage and destruction.
- Notify investigators when necessary.

Slide 5-7

F. The CO may be the senior officer who determines if a fire investigator is needed.

1. Are circumstances found during and after fire suppression consistent with an accidental fire?

2. Are they consistent with a nonaccidental fire?

FIRE OFFICER II

- Determine area of origin and preliminary fire cause.
- Requisite knowledge includes: methods used by arsonists, common causes of fire, basic origin and cause determination, fire growth and development and documentation of preliminary fire investigative procedures.

Slide 5-8

G. Per NFPA 1021, a Fire Officer II has the responsibility to determine the area of origin and identify a preliminary cause.

FIRE OFFICER III AND IV

No additional JPRs related to fire investigation at this level.

Slide 5-9

H. Per NFPA 1021, a Fire Officer III and IV have no additional JPRs related to fire investigations.

NFPA 1033

- NFPA 1033, *Standard for Professional Qualifications for Fire Investigator*.
- The purpose of this standard shall be to specify the minimum JPRs for service as a fire investigator in both the public and private sectors.

Slide 5-10

I. NFPA 1033, *Standard for Professional Qualifications for Fire Investigator*, specifies the minimum JPRs for public and private sector fire investigators.

NFPA 1021 AND NFPA 1033

- It is important to remember that:
  – This course is designed to address the criteria outlined in NFPA 1021.
  – It is **not** intended to meet the criteria from NFPA 1033 and qualify you to be a "fire investigator."

Slide 5-11

NFPA 921

- Called a "guide" by NFPA.
- Considered to be a "standard of care" by state and federal courts.
- Developed by an open, committee consensus process.
- Basis for certification programs by professional organizations.

Slide 5-12

J. NFPA 921, *Guide for Fire and Explosion Investigations*, contains recommended guidelines that are widely used by fire investigators throughout the country to conduct fire and explosion investigations.

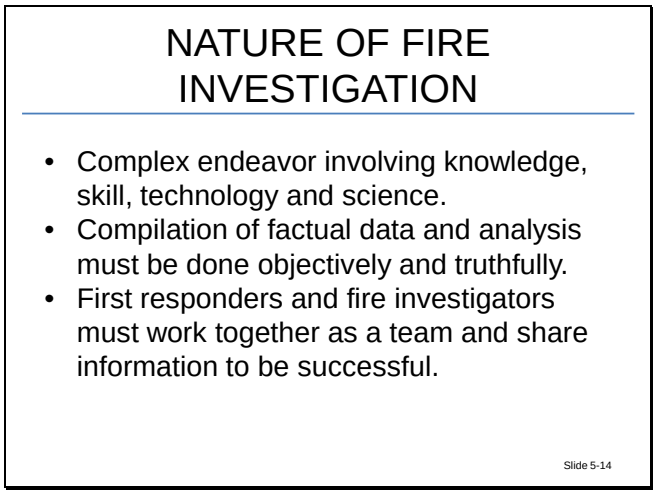
NFPA 921 (cont'd)

- Developed as model for the advancement and practice of fire and explosion investigation, fire science, technology and methodology.
- Basis for fire and explosion investigator training and education programs.

Slide 5-13

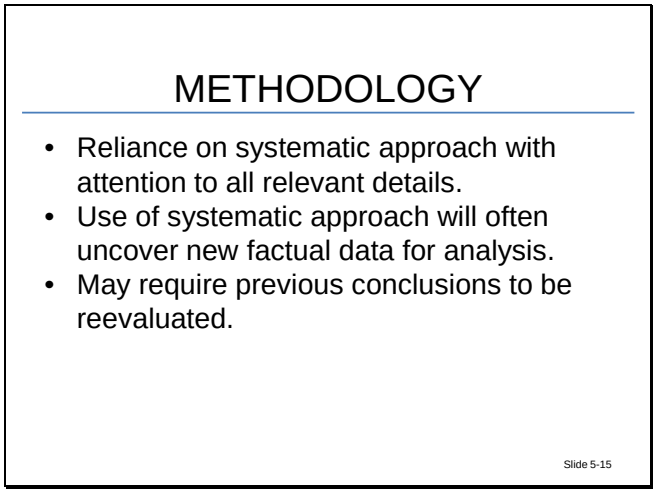
1. Developed as a model for the advancement of fire science and to promote the use of the scientific method in fire investigation.

2. Serves as the basis for most fire investigator training and continuing education programs.



II. SCIENTIFIC METHODOLOGY

A. Fire cause determination and investigation should be based on a team approach focusing on the collection of all facts and circumstances, analyzed objectively and truthfully to reach valid conclusions.



B. The process used to collect and analyze data should follow a systematic approach.

PROCESS

- Proper methodology with fire investigation is:
  – First determine and establish the origin(s).
  – Then investigate cause (circumstances, conditions, or agencies that brought the ignition source, fuel and oxidant together).

Slide 5-16

C. The CO needs to process a fire scene in an orderly and logical manner.

1. Outside to inside.

2. Least damaged to most damaged.

3. Once the origin is established, the circumstances or conditions responsible for ignition must be identified.

D. This may be difficult depending on the severity of the fire damage.

E. Significantly fire-damaged structures usually have fire damage to several rooms or floors.

1. Inspection starts outside with a 360-degree observation of the scene.

2. Determine which portions appear most damaged and least damaged.

3. Continue inside the structure from the least burned area toward the most damaged (likely room or area of origin).

4. Limited fire damage usually results from fires that do not reach flashover or are otherwise suppressed.

   a. Start inside the room from the least-damaged area toward the area of greatest fire damage.

   b. Note the extent of smoke and heat damage.

SYSTEMATIC APPROACH

- Recommended systematic approach is that of scientific method.
- Used in physical sciences.
- Provides for the proper collection, analysis and evaluation of data necessary in a successful investigation.

Slide 5-17

5. A fire scene examination that follows the scientific method provides for the proper collection, analysis and evaluation of information used to determine the origin and cause of a fire.

STEPS OF SCIENTIFIC METHOD

Recognize the need (identify the problem)
↓
Define the problem
↓
Collect data
↓
Analyze data
↓
Develop a hypothesis (inductive reasoning)
↓
Test hypothesis (deductive reasoning)
↓
Select final hypothesis

Slide 5-18

F. The scientific method is based on the following steps:

1. Recognize the need.
2. Define the problem.
3. Collect data.
4. Analyze data.
5. Develop a hypothesis.
6. Test hypothesis.

7. Select final hypothesis (conclusion).

STEP 1
RECOGNIZE THE NEED

- Problem exists.
- Fire or explosion has occurred.
- Cause should be determined so that future similar incidents can be prevented.

Slide 5-19

G. Recognize the need — A fire has occurred and a fire cause needs to be determined.

STEP 2
DEFINE THE PROBLEM

- Define the manner in which the problem can be solved.
- Proper origin and cause investigation conducted.
- Examination of scene and combination of other data collection methods.
- Review of previous investigations of the incident, interviews, scientific testing.

Slide 5-20

H. Define the problem — Determine the manner in which the origin and cause of the fire can be identified.

STEP 3
COLLECT DATA

- Facts are now collected.
- Collected by observation, experiment or other direct data gathering means.
- This is “empirical data.”
- Must be based on observation or experience.
- Capable of being verified.

Slide 5-21

I. Collect data — Based on observation, experience or other means, it is capable of being verified.

STEP 4
ANALYZE DATA

- All data must be analyzed.
- Essential step before forming final hypothesis.
- Based on knowledge, training, experience and expertise.
- Form hypothesis based on evidence, rather than speculation.

Slide 5-22

J. Analyze data — An essential step before forming a final conclusion based on knowledge, training and experience.

STEP 5
DEVELOP A HYPOTHESIS

- Based on the data analysis.
- Form a hypothesis that explains what happened.
- Based **solely** on empirical data.
- Known as "inductive reasoning."

Slide 5-23

K. Develop a hypothesis — Based on data analysis, identify potential scenarios or factual reasons why the fire may have occurred.

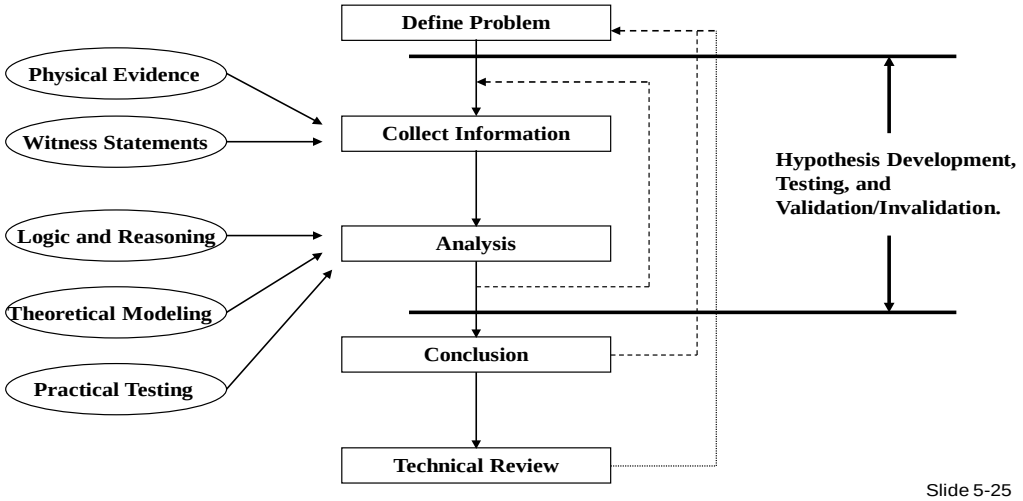
STEPS 6 AND 7 — TEST AND SELECT FINAL HYPOTHESIS

- Must withstand the test of careful and serious challenge.
- Deductive reasoning.
- Comparison of **all** known facts as well as body of scientific knowledge.
- Can be experiment or research.

Slide 5-24

L. Test and select final hypothesis — Compare all known facts and information necessary to form a valid conclusion concerning the fire's origin and cause based on generally accepted scientific principles to arrive at a final cause.

SCIENTIFIC METHOD (APPLIED TO FIRE INVESTIGATION)



Slide 5-25

III. FIRE SCENE EXAMINATION

RESPONSIBILITY FOR FIRE/ARSON INVESTIGATION

- Fire department (including state fire marshals)
- Police department-based units
- Joint fire/police teams
- Arson task "strike" forces
- Generally, joint fire/police teams and arson task "strike" forces are the most successful units.

Slide 5-26

A. Responsibility for fire/arson investigation.

1. Fire department.
2. Police department (or other law enforcement-based agencies).
3. Joint fire/police teams.
4. Arson task or strike forces.

SCENE EXAMINATION

- The major objective of a fire scene examination is to determine the origin and cause of a fire through the recognition, identification and analysis of fire (burn) patterns.

Slide 5-27

B. The major objective of a scene examination is to determine the origin, cause and associated responsibility.

SCENE EXAMINATION (cont'd)

- Requires reconstruction of the events leading up to the time that the ignition source (heat) came in contact with the first material ignited (fuel) to determine the fire cause.

Slide 5-28

C. Examination requires personnel to reconstruct the events and circumstances that led up to the time of the fire.

SCENE EXAMINATION (cont'd)

- The ignition sequence is an event that allows a competent ignition source to initiate combustion.
- The act or conditions that led to the ignition of the fuel package establishes the fire cause.

Slide 5-29

D. The ignition sequence is the act or circumstances that contributed to the cause of the fire and must be identified in all incidents to properly classify a fire as either accidental, natural, incendiary, or undetermined.

SCENE EXAMINATION (cont'd)

- There are four basic steps in determining the area of origin:
  – Examine the exterior of the structure or vehicle and surrounding area.
  – Examine the interior of the structure or vehicle.
  – Interview everyone present that may have information related to the fire.
  – Analyze and evaluate information using the scientific method.

Slide 5-30

E. The four basic steps in determining the area/point of origin are:

1. Examine exterior.
2. Examine interior.
3. Obtain information from witnesses (interviews).
4. Analyze information using the scientific method.

SCENE EXAMINATION (cont'd)

- The determination of fire cause begins with the identification of the point of origin.
- The general systematic approach is to work from areas of least damage to most damage.

Slide 5-31

F. The first step in successfully determining the fire cause is to identify the area/ point of origin.

SCENE EXAMINATION (cont'd)

- Once the origin is identified, a careful analysis of this area is required to determine the cause.
- Personnel should keep in mind that the area of greatest damage is not always the point of origin.

Slide 5-32

G. Once the suspected area/point of origin has been identified, every layer of debris must be carefully and thoroughly examined to identify the potential cause.

SCENE EXAMINATION (cont'd)

- Exterior to interior.
- Areas of least to most damage.
- Evaluate patterns.
- Evaluate all potential accidental sources of ignition.
- Notify investigators if there is any indication of an intentionally set fire.

Slide 5-33

H. Recommended systematic approach works from the exterior to the interior and from the least damage to the most damage.

1. Evaluate any fire patterns that are observed.

2. Evaluate all potential accidental ignition sources in or around the area of origin.

EXTERIOR EXAMINATION

Areas of greatest fire involvement.

Slide 5-34

3. Note areas of greatest damage.

EXTERIOR EXAMINATION (cont'd)

Fire patterns and wind conditions.

Slide 5-35

4. Note areas where fire exited the building.

   a. Examine doors to determine if they were open prior to or during the fire.

   b. Doors open during fire generally will be more damaged on the side of fire travel.

   c. Doors closed during fire generally will be damaged evenly across.

EXTERIOR EXAMINATION (cont'd)

Burn patterns at ventilation points.

Slide 5-36

5. Examine all sides of the structure.

   a. Walk around the entire structure.

   b. Note items that may be critical to fire origin and cause determination.

   c. A fire starting in a living room sofa could create a "V" pattern leading into the next room or to the floor or ceiling above.

EXTERIOR EXAMINATION (cont'd)

Burn patterns at ventilation points.

Slide 5-37

6. Note building construction classification type, or method of construction.

7. It often helps to view the fire building from the top of an aerial device to get another perspective of the path of fire travel.

EXTERIOR EXAMINATION (cont'd)

- Conduct a 360-degree exterior examination of the fire scene.
- The results of the exterior examination should be fully documented.
- Note burn patterns and other evidence that may be present or other information important to the investigation.

Slide 5-38

I. Personnel should first conduct a 360-degree exterior examination of the fire scene. The results of the exterior examination should be fully documented. Any signs of burn patterns, evidence, or any other information that may be pertinent to the investigation, should be noted.

PRIOR TO ENTRY

- Safety first!
- Proceed from areas of least damage to most damage.
- Be aware of evidence contamination issues (e.g., refueling of gasoline-powered equipment).

Slide 5-39

IV. EXAMINATION OF INTERIOR STRUCTURAL COMPONENTS

A. Security prior to the fire.

1. Signs of forced or broken windows.

   a. Were windows forced or broken during fire suppression?

   b. Is clear or stained glass located inside or outside the building?

2. Signs of forced entry or broken doors.

a. Were they forced during fire suppression?

b. Type and number of locks on the door?

B. Unusual events or out-of-place items.

1. Fuel containers that do not belong in the area.

a. Found in a hidden area?

b. Are containers empty or full?

2. Repair work in progress.

a. Are there signs of heating devices?

- Torches.
- Paint-removing heaters.
- Space heaters.
- Ladders to roof.

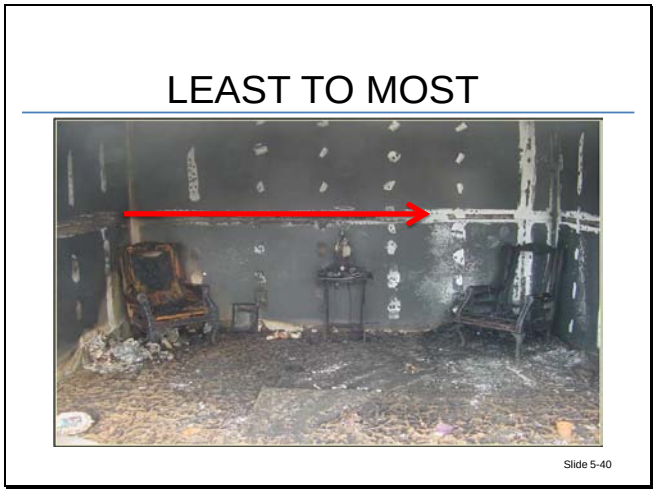
b. Ladders to the roof also may indicate an attempt to extinguish a fire.

3. Electrical equipment on the outside of the structure.

a. Holiday lighting.

b. Heat tapes for pipes.

c. Heat tapes for edges of roof.



C. The examination proceeds from the least damaged area to the most damaged area.

1. This helps avoid hasty and perhaps faulty judgments about the area of fire origin.

2. All visible fire patterns and clues are evaluated to determine the area of fire origin.

INTERIOR EXAMINATION

Slide 5-41

D. The process surveys structural elements to check for path of fire and smoke spread.

1. Lightly smoke-stained, damaged and charred areas to heavily smoke-stained, damaged and charred areas.

2. Components may be charred more heavily on the side facing the fire origin, as it was exposed longer to the heat source.

   a. Holes in the ceiling may have helped the fire spread.

   b. Damage could be due to fire suppression activity.

   c. There may have been openings in or damage to the ceiling prior to the fire.

3. Areas above doors closest to the fire origin may have more severe charring.

4. Ceiling damage as one approaches the area of fire origin should become greater.

5. Check floor for all fire damage and compare it to the ceiling damage in the room/area of origin.

a. Note carpet burns or melting.

b. Carefully evaluate extensive damage, such as holes burned through. Look for:

- Signs of distinct patterns of burned and unburned areas.

6. Doors also can provide clues about fire travel.

a. Doors closed at the time of a fire should exhibit an even burn pattern.

b. Edges of the door should be protected from burning or charring.

c. Doors closed at the time of fire with fire on bottom side may indicate use of ignitable liquids.

d. Doors open at the time of fire should exhibit a distinct burn pattern.

- Burning should be greater at the hinged side of the door.

- If fire came from low burning, the burn pattern on the door should be at an angle.

E. Nonstructural building components.

1. May provide clues to the lowest level of fire activity.

2. Shelving should be evaluated for burning on the bottom as well as on the top.

a. The top often will be protected by the material placed on it.

b. If shelves collapsed onto other shelves, find the lowest level of burning.

COMMON FIRE SCENE PATTERNS/TERMINOLOGY

- "V" pattern
- Trailers
- Charring
- Lines of demarcation (smoke/heat line)
- Calcination of gypsum board
- Clean burn
- Protected areas

Slide 5-42

F. There are several terms used to describe many types of patterns that may be commonly found at fire scenes.

FIRE PATTERNS

- Major objective of a fire scene examination is the recognition, identification, and analysis of fire patterns.
- Analysis of fire patterns is performed in an attempt to trace fire spread, identify areas and point of origin, and identify the fuels involved.

Slide 5-43

G. An important step in the fire cause determination process is to analyze fire patterns which may prove helpful in locating the area/point of origin and identifying the fire cause.

DYNAMICS OF PATTERN PRODUCTION

The damage created by flame, radiation, hot gases, and smoke creates patterns that investigators use to help locate the area or point or origin.

Slide 5-44

H. Dynamics of pattern production.

1. As fire travels through a structure, it creates various patterns that may assist in determining the origin and cause.

2. Relatively even burning on interior surfaces may indicate burning from a thermal layer of radiant heat due to flashover.

3. Items in the path of the fire, such as shelves, may block the fire's normal path.

"V" PATTERNS

- Created by flames, convective or radiated heat from hot fire gases, and smoke within the fire plume.
- Appearance and size depends on:
  - Heat Release Rate (HRR)
  - Geometry/Size of fuel package
  - Ventilation
  - Ignitability of vertical surface

Slide 5-45

I. The characteristic pattern from a fire is commonly referred to as a "V" pattern.

1. Fire normally progresses upward and outward.

   a. Wind direction associated with ventilation may affect this.

   b. Heat release ratio and geometry/size of fuel package.

c. Ceiling damage directly above the area of origin will usually be significant.

"V" PATTERN (cont'd)

Slide 5-46

2. Examine "V" patterns at the base of walls for possible sources of ignition.

   a. It is common for items like a trash container to be found in the area of origin and it should be evaluated to determine its role in the fire.

   b. Was something present that was observed during fire suppression?

INVERTED "V" PATTERN

Slide 5-47

J. An inverted "V" pattern is not necessarily an indicator of an incendiary fire. The proper interpretation is a fire of relatively short duration that did not fully develop from floor to ceiling.

FIRE PATTERNS

- There are two basic types of fire patterns:
  - Movement patterns
  - Intensity patterns

Slide 5-48

K. The two basic types of fire patterns that may be found at fire scenes are movement patterns and intensity patterns.

MOVEMENT PATTERNS

- Flame and heat movement patterns are produced by the growth movement of fire and products of combustion away from an initial heat source.
- If accurately identified and analyzed, these patterns can be traced back to the origin of the heat source that produced them.

Slide 5-49

L. Movement patterns.

1. Produced by the growth of the fire and products of combustion away from the initial heat source.

2. Can be traced back to the origin of the heat source if properly evaluated.

INTENSITY PATTERNS

- Flame and heat intensity patterns are produced by the response of materials to the effects of various intensities of heat exposure.
- The various heat effects on a certain material can produce lines of demarcation.

Slide 5-50

M. Intensity patterns.

1. Produced by the response of the materials to the effects of exposure to various levels of heat.

2. The heat effects on certain materials can produce distinctive lines of demarcation.

LOW BURN PATTERNS

- The investigator should identify these areas of low burning and be cognizant of their possible proximity to a point of origin.
- In a compartment where the fire has transitioned through flashover to the fully developed stage, burning down to floor level is **not necessarily indicative of an origin at the floor level.**

Slide 5-51

3. Low levels of burning must be evaluated.

   a. It could lead to the area or point of fire origin.

   b. It could be the result of a secondary fire resulting from burning material dropping below the original point of origin.

BUILDING CONTENTS

- Patterns can be present on the sides, tops, and bottoms of building contents.
- Patterns will be similar in shape but may display only a portion of the pattern due to limited side of items.

Slide 5-52

V. EXAMINATION OF BUILDING CONTENTS

A. "V" patterns may be found on the top of shelves, tables, dressers, or other items.

1. Fires originating on top of dressers, shelves, and tables should be evaluated for a cause.

2. Look for electrical items, evidence of smoking materials, or possible accelerants.

3. Items there that do not seem to belong.

   a. Were there items moved into or out of the area before the fire occurred?

   b. Were cheaper items substituted for expensive items?

   c. Were items arranged in an unusual way?

   d. Were items placed in a safe area as opposed to one not normally secured?

   e. Were items of clothing missing from closets?

4. A large pile of clothing placed on a bed and set on fire may indicate an interpersonal or domestic problem (spite/revenge motive).

   a. Do items appear to be out of place?

   b. Were furniture or other items conveniently rearranged for a fire?

   c. Was furniture used to block doors and make entry difficult?

B. Examination of contents.

1. Furniture may provide clues to the fire origin or path of fire travel.

   a. Is one side burned more heavily than another?

   b. Is it burned more on the top than on the bottom?

   c. Was there a high fuel load?

   d. Are the legs or feet of furniture burned at or near the floor?

2. Examination of appliances may reveal if the damage was related to the cause of the fire or was the result of the fire.

   a. If the power switch can be located, was the power on or off?

   b. Were the appliances plugged in at the time of the fire?

   c. Is the appliance case or cabinet more heavily damaged on the inside or the outside?

   d. Is there any indication that the fire originated at or near an appliance?

   e. Heating sources such as a kitchen stove, heater, iron, or other appliances should be evaluated carefully.

EFFECTS OF ROOM VENTILATION

- Where fresh air ventilation is available to a fire, it is not uncommon to find locally heavy damage patterns on combustible items.
- These patterns may be close to the ventilation opening which may have no relevance to the point of origin.

Slide 5-53

C. Ventilation can produce burn patterns that may be confused with the area/point of origin.

POST-FLASHOVER DAMAGE

- It is not uncommon for the flashover process to modify, or obliterate, many of the fire indicators that existed prior to flashover.
- This is especially true for fire patterns.

Slide 5-54

D. Flashover can modify or destroy many of the indicators and patterns that are used by investigators to identify the origin and cause of the fire.

WARNING

- In most cases no single pattern in and of itself should be relied upon to draw a conclusion as to a fire's origin and cause.
- Old thoughts, theories, and literature gave different meanings and interpretations to some patterns.

Slide 5-55

E. No single pattern should be relied upon to conclusively determine the fire's origin and cause.

WARNING (cont'd)

- Patterns should be examined and evaluated in light of other information obtained from sources at the scene.

Slide 5-56

1. There are many different meanings and interpretations given to the creation and analysis of fire patterns, therefore be cautious in relying solely upon them during fire cause determination.

2. Always examine fire patterns in conjunction with information collected at the scene.

FIRE SCENE RECONSTRUCTION

Photo by R.J. McCormick

Slide 5-57

F. Reconstruction of the fire scene is a valuable tool to help identify prefire locations of building contents and their proximity or relationship to the fire origin.

1. No item should be moved until the fire cause has been determined. If items are moved, they should first be documented and photographed.

2. Moving items from the room/area of origin before a cause determination has been made, severely hampers the ability to make an accurate cause determination.

EVALUATE APPLIANCES

Note position of controls.

Slide 5-58

G. All appliances and equipment located in or near the area/point of origin need to be examined, especially documenting whether, if any of them, were left on or operating at the time of the fire.

CONTENTS AND FURNISHINGS

Slide 5-59

H. All contents and furnishings should be left in place so they can be used as indicators to help identify the location or sources of heat that may have been present.

ROLE OF ELECTRICAL SYSTEM AND EQUIPMENT

Slide 5-60

I. The role of the electrical system and any electrical equipment or appliances that may be in or near the area/point of origin must be evaluated to rule them in or out as a potential cause of the fire.

SPRINKLER SYSTEM ACTIVATION

Slide 5-61

J. Sprinkler system(s), if present, must be inspected to determine if it was operational and activated as designed.

FIRE PROTECTION SYSTEM ACTIVATION

Slide 5-62

K. Fire protection systems, if present, must be inspected to determine if they were operational and activated as designed.

INVENTORY

Slide 5-63

L. The presence or absence of inventory should be noted as it may have a connection to the underlying cause of the fire. The inventory should be consistent with the use/occupancy of the building.

ACCOUNTABILITY OF KEYS

Slide 5-64

M. The accountability of keys and who they were assigned to should be documented as it may provide a clue as to who had access to the building/structure.

MYTHS, LEGENDS AND PITFALLS

- Temperatures in accelerated fires are higher than temperatures in nonaccelerated fires.
- Burns to the floor are conclusive indicators that an accelerant was used.
- Gasoline-fueled fires burn hotter than typical fuel loads.

Slide 5-65

VI. MYTHS, LEGENDS AND PITFALLS

A. There are many myths and misconceptions that have been passed down over the years in fire investigation that have since been proven through science and research not to be valid indicators of arson. The most common myths are:

1. Temperatures are always higher in accelerated fires.

2. Burns to the floor are positive indicators that an accelerant was used.

3. Gasoline fires always burn hotter than normal fires.

MYTHS, LEGENDS AND PITFALLS (cont'd)

- Melted aluminum thresholds mean an accelerant was used.
- Area of most damage always equals the area (point) of origin.
- Multiple "origins" always means — incendiary.

Slide 5-66

4. Melted aluminum thresholds mean an accelerant was used.

5. Area/Point of origin always has the most damage.

6. Multiple origins always mean the fire was incendiary.

MYTHS, LEGENDS AND PITFALLS (cont'd)

- Annealing of springs indicate an accelerant was used.
- Spalling is an indicator of an ignitable liquid pour.
- Spidering or crazing of glass means the fire was accelerated.

Slide 5-67

7. Annealing of springs always indicates an accelerant was used.

8. Spalling of concrete always indicates an accelerant was used.

9. Spidering or crazing of glass always indicates an accelerant was used.

MYTHS, LEGENDS AND PITFALLS (cont'd)

MYTH: Temperatures in accelerated fires are higher than temperatures in nonaccelerated fires.

REALITY: The temperature of the fire is relatively the same based on geometry and ventilation conditions (e.g., wood and gasoline burn at approximately 1,880 ºF (1,027 ºC)).

Slide 5-68

B. Reality to previous myths and misconceptions are:

1. The temperatures of accelerated and nonaccelerated fires are approximately the same.

Accelerated. Nonaccelerated.

Slide 5-69

MYTHS, LEGENDS AND PITFALLS (cont'd)

MYTH: Burns to the floor are conclusive indicators that an ignitable liquid was used.

REALITY: Burns to the floor can result from several factors including post-flashover burning, fall down/drop down, fuel load, etc.

Slide 5-70

2. Burns to the floor can result from several factors including flashover, fall-down/dropdown and ventilation.

Slide 5-71

MYTHS, LEGENDS AND PITFALLS (cont'd)

MYTH: Melted aluminum thresholds mean an ignitable liquid was used.

REALITY: Melted aluminum thresholds are commonly caused by the effects of flashover, not the use of ignitable liquid pours. (Aluminum melts at approximately 1,220 ºF (660 ºC).)

Slide 5-72

3. Melted aluminum thresholds are commonly caused by the effects of flashover and not the use of ignitable liquids.

Slide 5-73

MYTHS, LEGENDS AND PITFALLS (cont'd)

MYTH: The area with the greatest damage is always the area of origin.

REALITY: Several factors must be taken into consideration when identifying areas of greatest damage such as fuel load, ventilation, location of fuel and geometry of fuel.

Slide 5-74

4. There are several factors that must be considered when identifying areas of greatest damage such as fuel load, ventilation, location or fuel and geometry of fuel.

Slide 5-75

MYTHS, LEGENDS AND PITFALLS (cont'd)

MYTH: Multiple origins always means an incendiary fire cause.

REALITY: Multiple origins can be caused by fall down/drop down burning and flashover. Fires that are thought to have multiple origins must be shown to have separate, noncommunicating points of origin.

Slide 5-76

5. Multiple origins can be caused by flashover, fall-down/dropdown and ventilation.

Slide 5-77

MYTHS, LEGENDS AND PITFALLS (cont'd)

MYTH: Annealing of springs is always the result of use of an accelerant.

REALITY: Annealing of springs is dependent on temperature and can be caused by accidental means provided the temperature reaches 1,000 ºF (538 ºC) or higher.

Slide 5-78

6. Annealing of springs may also be caused by various accidental means as long as the temperatures reach at least 1,000 °F (538 °C).

Slide 5-79

MYTHS, LEGENDS AND PITFALLS (cont'd)

MYTH: Spalling is a positive indicator of an ignitable liquid pour.

REALITY: Spalling is the fracturing of concrete or brick surfaces as a result of exposure to thermal or mechanical stress.

Slide 5-80

7. Spalling can be caused by thermal or mechanical stress.

Slide 5-81

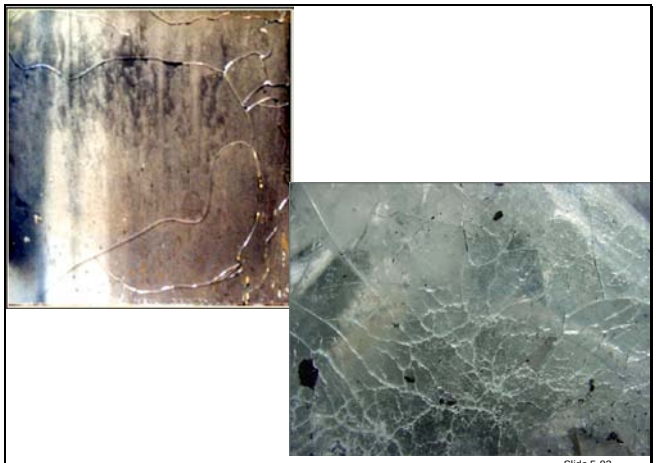
MYTHS, LEGENDS AND PITFALLS (cont'd)

MYTH: Spidering or crazing of glass means the fire was accelerated.

REALITY: Spidering or crazing of glass is the internal shattering into small irregular areas caused by the sudden cooling of hot glass.

Slide 5-82

8. Spidering or crazing of glass is caused by sudden cooling and not necessarily by ignitable liquids.



Slide 5-83

MYTHS, LEGENDS AND PITFALLS (cont'd)

- There are several variables that affect the condition of glass after fire. These include the type and thickness of glass, rate of heating, degree of insulation to the edges of the glass provided by the glazing method, degree of restrain provided by the window frame, history of the flame contact, and cooling history.

Slide 5-84

a. Several variables affect the condition of glass after a fire including type and thickness, rate of heating and amount of insulation.

SMOKE STAINS ON GLASS

Slide 5-85

TEMPERED GLASS

- Tempered glass, whether broken when heated by fire impact or when exploded, will break into many small cube-shaped pieces.
- This should not be confused with crazed glass that tends to be more regularly shaped than the complicated pattern of short cracks of crazing.

Slide 5-86

b. Tempered glass may break into many small pieces whether broken by heat or impact.

VENTILATION

- Auto ventilation — caused by the fire breaking through an obstruction such as a window or roof.
- Mechanical ventilation caused by fire department cutting hole in roof or breaking windows.

Slide 5-87

VII. FIRE EFFECTS AND INDICATORS

A. Ventilation may be introduced by the fire department as part of their suppression activities or by the fire itself, breaking out the windows or other openings.

LINES OF DEMARCATION

- Lines or areas that are borders defining the differences in certain heat and smoke effects of the fire on various materials that may be used to determine direction of fire spread or differences in intensity of burning.

Slide 5-88

B. Lines of demarcation are lines that separate burned from unburned areas.

LINES OF DEMARCATION (cont'd)

- The production of lines, areas of demarcation, and subsequent fire patterns that they define, depend on a combination of variables:
  - The material itself.
  - The rate of heat release of the fire.
  - Fire suppression activities.
  - Temperature of the heat source.
  - Ventilation.
  - Time the material is exposed to the heat.

Slide 5-89

C. Lines of demarcation may be caused by burning materials, ventilation, length of time materials are exposed to heat, or fire suppression activities.

LINES OF DEMARCATION (cont'd)

Slide 5-90

SURFACE EFFECTS

The characteristics of the material and shape and texture of the surface can affect the shape of the lines of demarcation displayed and the amount of pyrolysis and combustion by differing surface areas.

Slide 5-91

D. The lines of demarcation may be affected by the type of surfaces and the extent of combustion that occurred.

PENETRATION OF HORIZONTAL SURFACES

- Penetration of horizontal surfaces from above or below can be caused by radiant heat, direct flame impingement, or localized smoldering with or without the effects of ventilation.

Slide 5-92

E. Penetration of horizontal surfaces may be caused by radiant heat, direct flame contact or localized burning.

PENETRATION OF HORIZONTAL SURFACES (cont'd)

- In fully involved compartments hot gases may be forced through small pre-existing openings in a floor resulting in a penetration.
- Penetration may also be the result of intense burning under items such as polyurethane mattresses, couches or chairs.

Slide 5-93

F. Penetrations may also be caused by hot gases being forced through pre-existing openings or intense burning under items such as mattresses, couches or chairs.

PENETRATION OF HORIZONTAL SURFACES (cont'd)

- Penetrations in a downward direction are often considered unusual because the more natural direction of heat movement is upward through the action of buoyancy.

Slide 5-94

G. The normal direction of heat movement is upward, therefore any evidence of downward burning in floors and/or ceilings should be carefully evaluated.

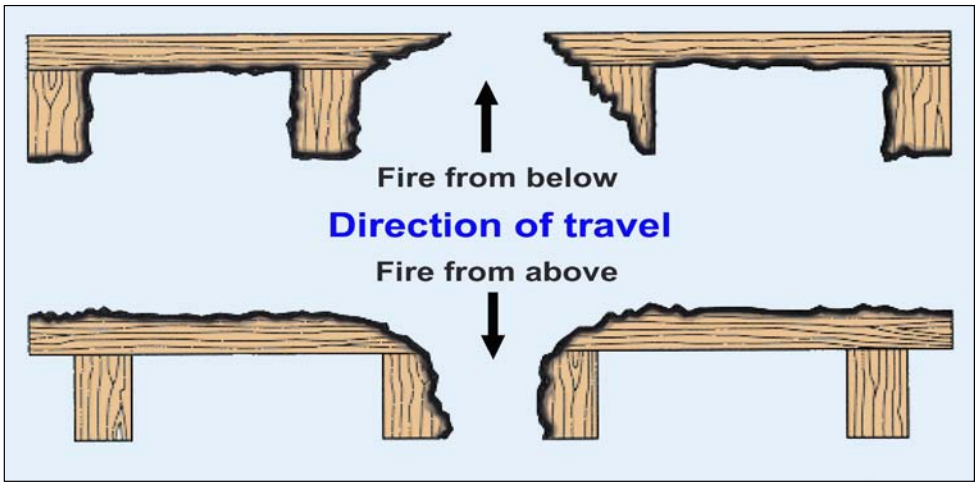
PENETRATION OF HORIZONTAL SURFACES (cont'd)

- A hole burned into a surface, whether from above or below, may be identified by examining the sloping sides of the hole.

Slide 5-95

H. Examination of the sloping sides of holes in horizontal surfaces can help determine whether it was created from above or below the surface.

BURNING PATTERNS THROUGH FLOORS



- NFPA 921, *Guide for Fire and Explosion Investigations*

Slide 5-96

TEMPERATURE DETERMINATION

The amount of heating depends on the temperature and velocity of the airflow, the geometry and physical properties of the heated item, its proximity to the source of heat, and the amount of heat energy present.

Slide 5-97

I. The amount of heating depends on several factors including the temperature and velocity of the air flow, physical properties of the burning item, its location in relationship to the heat source and the amount of energy present.

MELTING OF METALS

- Aluminum melts at approximately 1,220 ºF (660 ºC).
- Copper melts at approximately 1,981 ºF (1,083 ºC).
- Steel melts at approximately 2,660 ºF (1,460 ºC).
  – At temperatures above 1,000 ºF (538 ºC), steel will begin to soften and fail depending on the load.

Slide 5-98

J. Melting of metals (aluminum, copper and steel) may provide a clue regarding the approximate temperatures the fire may have reached.

SMOKE AND SOOT

- Smoke and soot can collect on cooler surfaces of buildings or its contents, often on upper parts of walls in rooms adjacent to the fire.
- Smoke tends to condense on walls, windows and other cooler surfaces.

Slide 5-99

K. Smoke and soot typically collect on cooler surfaces, such as walls and windows in the upper areas of a room.

CLEAN BURN

- Produced most commonly by conductive heat or intense heat transfer to a surface.
- Although they can be indicative of intense heating in an area, **clean burn areas by themselves do not necessarily indicate areas of origin.**

Slide 5-100

L. Areas of clean burn by themselves do not necessarily indicate the areas/points of origin but typically are an indication of intense heating or direct flame contact in the area.

CLEAN BURN ON INTERIOR OF STRUCTURE

Slide 5-101

CALCINATION

- Moisture content is driven-out of gypsum due to heat.
- The paper surface will char and might also burn off.

Slide 5-102

M. Calcination usually occurs when the moisture content of gypsum board (drywall) is depleted due to intense heating in the area.

HEAT SHADOWING

- The object blocking the travel of the heat energy may be solid, liquid, combustible or noncombustible.

Slide 5-103

N. Heat shadowing occurs when objects located within the compartment block or limit the flow of heat.

HEAT SHADOWING (cont'd)

- Any object that absorbs or reflects the heat energy may cause the production of a pattern.

Slide 5-104

O. Patterns created by the effects of heat shadowing can be produced by any object that absorbs or reflects heat energy.

What aided in the fire spread?

Heating, ventilating and air conditioning (HVAC) unit supply and return vents may influence fire spread in a room.

Slide 5-105

FLOORS

Burning from full room involvement can also produce burning of floors around door thresholds and baseboards due to radiation or air sources (ventilation).

Slide 5-106

P. Evidence of burning on floors, around door thresholds and/or baseboards can be caused by full room involvement or ventilation.

PROTECTED FLOOR AREAS

- The presence of furniture, stock, counters, or storage may result in these linear patterns.
- These patterns may also result from wear on floors, and the floor covering due to high traffic, and may be confused with ignitable liquid pour patterns.

Slide 5-107

Q. Protected areas on the floor can be caused by furniture, office equipment, appliances, etc. that are located in the area and present at the time of the fire. The patterns created should not be confused with ignitable liquid (pour) patterns.

PROTECTED FLOOR AREAS (cont'd)

Slide 5-108

PROTECTED FLOOR AREAS (cont'd)

- Irregularly shaped objects on the floor, such as clothing or bedding, may also provide protection, and produce patterns that may be confused with ignitable liquid pour patterns.

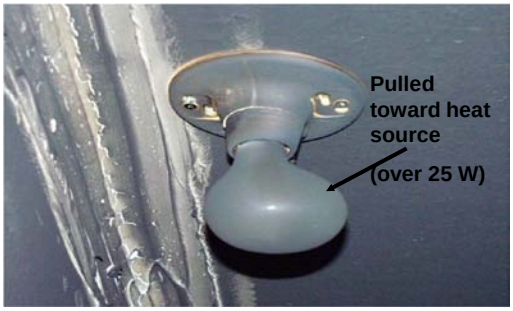
Slide 5-109

R. Other items that are located on the floor may also produce patterns that can be confused with ignitable liquid (pour) patterns.

PROTECTED FLOOR AREAS (cont'd)

Slide 5-110

LIGHT BULBS



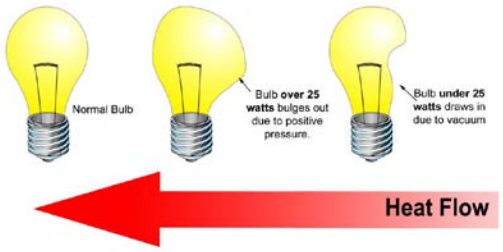
Slide 5-111

S. Incandescent light bulbs over 25 watts may begin to distort when subjected to a temperature of 900 °F (482 °C), for a length of 10 minutes, and will usually distend in the direction of the fire origin or source of heat.

1. Bulbs usually will have smoke residue on them.

2. The side toward the fire origin may have less residue.

HEAT EFFECTS ON INCANDESCENT LIGHT BULBS



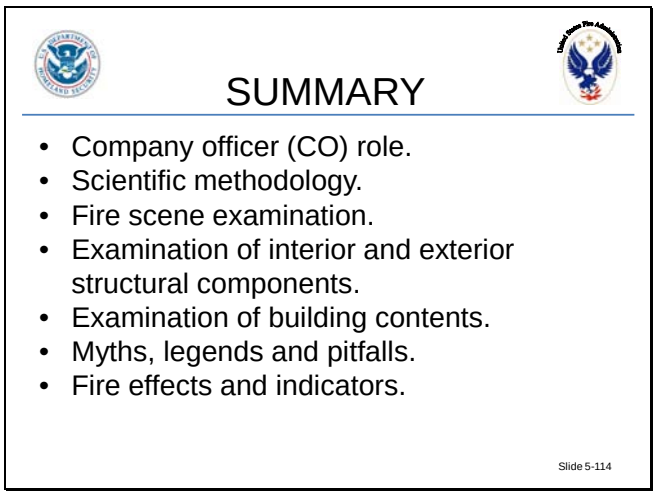
Slide 5-112

3. Bulbs heated evenly may not leave a clue.
4. Bulbs may rupture with only a small part of the glass globe missing.
5. Bulbs may distort in such a manner that no significant clues remain.

DVD PRESENTATION

"NFPA 921 Determining Origin and Cause (5 in a series)"

Slide 5-113



VIII. SUMMARY

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APPENDIX

FIRE SCENE EXAMINATION CHECKLIST

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Fire Scene Examination Checklist

This checklist is provided to help the company officer (CO) and crew conduct a systematic examination of the fire scene to help determine the area of fire origin and the possible cause.

1. Should overhaul be delayed to allow fire cause determination? [ ] yes [ ] no

2. Exterior Examination Observations

   a. Classification of building construction _____

   b. Estimated age of construction _____

   c. Area(s) of greatest damage _____

   _____

   _____

   d. Area(s) where fire exited building _____

   _____

   _____

   e. Are there obvious fire patterns? [ ] yes [ ] no

   f. Was building secure prior to the fire? [ ] yes [ ] no

   g. Are there any unusual signs or objects? _____

   h. Note anything unusual about the electrical system or equipment:

   _____

   _____

   _____

   _____

3. Interior Examination Observations

a. What area has the least damage? _____

_____

_____

_____

b. What area has the most damage? _____

_____

_____

_____

_____

c. Note damage to the following structural components:

Door moldings _____

_____

_____

_____

Walls _____

_____

_____

Ceiling _____

_____

_____

Floor _____

_____

_____

d. Note damage to the following nonstructural components:

Shelving _____

_____

_____

Incandescent light bulbs _____

_____

_____

Window glass _____

_____

_____

Broken window glass _____

_____

_____

Melted metal objects _____

_____

_____

Doors _____

_____

_____

4. Note the lowest level of burning: _____

_____

_____

5. What is the source of fire or secondary fire? _____

_____

_____

6. Examination of Building Contents

   a. Unusual items _____

   _____

   _____

   b. Furniture _____

   _____

   _____

   c. Appliances _____

   _____

   _____

7. Document Fire Patterns

   a. "V" patterns [ ] yes [ ] no

   b. Lines of demarcation [ ] yes [ ] no

8. Document Fire Travel/Spread

   a. Even levels of burning [ ] yes [ ] no

   b. Extent of charring [ ] yes [ ] no

Notes:

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UNIT 6: ACCIDENTAL FIRE CAUSES

TERMINAL OBJECTIVES

The students will be able to:

1. *Explain the four fire cause classifications.*
2. *Describe various common accidental fire causes.*
3. *Explain the basic principles and components of 120/240 volt electrical systems and their potential to cause fires.*

ENABLING OBJECTIVES

The students will be able to:

1. *Define fire cause and identify four classifications of cause.*
2. *List various accidental fire causes and related fire and burn patterns.*
3. *Explain basic principles of 120/240 volt electrical systems.*
4. *Understand basic electrical theory and terminology.*
5. *Describe the basic components of a residential electrical system.*
6. *Understand potential ignition sources associated with electricity.*

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UNIT 6:
ACCIDENTAL FIRE CAUSES

Slide 6-1

ENABLING OBJECTIVES

- Define fire cause and identify four classifications of cause.
- List various accidental fire causes and related fire and burn patterns.
- Explain basic principles of 120/240 volt electrical systems.

Slide 6-2

ENABLING OBJECTIVES (cont'd)

- Understand basic electrical theory and terminology.
- Describe the basic components of a residential electrical system.
- Understand potential ignition sources associated with electricity.

Slide 6-3

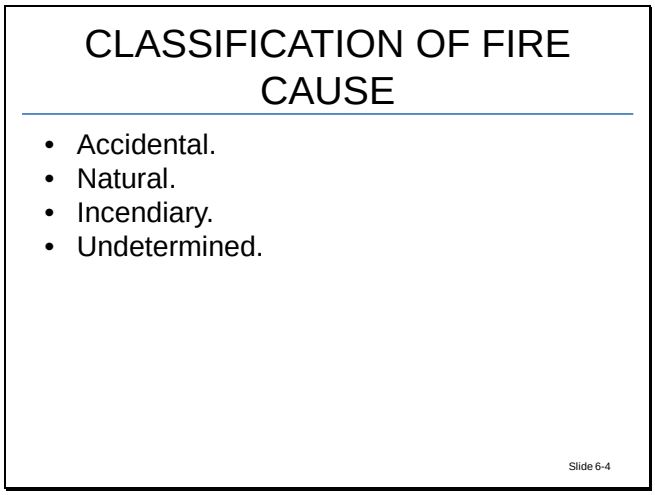
I. PURPOSE AND CLASSIFICATION OF FIRE CAUSE

A. Fire department personnel should be able to determine the area of fire origin by using a systematic method of fire scene examination.

1. Personnel must be able to determine when a fire may be classified as accidental or natural and when a fire investigator should be summoned to the scene.

2. Successful criminal prosecution of arson depends on properly trained firefighters, company officers (COs) and investigators working as a team. Prosecutors must also prove beyond a reasonable doubt that the fire was intentionally set and that all potential accidental causes were ruled out.

3. The cause of a fire must be fully understood before corrective action can be taken to avoid similar fires in the future.



B. Four possible fire cause classifications.

1. Accidental — Fires that are not the result of a deliberate (intentional) act.

2. Natural — Fires that ignite without human intervention.

3. Incendiary — Fires that result from deliberate actions or circumstances in which the person starting the fire knows that it should not have been started.

4. Undetermined — Fires where the cause cannot be proven to an acceptable level of certainty.

SOURCE AND FORM OF HEAT OF IGNITION

- Source of ignition will be at or very near point of origin.
- Physical evidence may remain, be heavily damaged, or be destroyed.
- Source of ignition should be identified in order for the cause to be proven.

Slide 6-5

C. Source and form of heat of ignition.

1. Generally speaking, the source of ignition will be found at or near the area/point of origin.

2. In many situations, this can be difficult due to physical evidence sometimes being damaged or destroyed.

HEAT SOURCE

- Chemical.
- Electrical.
- Mechanical.
- Nuclear.

Slide 6-6

D. There are four primary heat sources.

1. Chemical heat sources (e.g., acids, water-reactive materials).

   a. Heat of combustion — Amount of heat during complete oxidation (the caloric fuel value).

   b. Spontaneous heating — Increase in temperature without drawing heat from its surroundings.

c. Heat of decomposition — Break down or loss of material due to thermal (heat) energy.

d. Heat of solution — Heat released when a substance is dissolved in liquid.

2. Electrical heat energy (e.g., overloading of circuit, loose connections).

a. Resistance heating — The generation of heat by electric conductors carrying current. Example: heating element in an electric heater.

b. Induction heating — Influencing a conductor by an alternating magnetic field. Example: soldering of wires or metals together.

c. Dielectric heating — Dirt/Dust on surface of an insulator allows ground fault leak of current. Example: a microwave oven.

d. Heat from arcing.

e. Static electricity.

f. Lightning.

3. Mechanical heat energy (e.g., motors, heating, ventilating, and air conditioning (HVAC) units).

a. Friction heat.

b. Friction sparks.

c. Heat of compression.

4. Nuclear heat energy.

FIRST MATERIAL IGNITED

- Material that sustains combustion beyond the ignition source.
- Initial fuel can be part of the ignition source.
- Vital element in understanding the events that caused the fire.

Slide 6-7

E. First material ignited.

1. Material that sustains combustion beyond the ignition source.

2. The fuel load present is critical to understand the circumstances responsible for the fire cause.

IGNITION FACTOR OR CAUSE

- Mere presence of an ignition source and fuel by themselves do not cause a fire.
- What event or sequence of events brought the elements together?

Slide 6-8

F. Ignition factor or cause.

1. The presence of fuel and an ignition source in and of themselves does not establish the cause of the fire; the event, actions or circumstances that brought the fuel and ignition source together must be identified.

2. The propensity for fuel to ignite is dependent on the following:

   a. Mass of the fuel.

   b. Form (physical state) of fuel (i.e., solid, liquid, gas).

DETERMINING FIRE CAUSES

- Evaluate combustion characteristics of materials involved.
- Compare similar materials and situations.
- Fit known facts to various possibilities.
- Coordinate information obtained during scene investigation.

Slide 6-9

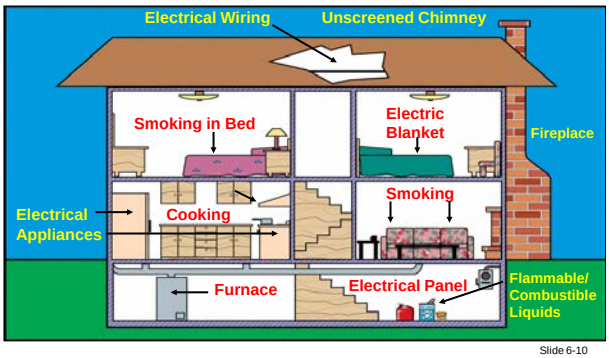
II. DETERMINING FIRE CAUSES

A. Determining fire causes begins with an evaluation of the combustion characteristics of the fuel load (materials) involved.

1. A key aspect of this process is to compare similar materials and situations to known facts.

2. Personnel should coordinate information obtained during the preliminary scene examination with investigators as needed.

COMMON CAUSES OF DWELLING FIRES



Slide 6-10

B. There are several common accidental causes of most residential fires:

1. Heating equipment.

2. Combustibles too close to heat sources.

3. Smoking.

4. Electrical malfunctions.

5. Cooking.

HEATING EQUIPMENT

- Fixed or portable.
- Electric or fuel-fired.
- May be wall mounted, located in closets, attics or crawlspaces.

Slide 6-11

C. Heating equipment.

1. Fire causes involving heating equipment may include fixed or portable space heaters.

   a. Electric or fuel-fired.

   b. May be wall-mounted in closets, attics or crawlspaces and can be free-standing in other locations.

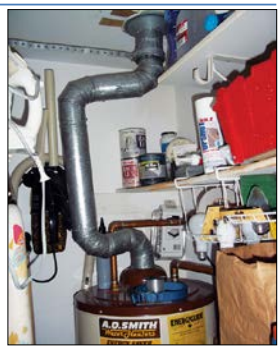
2. Fires may start in combustibles placed near heating unit.

   a. Papers.

   b. Clothing.

MAJOR FIRE CAUSES

- Defective equipment.
- Misuse of equipment.
- Too close to combustibles.
  - Installation.
  - Storage.



Slide 6-12

3. Major fire causes may be due to defective or overheated equipment.

   a. May be installed too close to combustibles.

   b. May have malfunctioned due to manufacturing defect, improper installation or misuse.

KEROSENE HEATERS

- Flareups due to improper fuel use.
- Fuel leakage (spill).
- Too close to combustible materials.

Slide 6-13

D. There are two basic types of kerosene heaters.

   1. Convective.

      a. Usually circular in shape. Its fuel tank is located below the wick and combustion chamber. The wick absorbs and delivers fuel to the combustion chamber.

      b. Convective heaters circulate warm air upward and outward in all directions. They are designed for large areas or even several rooms, but never for a small, closed area, such as a bedroom.

c. Must be moved for refueling because they don't have a removable fuel tank.

2. Radiant.

a. Usually rectangular in shape and designed for smaller areas. They also feature a wick, combustion chamber and in addition, a reflector which directs heat at people or objects.

b. Some radiant heaters have electric fans to increase the flow of warm air.

c. Many radiant models have a removable fuel tank which allows only the fuel tank to be transported for refueling.

3. Most of the fires associated with kerosene heaters are due to:

a. Fuel spills.

b. Placement too close to combustible materials.

c. Using improper fuel (i.e., gasoline versus 1-K grade kerosene).

PORTABLE ELECTRIC HEATERS

- Too close to combustibles.
- Use of extension cords.
- Tip-overs.
- Oil filled.

Slide 6-14

E. Portable electric heaters.

1. Common causes of accidental fires involving portable electrical heaters may be due to:

a. Combustibles located too close to units.

b. Use of extension cords that are not properly rated for the unit.

c. Units being knocked over and then coming in contact with combustible materials.

2. Check controls of unit.

   a. Most units have tilt or overturn switch.

   b. Designed to cause unit to turn off if tilted or knocked over.

3. Check location of unit.

   a. Is unit in normal location, or in a location where it would not normally be expected to be placed?

   b. Would unit be expected to be used based on time of year (i.e., heater being used during hot weather)?

MISUSE OF EXTENSION CORD

Slide 6-15

4. Once the heater is located, check whether the unit was plugged into an extension cord and if there is any evidence of an overload or short circuit.

SOLID FUEL HEATING EQUIPMENT

- Overfueled.
- Improper fuel.
- Too close to combustibles.
- Chimney/Flue fires.

Slide 6-16

F. Solid-fuel heating systems (e.g., wood, coal, etc.).

1. Check fuel supply.

   a. Overfilled?

   b. Improper fuel?

2. Fires may occur in nearby combustibles, including the fuel stored nearby.

   a. Check combustion and flue areas.

   b. Proper installation of flue or pipe where it passes through walls or ceilings.

   c. Creosote build up on seams of flue pipe could cause a fire.

3. Stovepipes, flues or chimneys that appear extremely clean may have been involved in a chimney fire.

   a. Produces extreme temperatures.

   b. May ignite nearby combustibles. Check manufacturer or code requirements for proper installation relative to distances from combustibles, etc.

4. Flammable and combustible materials igniting fuels improperly stored nearby.

5. Old solid fuel unit converted to burn fuel oil.

   a. Not suitable.

   b. Not designed for liquid fuel.

      - Subject to overheating.

      - Leaks combustion products.

Slide 6-17

G. Fireplaces.

1. Hot ashes and coals. Check disposal habits of occupants.

   a. Be careful of occupant cover-up.

   b. Compare account of events with observations/evaluation of area/ point of origin.

2. Timeframe may seem extreme.

3. Consider insulating effects of ashes and container construction.

Slide 6-18

4. Attempt to locate remains of container used to hold ashes and coals.

5. Combustibles placed or stored near fireplace? Consider distance from fireplace and time material was exposed to heat.

6. Animal activity.

COOKING EQUIPMENT

- Misuse.
- Incorrect installation.
- Improper maintenance.
- Inattention.

Slide 6-19

H. Cooking equipment.

1. Common causes are due to:

   a. Misuse.

   b. Incorrect installation.

   c. Improper maintenance.

   d. Inattention when in use.

2. Check location of room's trash container and other combustible materials in the immediate area. Ignition of container can occur by:

   a. Splattering grease.

   b. Conduction of heat from unit.

Slide 6-20

3. Equipment often placed between cabinet or wall. Check for accumulation of trash behind the appliance.

Slide 6-21

4. Attempts by occupants to remove burning fuel.

   a. Occupants frequently attempt to remove burning pans from cooking equipment.

   b. Burning pan and fuel may be dropped or thrown; may cause burn injuries to occupants.

   c. Point of origin may be located at floor level (or signs of burning fuel at floor level).

   d. Debris (evidence) may also be located in (or near) sink.

Slide 6-22

5. Check time factors.

   a. Did fire occur during normal meal preparation time?

   b. Check for other evidence of meal preparation.

CHECK CONTROL ELEMENTS

Slide 6-23

6. Check number of cooking elements being used. Check positions of elements and oven controls.

7. Check contact points of controls, switches and thermostats for malfunction, pitting, arcing, etc.

8. Check for repair or adjustment of unit and fuel supply.

   a. Tool marks.

   b. Missing cover plates and screws.

9. Portable cooking equipment.

   a. Check time, occupancy and location where found.

   b. In boarding houses and hotels, often stored under a bed or in a drawer.

OIL- AND GAS-BURNING EQUIPMENT

Slide 6-24

I. Oil- and gas-burning equipment.

   1. Check firebox, pipes and flue.

      a. Excess soot (carbon) may indicate incomplete combustion.

      b. Malfunction.

      c. Improper adjustment.

   2. Check controls and fuel lines.

      a. Prior trouble with equipment.

      b. Fresh tool marks.

      c. Recent repairs attempted?

CHIMNEY OR FLUE FIRES

- Creosote can ignite between 1,170 ºF (632 ºC) and 1,300 ºF (704 ºC).
- Coating as thin as one-eighth inch is sufficient to cause fire.
- Type of wood being burned normally has very little influence on accumulation.
- Temperatures as high as 2,000 ºF (1,093 ºC) may be reached.

Slide 6-25

J. Chimney or flue fires.

1. Creosote build up may ignite from sparks or overheating.

   a. Only a very thin coating is required to ignite under the proper conditions.

   b. The type of wood has little influence on the extent of heat build up.

2. Can cause roof fires as burning soot and debris are drawn out of flue.

3. Point of origin may be near area where flue passes through combustible construction materials.

4. Check to determine the last time that the chimney was cleaned.

CHIMNEY MATERIALS ARE CONDUCTORS OF HEAT

- Installed without recommended clearances.
- Constant use of appliance may cause combustible materials to ignite.

Slide 6-26

5. Chimney materials are conductors of heat and may cause nearby combustible materials to ignite.

   a. Can be a problem if improperly installed without recommended clearances per applicable codes.

   b. Constant use of appliance may cause combustible materials to ignite if not properly maintained.

SMOKING AND RELATED FIRES

- Temperature of burning cigarette ash will vary from 550 ºF (288 ºC) on the outside to 1,350 ºF (732 ºC) inside.
- Cigarette must be insulated to cause open flame ignition of furniture or bedding.

Slide 6-27

K. Smoking and related fires.

1. Heat generated by burning cigarettes varies greatly.

   a. 550 °F (288 °C) measured on outside surface of glowing ash.

   b. 1,350 °F (732 °C) measured in center of glowing ash.

2. Temperatures even higher than those mentioned have been estimated or recorded by various researchers.

3. Cigarettes and the ignition of most combustibles.

   a. Usually local char or damage due to small contact area.

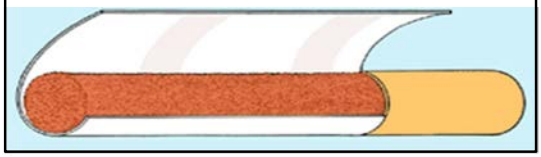
   b. Cigarettes usually must be insulated to ignite combustibles.

   c. Increases surface contact and allows build up of heat.

   d. Insulation effect occurs when cigarette or burning ash falls between the cushions on a sofa or chair.

ANATOMY

If a fire-safe cigarette is left unattended, the burning tobacco will reach one of these banded "speed bumps" and self-extinguish.



Slide 6-28

4. Fire-safe cigarettes are designed to self-extinguish if left unattended.

COALITION FOR FIRE-SAFE CIGARETTES

- The Coalition for Fire-Safe Cigarettes, coordinated by National Fire Protection Association (NFPA), is working to save lives and prevent injuries from cigarette-ignited fires.
- Call for manufacturers to immediately produce and market cigarettes that adhere to an established cigarette fire safety performance standard.

www.firesafecigarettes.org

Slide 6-29

5. The Coalition for Fire-Safe Cigarettes is an organization that is coordinated by the NFPA. They are encouraging manufacturers to follow a fire-safe cigarette performance standard and require it throughout the country.

EVIDENCE OF PRIOR FIRE?

Slide 6-30

6. Trash receptacles and other "nonapproved" containers for cigarette butts should be examined to determine if there is any evidence of prior fires or the possibility that improperly discarded smoking materials could be the cause.

Slide 6-31

7. Smoldering furniture usually requires a long period of time to produce open burning (flaming).

   a. It is difficult to identify an absolute minimum time period necessary for a slow, smoldering fire to reach open, flaming combustion.

   b. Smoldering fires inside padded furniture may produce temperatures of 1,400 °F (760 °C) to 1,600 °F (871 °C).

   c. Frequently, more extensive damage will be observed on the inside of the furniture frame than on the outside.

8. Personnel should look for ash trays, cigarette packs, matches, lighters and any other related evidence to support the possibility of smoking as a fire cause.

9. Although foamed plastics, foam rubber or polyfoam furniture padding can be manufactured with fire safety considerations in mind, they do contribute to the overall fuel load.

   a. May produce more heat than older (cotton padded) furniture.

   b. May or may not ignite easily upon contact with lighted cigarette (depends on chemical composition of material and actual circumstances of ash placement).

FLAMMABLE AND COMBUSTIBLE LIQUIDS

Slide 6-32

L. Flammable and combustible liquids storage.

1. Improper storage of flammable liquids.

   a. Can occur in almost **any** storage area.

   b. Residential occupancies (e.g., utility rooms, kitchen cabinets, garages, carports, bathrooms, storage sheds, basements).

   c. Commercial/Industrial occupancies (offices, plant or work areas, storage closets, warehouse areas).

2. Can occur either inside or outside.

   a. Improper selection and use of storage containers.

   b. Light weight plastic containers may become brittle with age and develop cracks or leaks or may be punctured by sharp objects.

c. Flammable liquids may cause deterioration of container.

d. Light weight metal containers may rust or deteriorate along seams and slow leaks may develop.

3. Improper use of flammable liquids.

a. Gasoline, kerosene and lighter fluid may be used as cleaning fluid.

b. They may be spread over large floor areas causing the vapors to ignite by ignition sources in the area.

4. Flammable liquids and ignition sources.

a. Flammable liquid vapors usually settle to lowest level in the involved area.

b. May contact ignition source and flash back over long distances (or in certain situations, an explosion may occur).

c. Common ignition sources may include:

- Gas appliances.
- Water heaters.
- Stove/Range.
- Electrical equipment.
- Light switches.
- Motors.
- Static electricity.

Slide 6-33

5. Other indicators to assist in the identification of accidental fires involving flammable or combustible liquids.

   a. Presence of cleaning equipment containing residue of flammable or combustible liquids.

   b. Stories of occupants concerning what liquids were stored in the area, the last time anyone was in the area and whether they noticed any odors or observed any spills, leaks, etc.

   c. Were children reported to have been playing in areas containing stored flammable or combustible liquids?

FIREWORKS AND EXPLOSIVES

Slide 6-34

M. Fireworks and explosives.

   1. Cover a wide range of materials and may be difficult to detect as fire cause without outside assistance (e.g., fire investigators, bomb technicians, hazardous materials response teams).

2. Juveniles and adults often obtain information concerning incendiary devices and explosives from “How To” guides available on the Internet.

N. Dust explosions.

1. Many common materials may also explode when in dust form such as wood, dust, grain, flour, metals, resins, etc.

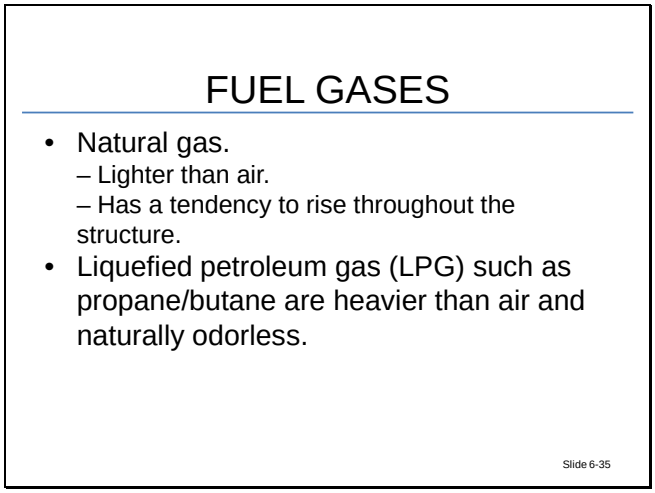
2. Factors influencing the possibility of dust explosions:

a. Size of dust particles.

b. Dust concentration.

c. Impurities present.

d. Oxygen concentration.



O. Fuel gases.

1. Natural gas.

a. Natural gas (or manufactured gas) is lighter than air and will rise to upper levels of a structure.

b. Explosions involving natural gas usually produce damage centered at the upper levels of the structure involved.

2. Liquefied petroleum gases (LPGs), such as butane or propane, are heavier than air and normally will settle to lower levels of a structure.

a. Explosions involving LPG usually produce damage centered at the lower levels of the area involved.

b. Structural components should be carefully examined to identify area(s) of most severe damage. Failures typically occur at the weakest point of a structure.

3. Many people wrongly believe liquefied petroleum and natural gases are poisonous and they may attempt to use gas-fueled cooking equipment to commit suicide.

4. All flammable liquid vapors are heavier than air and normally will settle to lower levels of the structure.

a. Explosions involving flammable vapors usually produce damage centered at the lower levels of the area involved.

b. Check for extinguished pilot lights and controls set to “on” position.

c. Destruction of fuel lines during fire may increase burn rate, and the resulting charring may appear unnatural.

d. Point of origin in area of gas appliance (requires confirmation of appliance malfunction).

OPEN FLAMES AND SPARKS

- Cutting and welding.
- Soldering.
- Grinding.

Slide 6-36

P. Open flames and sparks.

1. Welding and cutting.

a. Often conducted in areas of combustible storage.

b. Fire may smolder for a long period after completion of welding and cutting operations.

2. May result in fire from effects of heat conduction and/or convection.

3. When welding or cutting objects that are connected to or pass through combustible construction, fires can occur.

    a. May ignite combustibles through careless flame contact.

    b. Fires may be caused remote from the location where work is being performed.

4. Indicators of fire caused by welding/cutting.

    a. Slag in area of origin.

    b. Spot burning in area.

    c. Welding or cutting equipment in area.

    d. Metal objects showing evidence of recent welding/cutting.

5. Friction and sparks from machinery.

    a. High-speed rotation of objects may result in extreme heat generation if machinery is improperly lubricated.

    b. Similar to open-flame cutting in relation to fire cause and investigative indicators.

    c. May cause fire if heated material contacts combustibles.

    d. May cause a fire by convection of heat. Indicators of fire caused by friction.

        - Report of trouble or noise from equipment involved.

        - Point of origin near or inside suspected equipment.

        - Localized damage to metal parts (may produce actual melting of metal).

6. Thawing pipes and soldering with open flames.

    a. Similar to open-flame cutting in relation to investigative indicators.

    b. Electrical welding equipment often used to thaw pipes, if improperly grounded, can result in a fire.

SPONTANEOUS HEATING

- Certain materials and conditions must be present.
- Produced in one of three ways:
  - Chemical action.
  - Fermentation.
  - Oxidation.

Slide 6-37

Q. Spontaneous heating leading to ignition.

1. Sometimes used as a catchall by investigators.

   a. Somewhat rare.

   b. More common in rural or farm areas.

2. Many organic materials and some metals are subject to oxidation and/or fermentation that result in spontaneous heating.

3. Spontaneous heating is produced in three ways:

   a. Chemical action (e.g., unslaked lime and water).

   b. Fermentation or microbial thermogenesis.

   c. Oxidation.

SPONTANEOUS HEATING (cont'd)

- Fermentation is most common.
- Specific conditions are needed.
- Indicators of spontaneous heating need to be carefully evaluated.
- Materials susceptible should be identified.

Slide 6-38

4. The most frequently encountered fire situation involving spontaneous heating is fermentation.

   a. Moisture is a prime factor.

   b. Drying time prior to storage.

   c. Storage while wet or “green.”

5. Spontaneous heating may be accelerated by outside heat sources.

   a. Sunshine.

   b. Storage near steam pipes/heater.

   c. Hot-air ducts.

   d. Heat produced by friction (vibration of the mass of stored material or vibration of the storage container).

6. Available air is important to spontaneous heating.

   a. Too much air or air movement may dissipate heat and keep mass below ignition temperature.

   b. Too little air may restrict heating.

   c. Example: A rag soaked in an organic-based oil may produce spontaneous heating if wadded at bottom of trash can. While laid open on ground or floor, the rag may simply dry.

7. Mass of material is important. Usually requires several inches of material to allow spontaneous heating.

8. Spontaneous heating may occur for hours, days or months prior to reaching ignition temperature. Bacteriological preheating may initiate process.

   a. Spontaneous heating may continue or may halt, depending on all other factors present.

   b. Indicators of fires caused by spontaneous heating.

      - Charring inside mass or more than one area of charring in mass.

Slide 6-39

9. Some common materials that are susceptible to spontaneous heating:

   a. Linseed oil.

   b. Charcoal.

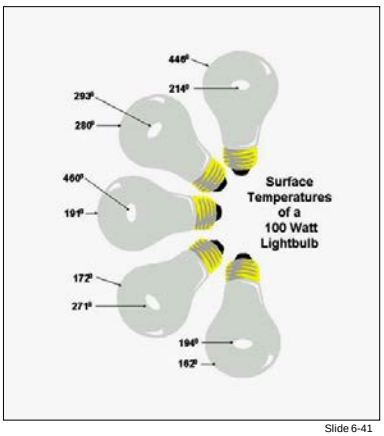
   c. Fish meal.

Slide 6-40

   d. Wool waste.

   e. Foam rubber.

100-WATT BULB



Slide 6-41

R. Light bulbs as fire cause.

1. Light bulbs may serve as a potential ignition source in certain situations.

2. High wattage bulbs may ignite combustible materials nearby depending upon the duration of heating and the ignition properties of the material.

Slide 6-42

3. Halogen lamps and bulbs can generate high temperatures making any combustible materials placed on or near them susceptible to ignition.

LIGHTNING STRIKES

Slide 6-43

S. Lightning strikes the Earth hundreds of times per minute.

1. Each year many electrical storms pass through communities, which can cause fires to start.

2. Fires may be discovered immediately or they may not appear for some time.

Slide 6-44

T. The electrical discharge usually consists of several electrical strokes.

1. Each lasts a few millionths of a second.

2. Discharges occur 20 to 80 thousandths of a second apart.

3. Current generated can reach 200,000 amperes.

4. Potential between clouds and earth may reach 100,000 million volts and generate temperatures as high as 54,000 °F (29,982 °C).

Slide 6-45

U. Damage from lightning usually is evident when it strikes a building.

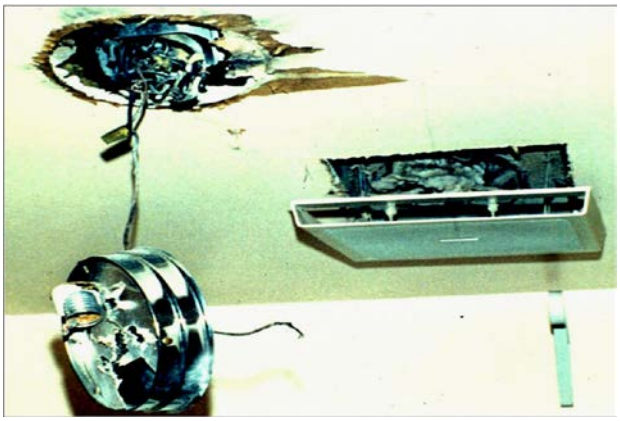
1. Witnesses hear, see or feel the strike.

2. Lightning strikes may be recorded at lightning tracking stations.

Slide 6-46

3. Weather service may confirm the presence of an electrical storm in area prior to fire.

4. Physical damage may be evident such as damaged siding, roof/floor joist, damaged concrete/brick, splintered wood, etc.



Slide 6-47

5. Damaged electrical equipment.

   a. Holes blown in roofs, ceilings or walls.

   b. Sources of ground may be vulnerable.

OTHER ACCIDENTAL FIRE CAUSES

- Sunlight reflected off shiny objects.
- Chemical reactions.
- Christmas trees.
- Candles.

Slide 6-48

V. Other accidental fire causes.

   1. The sun's rays can be concentrated to produce ignition temperatures of common combustible materials. Many items/articles have been reported to have been involved in such fires:

      a. Defective window glass.

      b. Magnifying glass.

      c. Eyeglasses.

      d. Prisms.

2. Chemical reactions.

   a. Oxidizing agents coming in contact with certain materials may produce heat/fire.

   b. Contamination of chemicals may produce sufficient heat to cause auto-ignition or ignition of nearby combustibles.

3. Christmas trees.

   a. Often ignited by faulty Christmas tree lights.

   b. Improperly watered trees drastically increase the potential for ignition.

   c. Often burn quickly and generate intense heat.

4. Candles.

   a. Unattended candles can be knocked over and come in contact with combustible materials causing ignition.

   b. Candles in use for lighting and/or heat near combustible materials may serve as a competent ignition source.

CAMPFIRES

Slide 6-49

W. Campfires.

1. Unattended campfires account for a large number of accidental (and incendiary) fires.

2. In some situations, ignitable liquids (gasoline, kerosene, lighter fluid) are used to start these fires which can quickly get out of control causing extensive damage to the surrounding area.

CAMPFIRE: IGNITION FACTORS

- Failure to properly extinguish.
- Lack of attendance.
- Improper clearance/construction.
- Careless placement.
- Improper discarding of coals/ash.
- Improper use of ignitable liquids.
- Careless discarding of matches.
- Camp stove malfunction.

Slide 6-50

3. Other possible causes include:

   a. Failure to properly extinguish.

   b. Improper clearance.

   c. Careless placement.

   d. Improper discarding of ashes.

   e. Careless discarding of matches or other ignition devices.

SMOKING

Slide 6-51

4. Improperly discarded smoking materials.

   a. Cigarettes carelessly discarded in dry brush or vegetation can ignite and spread.

SMOKING: IGNITION FACTORS

- Cigarettes are limited as a competent ignition source.
- Consider the following:
  – Physical characteristics of the cigarette.
  – Environmental factors.
  – Physical placement factors.

Slide 6-52

   b. The potential for cigarettes to cause ignition is dependent upon physical characteristics, environmental factors and physical placement.

DEBRIS BURNING

Slide 6-53

5. Debris burning.

   a. Unattended burning of trash, leaves or other materials may cause ignition of nearby combustibles if not properly controlled.

DEBRIS BURNING: IGNITION FACTORS

- Factors are similar to escaped campfires.
- Windblown embers or creeping into uncleared vegetation.
- Cause will usually be obvious.

Slide 6-54

b. The ignition factors are similar to those of camp fires.

c. In windy conditions, flying embers may be released and travel long distances and ignite fires.

LIGHTNING AND WILDLAND FIRES

Slide 6-55

6. Lightning and wildland fires.

a. Lightning is an atmospheric electrostatic discharge (spark) accompanied by thunder, which typically occurs during thunderstorms and is a leading cause of wildland fires.

b. Lightning strikes can also provide sufficient energy to cause structure fires which generally occur during storms.

LIGHTNING: INDICATORS

- Recent electrical storm (hours/days/weeks).
- Scarring on trees and/or snags.
- Ballistic penetration of adjoining vegetation by needles and small twigs or splinters.
- “Blow-holes” at base of tree.
- Splintered wood or vegetation.

Slide 6-56

c. Lightning indicators can include recent storm activity, splintered trees, poles or scarring and/or penetration on trees or surrounding structures.

d. Lightning may strike ground and leave little physical evidence of damage.

e. Structure may not be protected from lightning.

f. Height of structure to be considered in relation to the surrounding area.

g. May strike power and/or telephone lines and cause overloading of protective devices.

LIGHTNING: IGNITION FACTORS

- Discharged static electricity associated with thunderstorm activity.
- Series of short bursts approximately 2 inches in diameter, lasting for one-half second.
- Cloud-to-ground strikes:
  - 100 million volts.
  - 200,000 amperes.
  - 54,000 ºF (29,982 ºC).

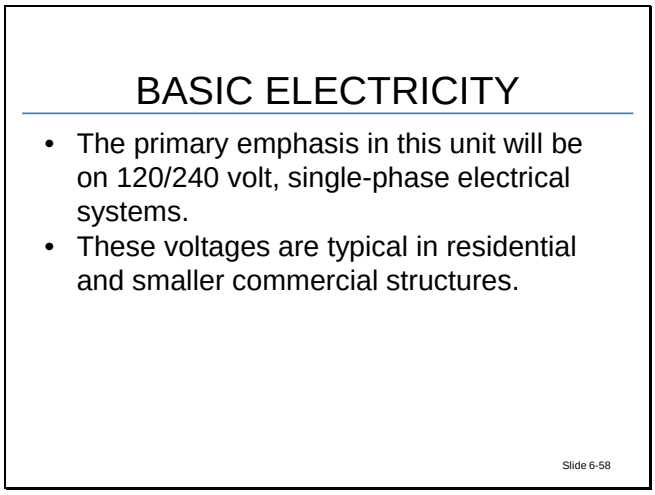
Slide 6-57

h. Ignition factors include discharge of static electricity and cloud-to-ground strikes that can generate millions of volts and temperatures in excess of 54,000 °F (29,982 °C).

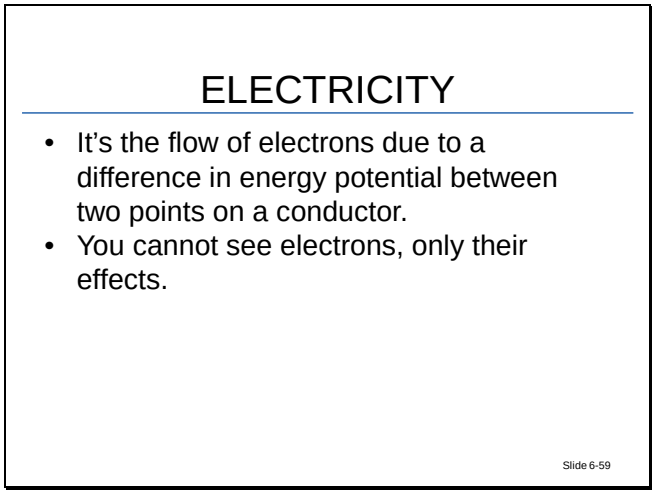
i. Lightning damage is often due to electrical charges converting the internal moisture in an object to steam and the resulting pressure build up causes splitting.

III. ELECTRICAL SYSTEMS

A. An understanding of the various terms, components and systems associated with electricity is essential to fire cause determination.



B. A working knowledge of 120/240 volt single-phase electrical systems that are typically used in residential and smaller commercial structures, is important so as to identify electricity as a potential cause.



1. Electricity — The flow of electrons due to a difference in energy potential between two points on a conductor.

2. Basic principle of electricity — Like charges repel; unlike charges attract.

3. Electricity and magnetism are closely related.

   a. Electricity can produce magnetism.

   b. Conversely, magnetism can produce electricity.

CONDUCTORS

- Materials that allow current to flow freely with minimal resistance.
- Copper and aluminum are two of the most recognized materials used.

Slide 6-60

4. Conductor — Any material that allows free flow of electricity (gold, silver, copper, aluminum, carbon).

INSULATORS

- They work the opposite of conductors; they oppose or stop the flow of current. Some insulators are glass, porcelain, air and pure water.
- A high enough voltage may defeat the insulator.

Slide 6-61

5. Insulator — Material that restricts or inhibits flow of electricity (rubber, plastic, glass, porcelain).

C. Electrical terms.

VOLTAGE (VOLTS)

- Electrical pressure that moves the electrons through the conductor.
- Electromotive force (EMF).
- E (volts).

Slide 6-62

1. Voltage — Unit of force or pressure that causes electrons to flow in a conductor (electromotive force (EMF). Expressed as **volts (E)**.

CURRENT (AMPERES)

- The rate at which electrons flow through a conductor. It is determined by measuring the amount of electrons flowing past a single point in one second.
- I (amperes) = intensity.

Slide 6-63

2. Current — The number of electrons that flow past one point in a circuit in one second. Expressed as **amperes (I)** = intensity.

RESISTANCE (OHMS)

- This is the opposition to current flow.
- Measured in ohms.
- Greek symbol omega (Ω).
- R (ohms).

Slide 6-64

3. Resistance — The opposition of a conductor to the flow of current. Expressed as **ohms (R)**.

   a. Every circuit offers some resistance to flow of current.

   b. Current flowing through resistance creates heat.

WATTAGE (WATTS OR KILOWATTS)

- This is the quantitative measurement of work done or power consumed in an electrical circuit.
- Watts themselves are no big deal, unless they exist for some time.
- W (watts).

Slide 6-65

4. Wattage — Amount of electrical power. Expressed as **watts (W)**.

FOUR EFFECTS OF ELECTRICITY

- Thermal.
  - Heat.
- Magnetism.
- Chemical reaction.
  - Oxidation.
  - Corrosion.
- Illumination.
  - Light.

Slide 6-66

D. Four effects of electricity.

1. Thermal (heat).
2. Magnetism.
3. Chemical reaction (oxidation and corrosion).
4. Illumination (light).

OVERHEAD DISTRIBUTION

12,000 volts

Slide 6-67

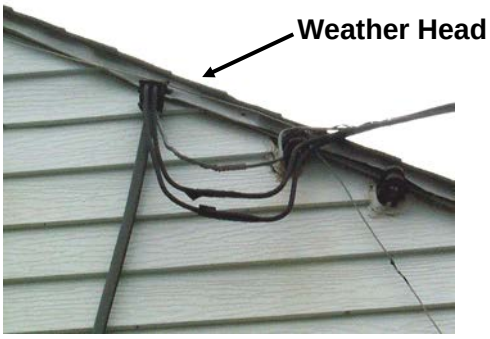
E. Overhead distribution lines.

1. Low cost method of transmission for large quantities of energy (power).
2. The utility company is capable of generating various voltages to the customer depending on residential or industrial use requirements. These voltages can be significant (12,000 volts or greater).

TRANSFORMER FOR UNDERGROUND SECONDARY

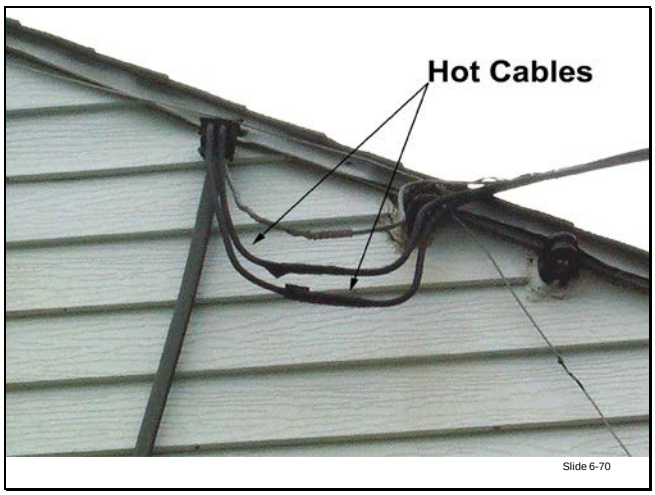
Slide 6-68

3. Since many commercial and industrial facilities generally demand much higher voltages, it is not uncommon to find transformers on site to support power requirements.

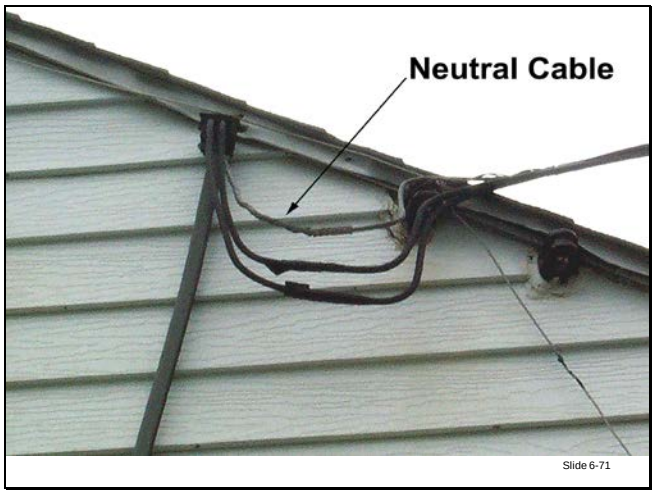


Slide 6-69

4. Most incoming power service to residential occupancies is 110/240 volts. At the customer's premises, the wires usually enter the building through a weather head that protects against entry of rain and snow.



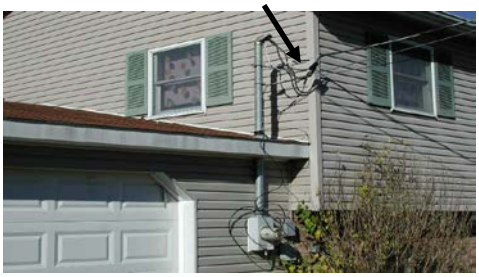
a. The service drop from the utility pole consists of hot and neutral cables that act as the primary feed to supply power to the structure.



b. This is an example of the service drop showing the location of the neutral cable which is a conductor that carries unbalanced current that is bonded to earth ground at the main service entrance.

SECONDARY VOLTAGE

Service Drop



Slide 6-72

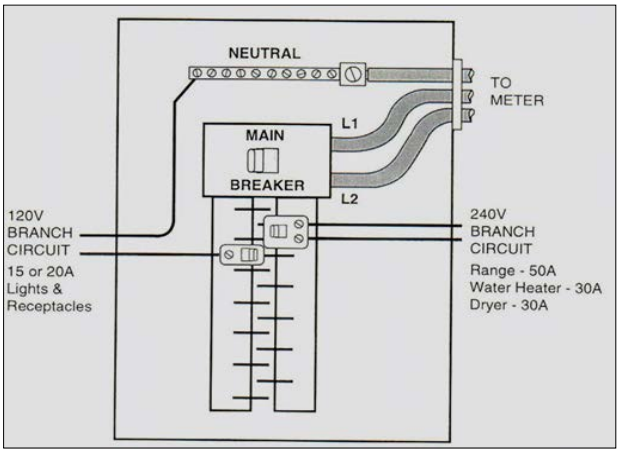
c. In an electric power distribution grid, a service drop is an overhead electrical line running from a utility pole, to a customer's building or other premises. It is the point where electric utilities provide power to their customers.

UNDERGROUND SERVICE LATERAL

Service Lateral

Slide 6-73

d. The customer connection to an underground distribution system is usually called a "service lateral." Conductors of a service drop or lateral are owned and maintained by the utility company.



Slide 6-74

4. Distribution panel, circuits and over-current protection within the structure.

   a. Incoming main divided into secondary circuits: lighting circuits and appliance circuits.

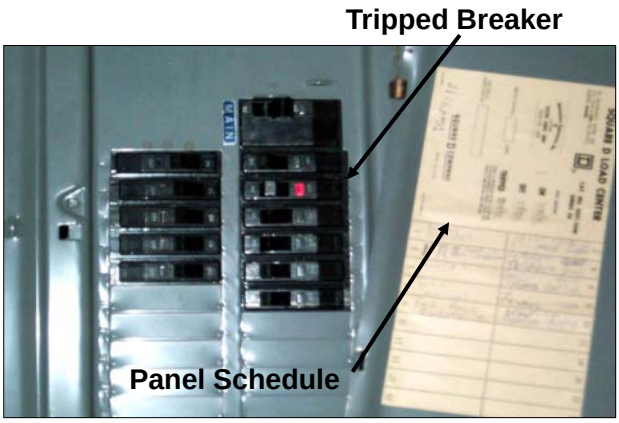
   b. Some circuits are dedicated to large appliances like a range.

   c. Secondary circuits (often called “branch” circuits) extend beyond the over-current device (fuse/breaker) and generally supply lighting fixtures.

   d. Wiring found in branch circuits.

      - General purpose branch circuits usually use #14 gauge copper wire, and will accommodate up to 15 amperes protected by a 15-ampere fuse/breaker.

      - Appliance circuits usually found in kitchen, dining room, laundry, and garage areas, use #12 gauge copper wire and will accommodate up to 20 amperes, generally protected by a 20-ampere fuse/breaker.



Slide 6-75

5. Fuses and circuit breakers are designed to withstand the temporary surge of current associated with equipment startup without tripping. Panel schedules are used in electrical design to assign a device a circuit breaker designation.

   a. The fuse or breaker (over-current device) will be rated to correspond to the power (current) demands of the system (amps).

   b. With proper grounding, a system malfunction will permit current flow through the ungrounded wire of sufficient current to cause the over-current device to operate and stop the flow of current.

   c. Many modern circuit breakers also have a "ground fault interrupter" (GFI), which activates the breaker in case of low-resistance ground faults.

FUSES

Slide 6-76

6. Fuse — A weak link in the circuit designed to self-destruct when excess current melts a fusible element.

CARTRIDGE FUSE

Slide 6-77

7. A cartridge fuse is a type of electric fuse in which the fusible element is connected between metal ferrules at either end of an insulating tube.

CIRCUIT BREAKER FUSE

Slide 6-78

8. A circuit breaker fuse operates similar to a circuit breaker, however its basic operating principle is that of a fuse.

   a. Commonly used in retrofit applications.

   b. Usually found in (Edison) type base fuse sockets and are equipped with a push-button that pops out when the circuit is overloaded.

   c. Fuse is reset by pushing the button back in.

CIRCUIT BREAKER

Slide 6-79

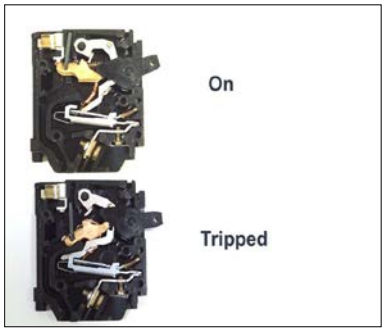
9. Circuit breaker — A mechanical device that opens a circuit on a predetermined overcurrent. There are three common ways breakers will trip: thermally, magnetically and mechanically. Normally reusable by manually resetting to the “on” position.

   a. Most are thermal-magnetic.

      - Magnetic element provides short circuit and ground fault protection.

      - Thermal element provides overload protection (usually a bimetal device).

CIRCUIT BREAKER (cont’d)



Slide 6-80

   b. If properly designed and operating, excess heat or current surge should cause the breaker to trip which produces an open circuit and stops the flow of current.

   c. Note position (on/off/tripped) — some breakers trip off.

GROUND FAULT CIRCUIT INTERRUPTER AND ARC FAULT CIRCUIT INTERRUPTER BREAKERS

GFCI

AFCI

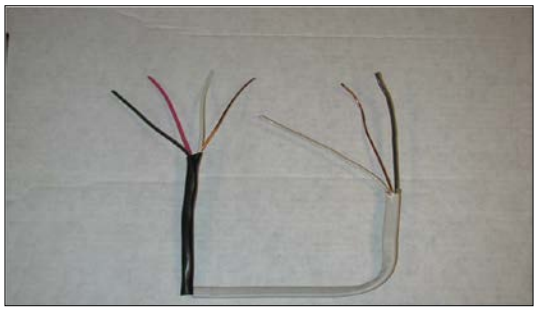
Slide 6-81

10. A ground fault circuit interrupter (GFCI) and arc fault circuit interrupter (AFCI) are inexpensive electrical devices that, if installed in household branch circuits, can prevent electric shock or electrocution.

    a. A GFCI monitors the amount of current flowing from the hot conductor to neutral conductor. If an imbalance is detected, it trips the circuit and stops the flow of current.

    b. An AFCI is designed to prevent fires by detecting a nonworking (i.e., nonintended/nonuseful) electrical arc and disconnecting the power before the arc starts a fire.

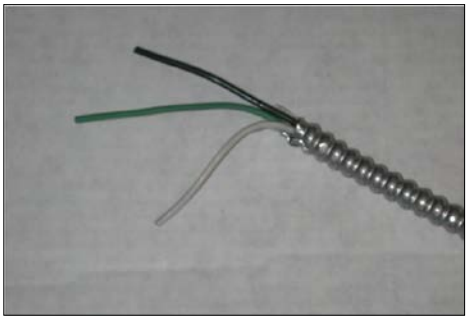
NONMETALLIC-SHEATHED CABLE



Slide 6-82

11. Nonmetallic-sheathed (plastic) is a type of covered electrical wire consisting of at least two insulated conductors and one bare conductor used in residential wiring (e.g., Romex® cable).

METALLIC-SHEATHED CABLE



Slide 6-83

12. Insulated wires in flexible metal tubing used for bringing electric power to electronic equipment (e.g., BX cable).

CONDUIT

Slide 6-84

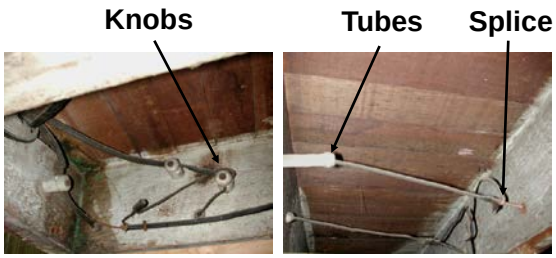
13. An electrical conduit is an electrical piping system used for protection and routing of electrical wiring.

    a. Electrical conduit may be made of metal, plastic, fiber or fired clay.

    b. Flexible conduit is available for special purpose/installations.

    c. The type of conduit used is dictated by requirements of the National Electrical Code (NEC).

KNOB AND TUBE



Slide 6-85

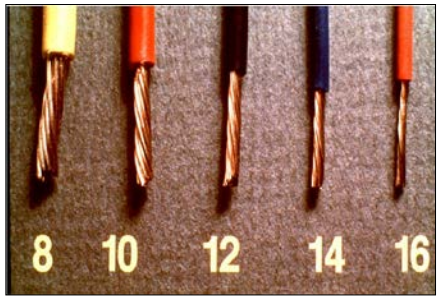
14. Knob and tube wiring is an older form of electrical distribution which was used in homes up until the 1930s.

    a. It incorporated an electrical delivery method which kept the hot and the neutral wires separated. This separation helps to reduce short-circuits.

    b. The “knobs” were porcelain fixtures used to keep the wire suspended as it ran along the ceiling or up inside interior walls.

    c. The “tubes” were the porcelain tubes which protected the wire as it was run through the joists or studs.

WIRING METHODS AND MATERIAL



Slide 6-86

15. The wiring method and materials used in residential and commercial applications should be carefully evaluated at all fire scenes to determine if they were properly designed and installed.

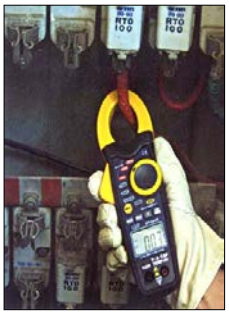
a. Current flow generates heat and is dependent upon the size of the conductor and its inherent resistance.

b. Excess current demand (i.e., too many appliances or too much load on a circuit) can cause conductors to build up excessive heat and fail.

c. The wire gauge is a measurement on how large a wire is and determines the amount of electric current it can safely carry as well as its resistance — the smaller the gauge (#8) the larger the diameter of the conductor and the higher current carrying capacity.

EXAMINING FIRE OF ELECTRICAL ORIGIN

- **Safety** is the number one concern.
- Make sure circuit or system is de-energized.
- **Check** with a metering device before touching anything!



Slide 6-87

16. Examination of the wiring and equipment at (or near) the point of origin.

    a. Unless properly trained and equipped with the appropriate test equipment, personnel should refrain from attempting to perform any work within the electrical distribution panel or related wiring. When in doubt, consult technical experts or the utility company representatives for assistance.

    b. In all situations, efforts must be made to ensure all the electrical circuits/systems are completely de-energized before attempting to examine them.

17. Electrical hazard as accidental fire cause.

    a. Many property owners extend or modify electrical service.

       - Nonqualified electrical repair or alterations.

       - Improper choice of wire and/or electrical equipment.

- Old electrical connectors/appliances.

- Improper grounding or lack of grounding.

b. Unsound mechanical support or unsound electrical components and wiring.

- Worn or damaged insulation on wiring that has been used several times.

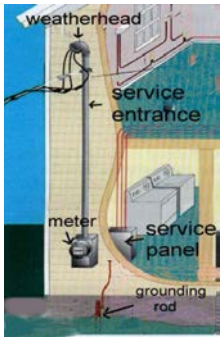
- Lack of anchoring/bracing.

c. Wiring exposed to travel of humans, animals or equipment.

d. Improper circuit overload protection or lack of circuit protection.

SERVICE ENTRANCE

- Begin on the exterior.
- Check for electrical failures at the attachment point, weather head, service conductors and meter base.
- Document the process with photographs.



Slide 6-88

18. Service entrance — The point where the utility company connects, usually contains an electric meter, disconnecting means, and over-current protection devices.

a. Scene examination should begin on the exterior checking for any signs of electrical failure.

b. Examine exterior areas for indications of electrical shorting/ malfunction including the utility company weather head and meter.

c. The process should be documented with notes and photographs.

DISTRIBUTION PANEL

- Identify fuses or breakers.
- Note any blown fuses or “tripped breakers.”
- Breakers can be removed to check bus bars for evidence of pitting or signs for arcing.

WARNING This may damage or destroy breaker and any chance of civil recovery. Consult with the Insurance Company, they may provide an Electrical Engineer.

Slide 6-89

19. Examine distribution panel and fuses or circuit breakers for any indications of tampering or malfunctioning.

    a. Examine service/distribution panel area for any signs of cover plate being removed (tool marks).

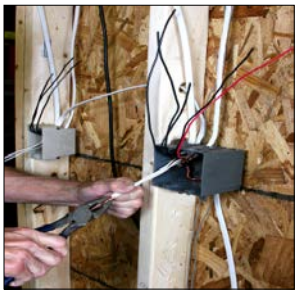
    b. Any evidence of recent repair work?

    c. Indications of efforts to bypass fuses/breakers.

    d. Note any blown fuses or tripped breakers.

COMMON STRUCTURAL WIRING

- Pure aluminum wire melts at 1,220 ºF (660 ºC).
- Pure copper wire melts at 1,981 ºF (1,083 ºC).

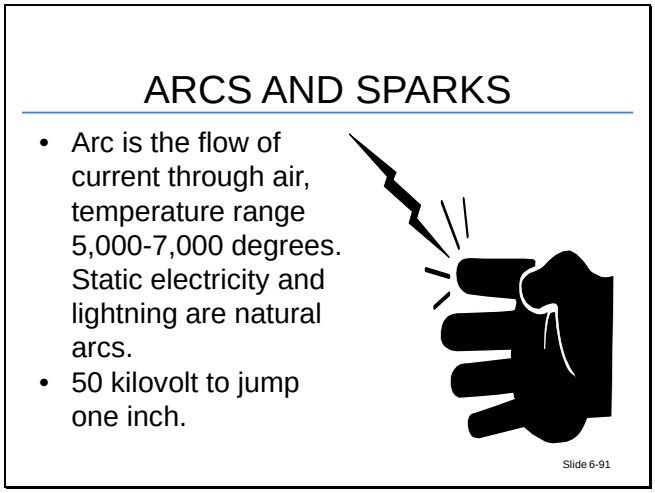


Slide 6-90

20. Common structural wiring used in residential or commercial applications is typically copper, however aluminum wiring may have previously been used.

a. Aluminum wiring expands and contracts at a much higher temperature (1,220 °F (660 °C)) than copper wire (1,981 °F (1,083 °C)), therefore may develop loose connections over time at screw terminals.

b. Aluminum wiring oxidizes more than copper wire, therefore it is more likely to develop resistance heating. Over time, this high resistance connection can cause ignition of structural members and combustible materials in the vicinity.



21. Arcs and sparks are produced in several ways.

a. A luminous (high temperature) electrical discharge across a gap.

b. Some arcs are an unavoidable result of operating electrical equipment and switches — for example, the arc is sometimes observed when a switch is operated.

c. Some arcs are the result of breakdown, malfunction or damage in electrical systems or equipment.

d. The temperatures developed by arcs typically range from 5,000 °F (2,760 °C) to over 7,000 °F (3,871 °C).

e. An arc may scatter hot particles of metal (sparks) over a wide area, however short duration arcs often have insufficient energy available to ignite solid fuels under normal conditions.

f. The presence of arc damage alone is not proof that the fire was caused by arcing.

g. A fire attacking energized conductors and equipment usually produces arcing.

SPARKS

- Sparks are much different; the spark is an incandescent particle, not an electrical discharge.
- Much better ignition source.

Slide 6-92

22. Sparks are not an electrical discharge; they are an incandescent particle.

    a. Electrical sparks can produce temperatures from 2,000 °F (1,093 °C) to 7,000 °F (3,871 °C).

    b. May occur overhead or at ground level.

    c. Generally, sparks are not competent ignition sources for ordinary combustible materials.

ELECTRICAL DAMAGE NOT CAUSE

- Check for holes or “blowouts” in the metal enclosures such as load centers, metal conduits, etc.
- Holes in metal conduit or metallic sheathed cables.
- Depicts area where the fire impacted the metal enclosure causing the insulation to fail resulting in an electrical fault to the metal enclosure.

Slide 6-93

23. All signs of electrical activity/damage should be carefully noted and documented.

    a. Check for holes or “blowouts” in metal enclosures, conduit, cables or load center (distribution panel).

"BLOWOUT" ON A METAL CONDUIT

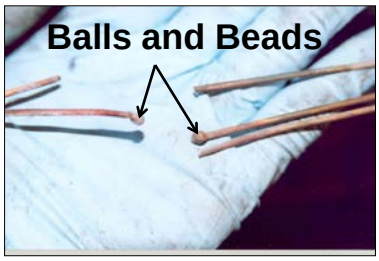
Slide 6-94

b. These artifacts may indicate when the fire impacted equipment or components causing a failure in the wiring and an electrical fault to the metal enclosure.

Slide 6-95

c. Damage caused by fire attacking service panel.

WHAT HAPPENS TO ENERGIZED WIRES THAT BURN?



Discrete balls of molten copper at the ends of wire. The rest of the wire shows no melting.

Slide 6-96

24. When wires are energized that are impacted by fire (heat), balls of molten copper are produced at the ends of the wire(s) and the remaining portion of the wire may show no signs of melting or damage.

    a. Solid copper conductors impacted by fire eventually melt and resolidified copper forms globules on the ends that are irregular-shaped.

    b. Stranded copper wires become stiff as they reach their melting temperatures, and in large gauge conductors, the individual strands may fuse, separate and form bead-like globules.

SUMMARY

- Purpose and classifications of fire cause.
- Determining fire causes.
- Electrical systems.

Slide 6-97

IV. SUMMARY

APPENDIX

ELECTRICAL FIRE CAUSE CHECKLIST

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Questions to Ask in Any Fire Suspected to Have Been Caused from Electrical Sources

1. Was the electricity on before the fire?

2. Was the electricity on at the time of the fire?

3. Did the local utility company respond to the fire?

4. Have there been any recent problems of an electrical nature in the building?

5. Have there been any blackouts or brownouts?

6. Have the fuses been blowing?

7. Have the circuit breakers been tripping?

8. Has the local utility company been called, or have service technicians been seen on the premises in recent days?

9. Do the lights seem to dim, or do they get dim at peak hours of electrical usage?

10. Do the lights flicker or dim when appliances are turned on?

11. Do appliances start or operate slowly?

12. Does the television picture shrink or fade when appliances are turned on?

13. Does the radio scratch or fade when appliances are turned on?

14. If there have been any electrical problems, what, if anything, has been done to alleviate them?

15. Has the maintenance person or janitor been working on the electrical system?

16. Has the owner or manager been working on the electrical system?

17. Has any other authorized or unauthorized person been working on the electrical system?

18. Has an electrical contractor been working on the electrical system? Who?

    a. Why was the electrical contractor called?

    b. Was he or she called to alleviate a problem?

    c. Was he or she called for an addition, remodeling or for new work?

d. Is the contractor licensed? Is there a permit for the job? If so, where is it?

e. Has the job been completed?

UNIT 7: INCENDIARY FIRE CAUSES AND DEVICES

TERMINAL OBJECTIVES

The students will be able to:

1. *Describe the various indicators of incendiary fires and the types of devices commonly used in firesetting.*
2. *Identify the procedures to properly preserve and document evidence associated with an incendiary fire.*

ENABLING OBJECTIVES

The students will be able to:

1. *Describe various indicators of incendiary fires.*
2. *Evaluate physical evidence to determine possible relevance to an incendiary fire.*

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UNIT 7: INCENDIARY FIRE CAUSES AND DEVICES

Slide 7-1

ENABLING OBJECTIVES

- Describe various indicators of incendiary fires.
- Evaluate physical evidence to determine possible relevance to an incendiary fire.

Slide 7-2

INCENDIARY FIRE CAUSES

- Absence of all accidental fire causes.
- Multiple fires.
- Trailers.
- Presence of liquid accelerants.
- Incendiary devices used as a means to delay the detection, accelerate the fire's spread, or slow the extinguishment of the fire.

Slide 7-3

I. INCENDIARY FIRE CAUSES

A. Causes of incendiary fires are limited only by the imagination of the firesetter.

B. The fire officer must understand how incendiary fires are set (or started) to make accurate origin and cause determinations.

C. The use of ignitable liquids as accelerants is common in incendiary fires.

D. The fire officer must know what materials are commonly used to construct incendiary devices.

E. Common indicators of an incendiary fire may include multiple fires, trailers or the presence of liquid accelerants.

F. Incendiary devices are used as a means to delay the detection, accelerate the fire's spread, or slow the extinguishment of the fire.

INDICATORS OF INCENDIARISM

- Use of common equipment and/or appliances.
- Structural damage prior to fire.
- Removal or substitution of contents prior to the fire.
- Absence of personal items or important papers.

Slide 7-4

INDICATORS OF INCENDIARISM (cont'd)

- Location of fire.
- Evidence of other crimes in the structure.
- Unnatural fire spread, excessive damage, and/or extreme heat.
- Limited entry or view.

Slide 7-5

INDICATORS OF INCENDIARISM (cont'd)

- Injuries to occupants.
- Time between exit of occupants and fire.
- Previous fires in same structure.
- Presence of fuel near point of origin.

Slide 7-6

INDICATORS OF INCENDIARISM (cont'd)

- Fires on holidays or weekends at commercial/industrial complexes.
- Time of day.
- Convenient heat source.
- Fires during renovations/remodeling.

Slide 7-7

INDICATORS OF INCENDIARISM (cont'd)

- Fires during electrical storms or bad weather.
- Activities of owners/occupants.
- Statements by owners or occupants.

Slide 7-8

MULTIPLE FIRES

- More than one point of origin.
- Must prove that each fire is independent of the others.

Slide 7-9

TRAILERS

Any combustible or flammable material used to spread fire from one point or area to another.

Slide 7-10

II. TRAILERS

A. A trailer is any combustible or flammable material used to spread fire from one point or area to another.

B. Common combustible materials that can be used as trailers include:

COMMON CLASS "A" TRAILERS

- Newspapers.
- Sheets.
- Clothing.
- Household trash.
- Rope, string, twine.
- Bounce™ (fabric softener sheets).

Slide 7-11

1. Newspaper.
2. Sheets.
3. Clothing.
4. Household trash.
5. Rope, string, twine, etc.
6. Bounce™ (fabric softener sheets).

C. Trailers usually leave a char or burn pattern on surfaces where used.

1. Floors.
2. Carpets.
3. Stairs.

REMAINS OF A CLASS "A" TRAILER

Slide 7-12

CIGARETTE AND MATCH DELAY

Slide 7-13

III. INCENDIARY DEVICES

A. Definitions.

1. **Delay mechanism:** They are chemical, electrical, or mechanical elements that provide a time delay. Elements may be used by themselves or in combinations.

2. **Incendiary material:** A material that burns with a hot flame for a period of time. Its primary purpose is to set fire to other materials or structures.

B. Construction of devices.

1. Incendiary devices often are constructed from readily available materials.

2. They may be found in everyday use, or the materials may be normal for a given occupancy.

3. When used separately, these materials may be harmless.

CIGARETTE AND MATCH DELAY (cont'd)

Slide 7-14

4. Cigarette and match delay.

   a. Effectiveness of delay depends on length of cigarette, tightness of tobacco, and whether or not match is fully inserted into cigarette.

   b. Matches bundled around cigarette provide additional fire intensity.

Slide 7-15

   c. Filter-tip cigarettes limit delay to approximately seven minutes.

Slide 7-16

5. The length of delay (time) varies widely depending on the type of device, materials, environmental conditions, construction, placement and ventilation.

HIGHWAY FLARES

Slide 7-17

6. Highway flares.

   a. Ignition of flare may be delayed by use of model rocket fuse, cigarette or match. Such fuses are very inexpensive and are available at most hobby shops.

   b. Flares may produce temperatures up to 1,200 °F (648.9 °C).

   c. Flares usually burn for 15 to 30 minutes.

   d. Flares are available in various colors, shapes, sizes, etc.

   e. Highway flares may also be used as fuses in the construction of Molotov cocktails.

- Standard highway safety flare is taped to bottle filled with accelerant.

- Flare is ignited and bottle is thrown.

STANDARD MOLOTOV COCKTAIL WITH PAPER WICK

Slide 7-18

7. Molotov cocktails.

a. Standard Molotov cocktail.

- Thin-walled bottle filled with gasoline and wicked with rag, paper towel or similar materials.

- Arsonist (bomber) lights wick and throws “cocktail.” Cocktails often fail to function properly.

-- Thick glass soda bottle does not break on contact, bottle does not strike solid target, or cocktail is thrown too soon (self-extinguishes in flight).

b. Cocktails and other ignition devices.

- Bottle is filled with accelerant, and bottle opening is wicked with combustible material.

- Several strike-anywhere matches are taped to neck of bottle.

- Bottle neck is scraped across rough surface, and tampon wick is ignited (provides easy wick ignition).

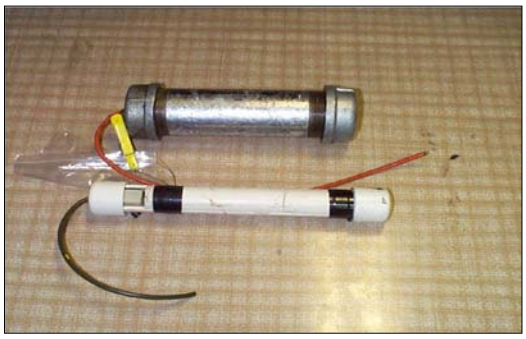
c. Thickened accelerants and cocktails.

- Various materials frequently are added to accelerants to produce limited spread of accelerant or to cause sticking of accelerant to target (e.g., accelerant and heavyweight oil and/or gasoline).

d. Chemical Molotov cocktails (sometimes called British Molotov).

- Bottle is filled with mixture of gasoline and concentrated sulfuric acid. Bottle then is capped and may be stored for long periods.

PIPE BOMBS



Slide 7-19

C. Pipe bombs are improvised explosive devices, typically constructed of metal or plastic (polyvinyl chloride (PVC)) pipe containing an explosive mixture and closed at both ends with caps.

1. A fuse is inserted into the pipe with a lead running out through a hole in the side or capped end of the pipe.

2. The fuse can be electric with wires leading to a timer and battery or can be a common fuse. All of the components are easily obtainable.

3. The containment provided by the pipe means that simple low explosives can be used to produce a relatively large explosion, and the fragmentation of the pipe itself creates potentially lethal shrapnel.

4. Premature detonation is a hazard, and the materials and methods used make unintentional detonations common.

5. The availability of directions/plans for the design and construction of pipe bombs and other incendiary devices can be easily obtained from various sources:

   a. Underground movements.

   b. Bookstores.

   c. Mail-order companies.

   d. Internet.

CLASS "B" TRAILERS

- Liquid accelerant.
- Any flammable/combustible liquid can be used.
- Liquids soak into and through certain overlays (i.e., carpet, foam padding).
- Usually leave a deep burn in overlays.
- Liquids on tile or linoleum overlay usually blister the surface.

Slide 7-20

IV. PRESENCE OF FLAMMABLE ACCELERANTS

A. Class "B" (liquid) trailers include a wide variety of flammable and combustible liquids.

1. Gasoline.
2. Kerosene.
3. Alcohol.
4. Lighter fluid.
5. Any other common or readily available ignitable liquid(s).

B. Often found in areas where they would not normally be in a given occupancy.

C. When found throughout area and:

1. Not caused by explosion of container; no sign of a container explosion.
2. Not due to container leakage; no sign of container leakage.

CLASS "B" TRAILERS (cont'd)

- Most liquid accelerants contain large amounts of hydrogen and carbon.
- Some other liquid accelerants do not contain hydrocarbons and are used as accelerants.

Slide 7-21

D. Although most ignitable liquids used as accelerants are derived from crude oil (petroleum-based), there are others that are not but can also be used as liquid trailers.

1. Ethanol.

2. Rubbing (isopropyl) alcohol.

3. Acetone.

COMMON CLASS "B" HYDROCARBON LIQUIDS

- Gasoline.
- Kerosene.
- Lighter fluid.
- Turpentine.
- Any other common or readily available liquid accelerant.

Slide 7-22

COMMON CLASS "B" NONPETROLEUM-BASED LIQUIDS

- Ketones.
  - Acetone.
  - Methylethyl ketone.
- Alcohol.
  - Methyl alcohol.
  - Ethyl alcohol.
  - Isopropyl (rubbing) alcohol.

Slide 7-23

PRESENCE OF LIQUID ACCELERANTS

- In unusual locations.
- Throughout the area.
- Above floor area.

Slide 7-24

E. The presence of liquid accelerants in locations where they would not normally be found or located throughout an entire area may be an indication that they were used to intentionally set a fire.

1. On or in furniture.

2. Inside drawers, cabinets, boxes, etc.

3. Inside files, desks, books, etc.

LIQUID PATTERN ON STEPS

Slide 7-25

F. Ignitable liquid accelerants that are poured on steps may be absorbed in carpet and padding (if present), and patterns may be visible once the debris in the area is carefully removed.

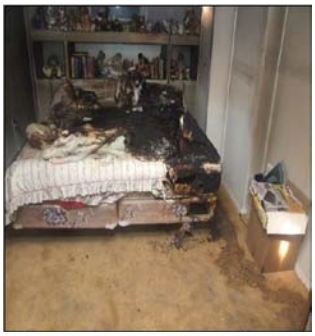
LIQUID BURN ON STEPS

Slide 7-26

1. Evidence (residue) may be recovered from the area beneath the steps.

2. Evidence (residue) may also be recovered from between the boards (risers) on the steps.

LIQUID PATTERN ON CARPET



Slide 7-27

G. Ignitable liquids may soak into any absorbent material.

1. Carpet: Liquid often leaves distinct patterns, and the residue may remain in carpet and pad on edge of burned area or in charred pad.

   a. Area may require cleaning away of debris before pattern is visible.

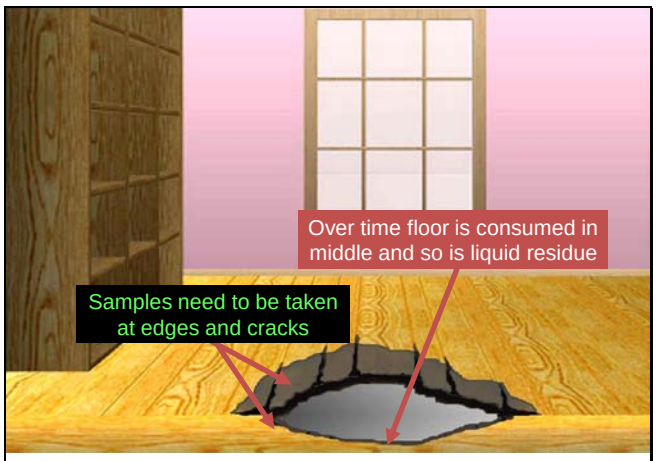
LOW BURN AT FLOOR LEVEL

Slide 7-28

   b. Pouring water onto floor may indicate direction of settling or running of accelerant.

2. Floor-length drapes: They act like wicks.

3. Porous materials such as plaster walls can also absorb liquids.



Slide 7-29

H. Common indicators of the presence (or use) of some flammable/combustible liquid accelerant (fuel).

Charring of floor surface.

1. Many accidental structure fires can produce significant floor charring.

2. Temperatures at floor level during flashover can exceed 1,100 °F (593.3 °C) or higher.

3. Evidence of burns or grooves between floorboards may indicate the presence of a liquid fuel.

4. Ignitable liquids may settle in the lowest parts of the floor surface, corners of rooms and along base of walls, or areas of heavy occupant travel or use.

LIQUID BURNS ON LINOLEUM

Slide 7-30

I. Blistering or destruction of floor tiles.

1. Asphalt and vinyl tiles may be blistered or destroyed in an area where flammables spread.

2. May be difficult to locate evidence (residue) due to adhesive in back of tiles.

EQUIPMENT OR APPLIANCES AS INCENDIARY FIRE CAUSES

- Check control settings.
- Tool marks.
- Tampering.
- Fuel placed nearby.
- Unusual location.
- Used at unusual times.

Slide 7-31

V. COMMON EQUIPMENT OR APPLIANCES AS INCENDIARY FIRE CAUSES

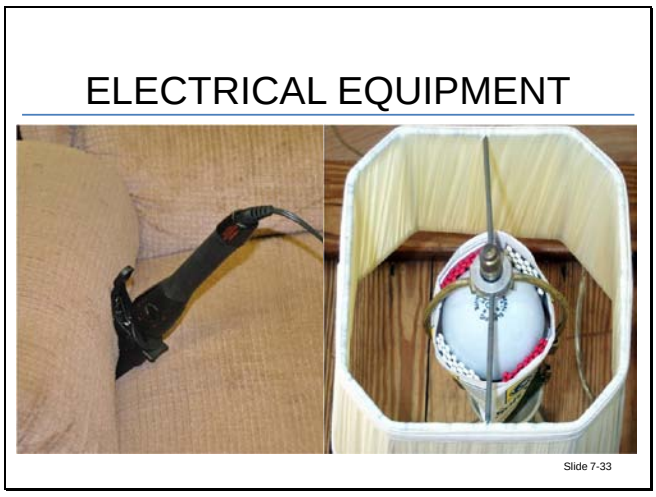
A. If equipment or appliances are suspected as being the ignition source, personnel should check for any evidence of tampering, fuels nearby, use at unusual times or in unusual locations, and examine the control settings to determine if they were on at the time of the fire.

SAFETY DEVICES — APPLIANCES

- Most appliances have built-in safety features that will function as designed and not result in ignition.
- Ignition may result if there is product failure **or** the appliance safety device is physically tampered with.

Slide 7-32

B. Although most appliances have built-in safety features, they may be disabled or tampered with to allow the appliance to overheat and serve as an ignition source for a fire.

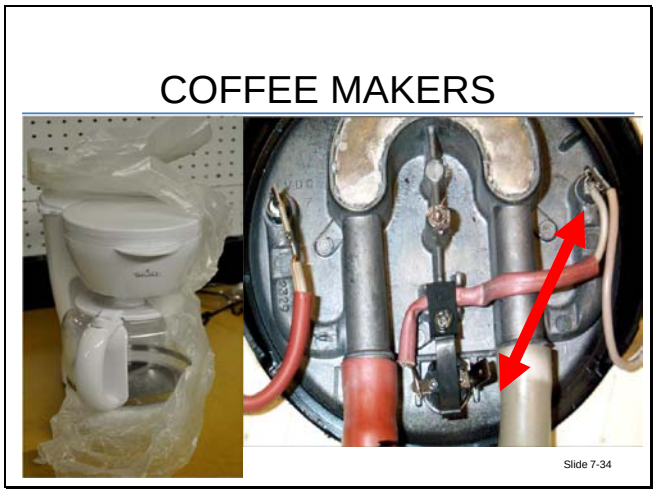


C. Electrical equipment and/or appliances used as incendiary devices.

1. Almost any electrical equipment or appliance may be used as an incendiary device.

   a. Heating elements placed in or on combustibles to produce heat.

   b. To activate some other device (timer).



2. Examples of common electrical devices.

   a. Coffee makers placed in or on combustibles — check for evidence of combustible fuel being arranged nearby (i.e., fuels such as gasoline may be placed in the water reservoirs) or the thermal cutoff being bypassed.

b. Heat produced by electrical devices depends on design, wattage and position.

c. Equipment found in unusual locations.

d. Electric appliances used at unusual times.

COMMON HEAT SOURCES

- Gas-fired water heater.
- Appliances which at one time may have had a history of causing fires.
- Possibility of an accidental fire always exists.

Slide 7-35

D. Heating equipment such as hot water heaters are a convenient heat source.

1. Appliances that at one time may have had a history of causing fires often are used as an “invented” fire cause to cover incendiarism.

   a. Check control settings.

   b. Check for tool marks on fuel lines.

2. Evidence of tampering with fuel supply lines, wiring, etc. should be documented.

STRUCTURAL DAMAGE PRIOR TO FIRE

- Holes in walls, floors or ceilings.
- Could be accidental.
- Poor upkeep of building.
- Document and relay information to investigators.

Slide 7-36

E. Personnel should note any holes in walls, floors or ceilings as they may have been made intentionally to aid in the spread of the fire; however, they may have been pre-existing and not related to the cause of the fire.

REMOVAL OR SUBSTITUTION OF CONTENTS PRIOR TO FIRE

- Expensive objects, antiques, etc. may be removed.
- Substitution of contents.
- Contents out of place or not assembled.

Slide 7-37

VI. REMOVAL OR SUBSTITUTION OF CONTENTS PRIOR TO FIRE

A. Expensive objects, antiques or objects with sentimental value may be removed.

1. Neighbors may have noticed removal of contents.

2. Neighbors may be able to state that objects are missing.

B. Substitution of contents.

1. Owner **may** remove usable contents and replace with junk furnishings.

a. Arsonist hopes officer **will not** be able to identify quality of contents.

b. Arsonist thinks **total** destruction by fire will cover the switch.

2. Neighbors may have witnessed exchange of contents or the presence of a truck or delivery trailer before the fire.

C. Contents out of place or not assembled.

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

2. Evidence of empty storage containers (boxes, drawers, etc.) is unusual and should be noted for follow-up.

D. The occupant may have obtained “junk” furnishings to fill the structure.

1. Such furnishings may be damaged, obsolete or even fire damaged.

2. The occupant believes the fire will destroy the furnishings.

E. Major appliances removed prior to fire.

1. Major-cost items may be removed and substitute items may or may not be used.

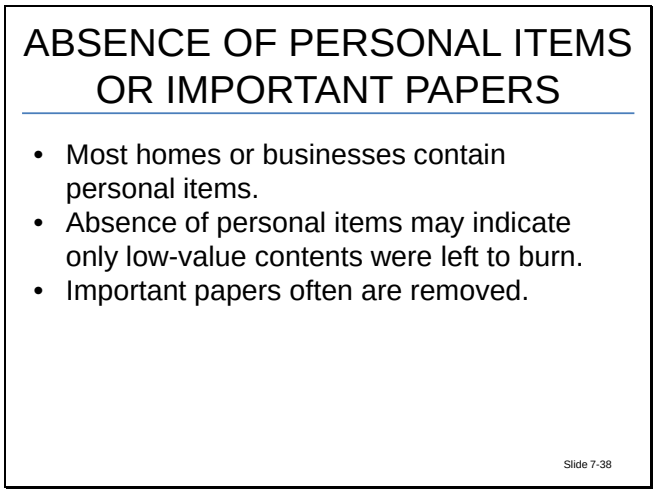
2. Substitute appliances may not be connected to power outlets or fuel lines.

3. Substitute appliances may be empty, in bad repair, or in poor condition.

4. Substitute appliances may not fit area of installation.

a. Check floor or cabinet cut-out area for indications that unit does not properly fit.

b. Check for indentations of leveling or leg buttons in floor covering.



VII. ABSENCE OF PERSONAL ITEMS OR IMPORTANT PAPERS

A. Most homes and businesses contain personal items.

B. Absence of personal items may indicate that only basic contents were left to burn.

1. Business, commercial or industrial occupancies.

a. Hand tools.

b. Portable power tools.

c. Work clothing (uniforms).

d. Business machines (computer, fax machine, etc.).

e. Petty cash.

2. Residential occupancies.

a. Expensive clothing.

b. Jewelry.

c. Family photographs.

d. Family records (birth certificates, family Bible, etc.).

e. Hobby equipment (guns, fishing or other sports equipment).

f. Tools.

C. Important papers frequently are removed prior to a set fire.

1. Insurance policies: Some people continue to believe it necessary to have their copy of an insurance policy in order to collect on that policy.

2. Marriage and church records.

3. Checking and savings account books.

4. Titles and deeds.

5. School records.

6. Wills.

LOCATION OF FIRE

- Areas with no identifiable heat source.
- Closets, crawlspaces, etc.

Slide 7-39

VIII. OTHER FACTORS RELATED TO INCENDIARISM

A. Fires that are determined to have occurred in areas that do not have identifiable heat sources may be incendiary such as closets, crawlspaces, under stairways, etc.

B. Unnatural fire spread may be due to an accelerant.

1. What appears to be unnatural fire spread by itself proves nothing.

2. These situations should cause the officer to conduct an extensive scene examination.

C. Excessive fire damage as compared to similar fires in similar occupancies.

1. Fire damage may have been increased due to use of an accelerant.

2. Structure fires may produce extreme temperatures (up to or above 2,000 °F (1,093.3 °C)) in many cases.

EVIDENCE OF OTHER CRIMES

- Fire may have been set to cover other crimes.
- Another crime could have been staged to help explain the set fire.

Slide 7-40

D. Some incendiary fires are set to cover up other crimes such as burglary and homicide.

LIMITED ENTRY OR VIEW

- Methods used to slow firefighters' entry.
- View into structure obscured to delay detection.

Slide 7-41

IX. LIMITED ENTRY OR VIEW

A. Methods used to slow firefighters' entry.

1. Removal of door hardware.
2. Doors or windows nailed, bolted or wired shut.
3. Contents moved to block doors or windows.

WINDOWS COVERED TO DELAY DETECTION

Slide 7-42

B. Occasionally the view into the structure will be blocked or obscured to delay detection of fire.

PREVIOUS FIRES IN SAME STRUCTURE

- May indicate incendiarism.
- Watch for “junk” furniture.

Slide 7-43

X. PREVIOUS FIRES IN SAME STRUCTURE

A. A second fire in the same structure over a short period may indicate incendiarism.

1. The first fire may have been an unsuccessful arson attempt.
2. The first fire may not even have been reported.
3. The second fire may involve large quantities of flammable accelerants.
4. The second fire could result in injuries to the firesetter.

PRESENCE OF FUEL NEAR THE POINT OF ORIGIN

- Readily available fuels.
- Question the reason.

Slide 7-44

B. Discovery of flammable liquid containers.

1. Arsonists sometimes use readily available materials on scene to set fires.

2. Firefighters may detect flammable or combustible liquid odors since they can remain after extinguishment.

3. If containers are used and not damaged, they may help to prove that fire was not accidental in nature.

4. If the container is retrieved and properly preserved for investigators, it may be able to be processed for the presence of latent fingerprints.

FIRES ON HOLIDAYS OR WEEKENDS

- Necessary setup time.
- Excuse for owner to be out of town.
- Delayed detection and more burn time.
- Arsonist believes there is less chance of injury.

Slide 7-45

XI. TIMING OF INCENDIARY FIRES

A. Fires on holidays or weekends at commercial/industrial complexes.

1. Provides the arsonist the necessary setup time while employees are away.

2. Provides excuse for owner to be out of town.

3. Fewer people in the area often cause a delayed detection and more burn time.

4. Arsonist believes there is less chance of injury to others.

B. Time of day.

1. Determine if fire cause or occupant's explanation of fire fits the time of the fire.

2. Kitchen fire (food on stove) at odd times may (or may not) be an indication of incendiarism.

3. Sofa fire (cigarette dropped into sofa) during daytime hours.

4. Often sofa/furniture fires caused by cigarettes are discovered early in fire's progress if occupants are in the area.

C. Time of year.

1. Fires during electrical storms or bad weather.

2. The arsonist may believe lightning is a convenient "cover" for the set fire.

3. Snowstorms may delay response by fire department.

FIRES DURING RENOVATIONS/REMODELING

- Causes:
  - Poor housekeeping.
  - Temporary electrical wiring.
  - Presence of liquid accelerants.
- Owner may decide to sell the property to the insurance company.

Slide 7-46

D. Fires during renovations/remodeling.

1. Causes.

   a. Poor housekeeping.

   b. Temporary electrical wiring.

   c. Presence of flammable liquids.

2. Owner may decide to sell the property to the insurance company.

   a. The structure was in worse condition than originally thought.

   b. The would-be renovator found the job to be too much work.

   c. Money ran out before the job was completed.

STATEMENTS BY OWNERS OR OCCUPANTS

- Complaints about the structure.
- Arguments with neighbors.
- Domestic problems.
- Signs of injuries.

Slide 7-47

E. Any statements made by owners, occupants or other witnesses at the scene should be carefully documented since they can provide key information for the investigation.

COMPARE SIMILAR MATERIALS AND SITUATIONS

Did the fire produce the results one would anticipate when compared to the many other fires in similar occupancies that you have observed?

Slide 7-48

F. Personnel should also compare similar situations and circumstances involved in the current incident to others that they have previously experienced. This can help determine whether things "add up."

ACTIVITY 7.1
Incendiary Fire

Slide 7-49

Slide 7-50

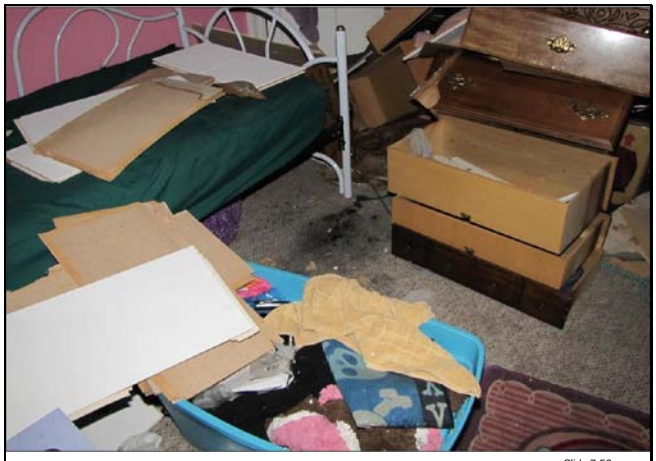
Slide 7-51

Slide 7-52

Slide 7-53

Slide 7-54

Slide 7-55



Slide 7-56

Slide 7-57

Slide 7-58

Slide 7-59

Slide 7-60

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ACTIVITY 7.1

Incendiary Fire

Purpose

To evaluate fire scenarios to determine the area of fire origin and the cause of the fire.

Directions

1. This activity uses a series of photos of fires that occurred in a commercial building and several different residential structures.

2. Your instructor will divide the class into small groups and each group will select a representative.

3. Examine the photos and answer the questions in your Student Manual (SM).

4. You will have approximately 30 minutes to determine the area or point of fire origin and the cause of the fire.

5. Be prepared to share your conclusions with the class.

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ACTIVITY 7.1 (cont'd)

Incendiary Fire

Slide 7-50 (Photo 1)

This picture shows the occupancies in the strip mall complex while the fire is still in progress.

Questions

What construction features should you be aware of in a strip mall complex?

_____

_____

_____

What might these features tell you regarding the potential area of fire origin?

_____

_____

_____

Slide 7-51 (Photo 2)

This picture shows the interior of an office located on the second floor inside of an occupancy that sustained fire damage.

Questions

Where do you notice the heaviest damage?

_____

_____

_____

What would you do to ensure safety in conducting this investigation?

Slide 7-52 (Photo 3)

This is a photo taken of a secondary point of origin in the same area.

Questions

What significance does separate, multiple noncommunicating points of origin have with respect to fire cause determination?

What actions would you take to preserve and protect the scene for investigators?

Slide 7-53 (Photo 4)

This picture is of the floor located in a hallway leading to an office area where an arsonist poured an ignitable liquid.

Questions

What would some of the reasons be for the patterns on the floor?

How would you document this area?

_____

_____

_____

Slide 7-54 (Photo 5)

This picture shows a storage room where combustible materials were piled into a corner and ignited.

Question

What might this type of fuel configuration indicate?

_____

_____

_____

Slide 7-55 (Photo 6)

This photo shows side D of a two-story residential structure.

Question

Based on the photo, where do you think the fire may have originated and what may be some of the potential causes?

_____

_____

_____

Slide 7-56 (Photo 7)

This picture shows fire/burn damage on a carpeted bedroom floor.

Question

What are some of the potential causes that may cause this type of fire?

_____

_____

_____

Slide 7-57 (Photo 8)

This picture shows a closer view of the area damaged by the fire. The damage is localized to the area between the bed and the dresser drawers.

Question

What do you notice in this type of burn pattern?

_____

_____

_____

Slide 7-58 (Photo 9)

This picture shows fire damage in the corner of an adjacent bedroom.

Question

What might the damage in this area tell you in regard to fire origin and cause?

_____

_____

_____

Slide 7-59 (Photo 10)

This photo shows a closer view of the remains of combustible materials (toys, blankets) on the floor in the corner of the bedroom.

Question

What precautions should be taken in performing overhaul in this area to preserve potential evidence of an incendiary fire?

Slide 7-60 (Photo 11)

This picture shows fire damage in a carpeted stairway leading to the second floor of the structure.

Question

What may this type of damage on a stairway indicate?

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DVD PRESENTATION

"NFPA 921 Arson Investigation (6 in a series)"

Slide 7-61

SUMMARY

- Indicators of incendiarism.
- Trailers.
- Incendiary devices.
- Presence of flammable accelerants.
- Common equipment or appliances as incendiary fire causes.
- Removal or substitution of contents prior to fire.

Slide 7-62

SUMMARY (cont'd)

- Absence of personal items or important papers.
- Other factors related to incendiarism.
- Limited entry or view.
- Previous fire in same structure.
- Timing of incendiary fires.

Slide 7-63

XII. SUMMARY

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UNIT 8: MOTIVATION OF THE FIRESETTER

TERMINAL OBJECTIVE

The students will be able to identify the most common motives associated with incendiary fires and the role that motive can play in fire cause determination.

ENABLING OBJECTIVES

The students will be able to:

1. *Describe common arson motives.*
2. *Identify the relationships that may exist between certain motives and certain types of fires.*
3. *Identify available resources.*

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UNIT 8: MOTIVATION OF THE FIRESETTER

Slide 8-1

ENABLING OBJECTIVES

- Describe common arson motives.
- Identify the relationships that may exist between certain motives and certain types of fires.
- Identify available resources.

Slide 8-2

MOTIVE/INTENT

- Motive — “Reason” for setting the fire.
- Intent — “Deliberateness” of the act.

Slide 8-3

I. THE MOTIVE OR "REASON" FOR SETTING THE FIRE

A. Sometimes confused with **"intent,"** which identifies the "deliberateness" of the act.

B. Motive is not necessary to prove the **corpus delicti** of the crime of arson.

C. Identification of the motive often helps during interviews.

D. Frequently, the district or state's attorney **may** decline to prosecute a case if the motive is **not** identified clearly.

E. Jurors **may** fail to find the accused guilty unless they know (and understand) **why** the individual(s) set the fire.

BASIC MOTIVES

- Spite/Revenge.
- Fraud/Profit.
  – Direct or indirect.
- Crime concealment.
- Excitement.
- Extremism.
- Vandalism.
  – Actions of juveniles.

Slide 8-4

II. COMMON ARSON MOTIVES

A. Spite/Revenge.

B. Fraud/Profit.

C. Crime concealment.

D. Excitement.

E. Extremism (i.e., civil disorder, revolution and political activity).

F. Vandalism — actions of juveniles.

SPITE/REVENGE

- Often the most deadly motive.
- Frequently weapon of someone who wants to be removed from physical act of violence.
- Can result in extensive loss of life.
- Responsible for large property losses.

Slide 8-5

III. SPITE/REVENGE

A. May be the most deadly type of fire.

1. Large loss of life.

2. Large property loss.

SPITE/REVENGE (cont'd)

- Initiated because of jealousy or uncontrolled emotion.
- Usually occurs at night.
- May involve available combustibles.
- Often set using liquid accelerants.
- Relationships often major factor.

Slide 8-6

B. Initiated by hatred, jealousy or other uncontrolled emotions.

1. Usually during hours of darkness.

2. May involve available combustibles or flammables transported to the scene.

3. Love/Sex often major factors.

4. To "get even."

SPITE/REVENGE (cont'd)

- Work or job relations.
- Labor disputes.
- Racial confrontations.
- Religious/Ethnic antagonism.
- Almost any age group.

Slide 8-7

C. May involve any emotional situation.

1. Work or job relationships (revenge for job termination).
2. Labor disputes.
3. Racial confrontations.
4. Religious or ethnic antagonism.
5. Almost any age group.

LOCATION OF FIRE MAY IDENTIFY MOTIVE

- Vindictive person may target valued possessions.
  – Vehicle, tools, jewelry, clothes, etc.
- Articles of clothing often placed in piles on bed or in closet.

Slide 8-8

D. The specific location of the fire may help to identify motives (bed, closet, etc.) and the person(s) responsible.

SPITE/REVENGE (cont'd)

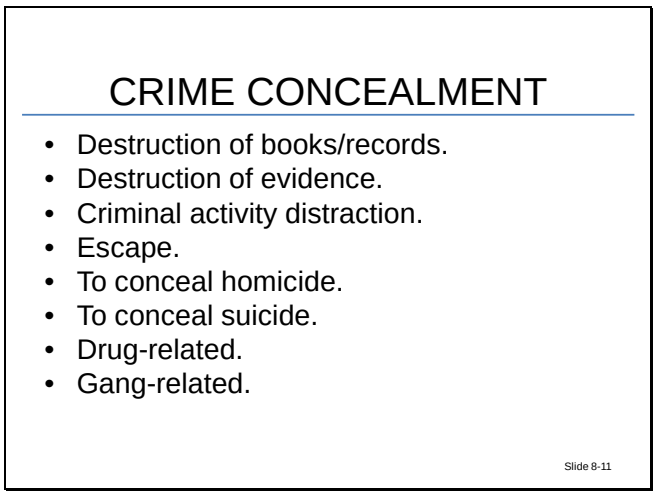
Slide 8-9

E. First responders should be aware of any graffiti present at the scene since it may provide a clue as to possible motive or possible gang affiliations.

SPITE/REVENGE (cont'd)

Slide 8-10

F. First responders should be aware of any writings or markings present at the scene since they may provide clues as to possible motive and suspect(s).



IV. ARSON USED TO CONCEAL OTHER CRIMES

A. Destruction of books/records used as a means to cover shortages of stocks, materials, cash, etc.

B. Destruction of evidence of another crime.

C. Distraction for other criminal activity.

1. To draw attention to other areas.

2. May be some distance away.

D. Arson for escape (i.e., prisoners/hospital patients attempting to escape).

E. Arson to conceal murder.

F. Murder or suicide by arson.

CRIME TO CONCEAL ARSON

- Staged burglary to help explain fire.
- Owner blames “criminal” for all unexplained situations.
- Often very difficult to investigate.

Slide 8-12

G. Crime to conceal arson (staged by burglary).

H. Used by burglars to destroy evidence of forced entry, fingerprints, stolen property, etc.

1. Used to help explain the fire.

2. Allows owner to blame unexplained situations on burglar.

3. Often very difficult to investigate.

4. Requires detailed interview(s).

I. Drug addicts and arson.

1. Arson to obtain salvage from burned building to sell for cash to support habit.

2. Arson as a diversion or to conceal burglary.

a. Provides opportunity to walk out openly with valuables.

b. Little concern for forced entry (forced entry usually attributed to fire department operations).

STOLEN GUNS AND VALUABLES

Slide 8-13

c. Stolen firearms and other valuables may be sold for quick cash to support a habit.

MISSING BUSINESS RECORDS

Slide 8-14

J. Important business records and documents (i.e., tax records, bank statements, etc.) may be burned to destroy evidence or cover up other criminal activities.

CONCEALMENT OF HOMICIDE

Slide 8-15

K. Arson can also be used as a means to cover up a homicide with the intent of destroying potential evidence of the crime.

FRAUD

A deception deliberately practiced in order to secure unfair or unlawful gain.

Slide 8-16

L. Fraud is defined as a deception deliberately practiced in order to secure unfair or unlawful gain.

ARSON FOR PROFIT MOTIVES

- Direct gain.
- Indirect gain.

Slide 8-17

M. Two types of fraud fires.

1. **Direct gain** fraud fires (usually to collect insurance money).

2. **Indirect gain** fraud fires (for personal gain, but not necessarily financial gain).

DIRECT GAIN FRAUD

- To collect insurance money.
- Unemployment.
- Unwanted property.
- Sale of land without buildings.
- Condemnation.
- Estate settlement.
- Business failure.
- Completion of business season.

Slide 8-18

N. Economic conditions.

1. Unemployment.

2. Bills piling up.

3. Embarrassment with family, neighbors, friends, etc.

4. One way out: Burn the house to collect insurance money to start over.

5. Mistakes often made by this type of firesetter:

a. Removal of personal property or valuables.

INSURANCE

- The amount of insurance is relative to the needs of the firesetter.
- An increase in coverage.
- A decrease in coverage may indicate fraud.

Slide 8-19

b. Belief that insurance policy should be removed prior to fire (not found as frequently today). Recent increases or decreases in coverage may indicate a potential fraud fire.

c. Homeowner often does not realize that loss payee (mortgage holder) will receive most of insurance money.

DIRECT FRAUD FIRES

- Economic conditions.
- Business problems.
- Vehicle fires.
- Natural disasters.

Slide 8-20

O. Inability to dispose of unwanted property; owner liable for taxes on useless structure.

1. Sale of land, less buildings.

a. Neighborhood changing from residential to commercial.

b. Land could sell faster without buildings.

2. Condemnation proceedings against structure. Cheaper to burn structures than to have contractor remove them.

DIRECT FRAUD FIRES (cont'd)

- Completion of business season/contract.
- Cancelled orders.
- Merchandise outdated/obsolete.
- Large inventory.
- Increasing business, occupancy too small.
- Desire to redecorate.

Slide 8-21

P. Imminent business failure or business recession.

1. Fire may appear to be a better choice than bankruptcy.

2. Completion of business season.

3. Failure to complete business contracts. Contract clause may allow for an **"out"** if manufacturer suffers fire damage.

4. Canceled orders. Businesses that rely on **one** order or **one** customer for most of their business.

5. Business increases or business becomes too large for expansion:

DIRECT FRAUD FIRES (cont'd)

- Lack of stock.
- Partner disagreement.
- Dissatisfaction with location.
- Changes in traffic patterns.
- Outstanding accounts.
- Breaking of a lease.

Slide 8-22

a. Mix and match growth.

b. Can expand no more.

c. Fire allows for relocating facility.

6. Merchandise outdated or obsolete.

7. Lack of market/high inventory.

8. Lack of stock, supplies and/or raw materials. Business may have orders but must turn them down because of lack of materials.

VEHICLE FRAUD FIRES

- Vehicle is a "lemon."
- Expensive mechanical repairs.
- Insurance value higher than trade or sale value.

Slide 8-23

Q. Vehicle fraud arson.

1. Continuous repairs become expensive.

2. Insurance value higher than trade or sale value. Fire offers only way to get "book value" for the vehicle.

INDIRECT FRAUD FIRES

- Contractual motives.
- Business motives.

Slide 8-24

3. Business partners disagree, or one partner wants out.

   a. Money easier to divide than property.

   b. Fast settlement.

4. Business appears good, but no cash coming in. Outstanding accounts receivable.

   a. Equipment obsolete.

   b. Orders being lost to businesses with newer/faster equipment.

R. Business competition.

1. New business in neighborhood offers better parking, lower prices, newer equipment, etc.

2. Often difficult to identify motive.

3. Often used by organized criminal groups.

S. Other possible fraud motives.

1. Public adjusters seeking to secure contract to adjust loss (may or may not involve property owner).

2. Contractor seeking repair contract (may or may not involve property owner).

3. Individual seeking employment.

4. Loss payee needs cash (generally found in situations where there is a private sale and payment agreement).

5. Salvage dealer seeking contract.

6. Tenant fires.

   a. To break lease.

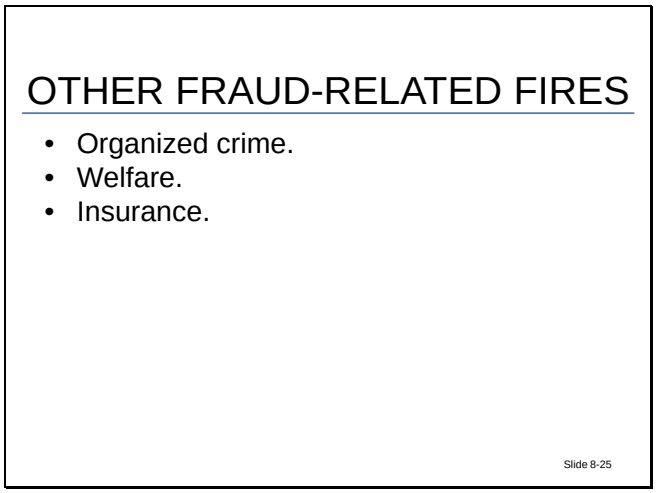
   b. Fire may not be in the area of structure occupied by firesetter.

7. Landlord fires.

   a. To force undesirable tenants to move.

   b. New leases (higher rent).

c. Condo conversions.



T. Fraud fires — general information. May be associated with other direct or indirect gain fraud fires.

1. Organized criminal activity.

   a. Insurance fraud.

   b. Elimination of competition.

   c. Intimidation or protection.

2. Welfare fraud fires.

   a. Usually caused by desire for new or different housing.

   b. Allows welfare recipient to go to top of waiting list.

   c. Fire in recipient's building may not directly involve his or her apartment or unit.

   d. Cash for property that was removed prior to fire, or for property that never existed, may be obtained from various assistance programs.

   e. Recipient also may receive relocation money.

3. Building construction/demolition and fraud fires.

   a. Building construction.

- Frequently improperly classified as fires by vandals, vagrants, juveniles or children.

- Labor problems that lead to spite/revenge.

- Confrontation between different labor unions or between union and nonunion groups.

- Failure to receive inspection approval.

- Project may become insolvable before completion.

- Extreme care required to eliminate all accidental causes.

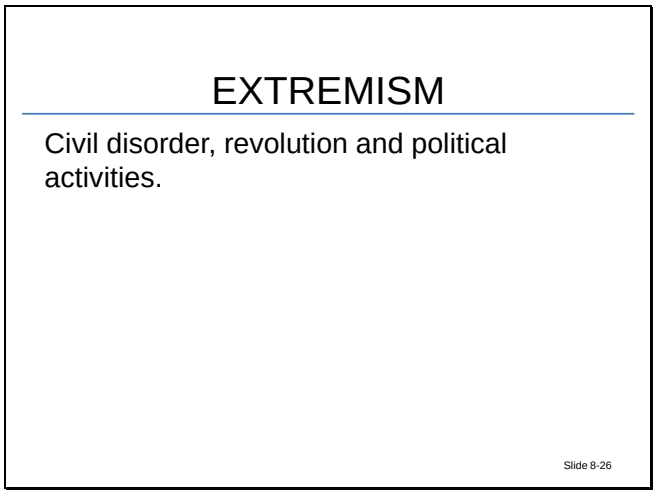
b. Building demolition.

- Labor problems similar to building construction.

- Avoid demolition permit costs.

- To reduce labor costs.

- Higher pay for demolition crews (increased pay for working under hazardous conditions).



U. Civil disorder and politically-motivated arson incidence in recent years.

1. Race riots.

2. Terrorist groups using explosives. (First responders must exercise **extreme caution**.)

3. Flash mobs that have surfaced through social media can also engage in these activities.

V. Can relate to other motives (excuses used for burning).

1. Spite/Revenge.

2. Vandalism.

3. To conceal looting.

FIRE USED AS WEAPON PROVIDES TWO RESULTS

- Destruction of property.
- Impression that group activity involves many people.

Slide 8-27

W. Fire used as a weapon.

1. Destruction of property.

2. Impression that group activity involves many people.

CIVIL DISTURBANCE

Slide 8-28

X. Civil disturbances can involve a number of activities related to perceived injustices by the government. These can be manifested by:

1. War protesters.

2. Anarchists.

CIVIL DISTURBANCE (cont'd)

Slide 8-29

Y. Groups that maintain strong views about reproductive health have targeted facilities and their employees that provide client services.

FIRE USED TO SHOW POWER OF GROUP OVER OTHERS

- Protesters.
- Political terrorism.
  – Militias.
- Labor disputes.
- Intimidation of the public and opponents.
- "Credit" may be taken by group not responsible.

Slide 8-30

Z. Other possible motivations include using fire to settle labor disputes and to intimidate public officials or high-profile persons.

1. "Credit" for arson may be taken by group not responsible.

2. Sometimes the intended targets are not hurt while innocent bystanders are either injured or killed.

EXCITEMENT

- Profit vanity.
- Hero vanity.

Slide 8-31

V. VANITY

A. The underlying motivation for vanity firesetting is excitement.

PROFIT VANITY

- Form of indirect fraud:
  – Security guard desires pay raise or promotion.
  – Paid on-call firefighters desire extra pay.
  – Individual wants to convince business they should hire him or her.

Slide 8-32

B. Profit vanity (also a form of indirect fraud).

1. Security guard desires pay raise.

2. Paid on-call or volunteer firefighter desires extra pay (when paid for each incident or run).

3. To convince businesses that individual should be employed.

HERO VANITY

- Often considered to be related to a possible psychological disorder.
  - Individual wishing to be hero.
  - Citizen attempting to gain attention.

Slide 8-33

C. Hero vanity.

1. Police officer, firefighter or security guard who wants to be "hero."
2. Private citizen to gain attention.
3. May be used to save entire building or for the attention of only one person.
4. Fascination with sirens, lights, fire department operations, etc.

JUVENILE FIRESETTERS

- Approximately 40-70 percent of intentional fires may be caused by juveniles' curiosity or vandalism.
- Both males and females will exhibit behavior.
- Most common between the ages of 4-12.
- Usually curiosity has no criminal intent.
- May be a cry for help due to abuse.

Slide 8-34

VI. VANDALISM — ACTIONS OF JUVENILES

A. Recent statistics generally show that approximately 40-70 percent of the fires set by juveniles are vandalism-related. Both sexes exhibit this behavior and are typically between the ages of 4-12.

JUVENILE FIRESETTERS (cont'd)

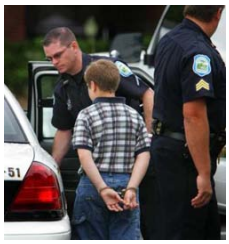
If child's intent was not to set fire to the building and/or if the act was intended as playing or experimenting with fire, then the incident should be listed as accidental **not incendiary**.

Slide 8-35

B. Curiosity or experimenting with fire is not considered criminal intent or arson; therefore, these fires should be classified as accidental and not incendiary.

AGE ACCOUNTABILITY

- At 7 years old for federal law.
  - State statutes will vary.
- Under 7, child usually not accountable.
- Depends on local or state statutes or policies.



Slide 8-36

C. Age of accountability.

1. At 7 years old **(federal law — state laws vary).**
2. Under 7, child usually is not legally accountable.
3. **Depends on local or state statutes or policies.**

AGE GROUP 4-12 YEARS

- Most common:
  - Curiosity.
  - Revenge.
  - Crime concealment.
    - -- Influenced by television.
    - -- Vandalism may be practiced by 8-12-year-olds — usually involves schools.

Slide 8-37

D. Motives and age groups.

At 4-12 years.

1. Revenge, or getting back at someone, can be predominant.
2. Curiosity.
3. Crime concealment.
   a. Not as frequent as with adults.
   b. Influence of TV.
4. Vandalism.
   a. Usually not found in age groups 4-8, but is found in 8-12.
   b. If present, may involve schools.

E. Examining the child-set fire.

1. Location of fire may aid in identifying a child or young person as the firesetter.
2. Fire experimentation usually done in hidden places.
   a. Closet fires.
   b. Under bed.
   c. Basements/Attics.

d. Alleyways.

e. Under porches.

F. Juvenile revenge-motivated fires may involve a number of targets that includes schools, sports/recreation centers, etc.

1. Predominant in the 12-18 age group.

2. Fire may be the only weapon available.

G. Schools are a favorite target of many firesetters. These fires often include:

1. Available fuels and matches.

2. Lockers.

3. Bathrooms.

4. Playground equipment.

5. Dumpsters.

6. Brush fires.

H. Time of day/night.

1. During daylight hours (depending on age group and area).

2. Hours after school.

3. Holidays, summer vacation.

4. Special events (sports, homecoming, dances, etc.).

I. Clues in identifying suspects.

1. Boastful behavior, excessive nervousness, etc.

2. Checking messages and pictures posted on social media networking sites (i.e., Facebook, MySpace, YouTube, etc.).

J. Personnel should make note of any graffiti or other identifiable markings at the scene since they may be helpful in identifying motives and suspect(s).

K. Type of structure or location of fire.

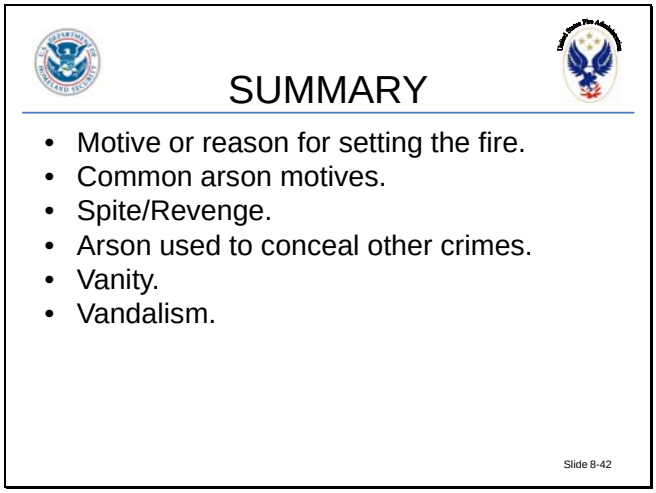
1. Vacant buildings.

a. Boredom.

b. Excitement.

2. Out-of-the-way places.

L. Some fires that are intentionally set may be related to satanic crimes (i.e., devil worship, occults or rituals) that may involve humans or animals. Any symbols/markings that may be found at the scene need to be documented since they may provide valuable clues for investigators.



VII. SUMMARY

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APPENDIX

COMMON CHARACTERISTICS OF FIRESETTERS

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Common Characteristics of Firesetters

A. A firesetter is defined as someone with an uncontrollable impulse to start fires. (It may or may not be connected to sexual desires and/or gratification.)

1. Wide range of opinions among experts.
2. Many lay opinions available.
3. Firesetters can be both male and female.
4. Little comprehensive research in recent years.

B. Composite characterization of a male firesetter.

1. He is a loner, a loser.
2. He is suffering a setback of some type.
3. He is unable to do anything about being a loser or a firesetter.
4. He is rarely an alcoholic, but he may require a few drinks for courage.
5. He is extremely cunning.
6. He seldom carries an accelerant.
7. He usually sets his fires in areas that provide an easy exit or escape.
8. He may set his fires either inside or outside the structure.
9. He may set more than one fire at a given time.
10. He finds some type of relief in setting fires.
11. His fires usually occur in buildings other than his own.
12. He usually has some type of activity pattern.
13. He may or may not stay in the incident area.
14. He may travel in an aimless fashion to avoid detection.
15. He may continue to commit acts of arson during incarceration.

C. Characteristics of the female firesetter.

1. She usually sets her fires in or near her home.
2. Her fires usually occur during daylight hours.
3. Her fires usually are small.
4. She seldom uses an accelerant.
5. She may not remain at the scene.

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UNIT 9: VEHICLE FIRES

TERMINAL OBJECTIVES

The students will be able to:

1. *Explain the basic methodology used to conduct a thorough vehicle fire examination.*
2. *Describe the three major compartments of a vehicle and their role in fire spread.*
3. *Effectively preserve and document evidence that can be used by fire investigators as part of a follow-up investigation.*

ENABLING OBJECTIVES

The students will be able to:

1. *Identify and understand basic vehicle components and construction.*
2. *Recognize and understand potential ignition sources and materials capable of being ignited.*
3. *Preserve the scene and document information important to investigators.*

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UNIT 9:
VEHICLE FIRES

Slide 9-1

ENABLING OBJECTIVES

- Identify and understand basic vehicle components and construction.
- Recognize and understand potential ignition sources and materials capable of being ignited.
- Preserve the scene and document information important to investigators.

Slide 9-2

CAUSES OF VEHICLE FIRES

- All motor vehicles contain sources of ignition as well as solid, liquid and vapor fuels.
- Cause of vehicle fires will be difficult to determine in many cases due to extent of damage.
- Even badly burned vehicles can provide information that will be of benefit to the investigator.

Slide 9-3

I. REASONS FOR VEHICLE FIRE INVESTIGATIONS AND MOTIVES

A. Often, vehicles are burned for many of the same reasons as structures.

B. However, certain motives usually are found only in vehicle arson.

C. All fire-damaged vehicles can provide important information that can be used to determine cause and responsibility.

D. Vehicle fires can occur accidentally, and vehicles may be destroyed by fires of various causes.

1. Improper or careless use of lighted cigars/cigarettes.

2. Leaking flammable liquids coming in contact with ignition source.

3. Overheating of mechanical equipment.

E. Accidental vehicle fires can cause vehicle destruction.

F. Most accidental vehicle fires cause only localized damage.

G. Most “total-loss” vehicle fires are thought to be of incendiary cause.

COMMON MOTIVES FOR VEHICLE ARSON

- Insurance fraud.
- Crime concealment.
- Vandalism.
- Spite/Revenge.

Slide 9-4

H. Common motives for vehicle arson.

1. Insurance fraud.

2. Crime concealment.

3. Vandalism.

4. Spite/Revenge.

I. Uncertain economic periods affect the number of vehicle fires.

J. Ownership of the vehicle may have an effect on the burning of the vehicle.

1. **Company-owned** (fleet, public, etc.) vehicles seldom are destroyed by fire.

2. **Privately owned** vehicles are destroyed by fire.

K. Many vehicle fires share the same motives as structure fires.

1. Cost to repair mechanical problems with vehicles sometimes may be a reason to burn the vehicle.

2. The vehicle may be a “lemon” or subject to recall and has lost its value.

L. Financed vehicles burn while vehicles owned outright seldom burn.

Exceptions:

1. Owner who is in dire need of ready cash.

2. Car is a gas hog, and no one will purchase it.

M. Insured vehicles burn while uninsured vehicles seldom suffer total-loss fires.

N. Fire injuries to operators/passengers may indicate incendiarism.

1. Injuries may have been caused by throwing flammable accelerants onto a burning vehicle.

2. Stories are often developed by injured operator/passenger to cover incendiarism.

O. Other facts that point to incendiarism.

1. Time of the fire is related to possible incendiarism — many cases of vehicle incendiarism occur late at night.

2. Area where vehicle is located is important; most incendiary vehicle fires occur on remote roads, back alleys, vacant lots, or in other locations that provide cover.

3. Area of the country may affect the number of total-loss vehicle fires. This fact may be related to regional standard of living.

   Example — highly populated area where standard of living is important as compared to rural or farm area where status is less important.

REASONS FOR VEHICLE FIRE INVESTIGATIONS

- Reduce insurance costs.
- Prevent loss of jobs, income, and services.
- Fire prevention/public safety.
- Criminality.
- Liability.

Slide 9-5

P. Reasons for vehicle fire investigations.

1. Identify defective vehicle components that may contribute to fire causes.

2. Identify fires of incendiary origin and to reduce insurance fraud.

3. Fire prevention.

II. PROBABILITY OF ACCIDENTAL VEHICLE FIRES

COMBUSTIBILITY OF VEHICLES

- Large amounts of flammable liquids.
- Many electrical circuits.
- Combustible interiors.
- Vehicles have a compartmentalized design.
- Fuel systems are designed for safety.
- Flame-retardant fabrics are used.

Slide 9-6

A. Combustibility of vehicles.

1. Not all experts agree about the combustibility of modern vehicles.

2. Modern vehicles have a compartmentalized design and other system safety features to limit the potential for accidental fires.

MODERN VEHICLE SAFETY DESIGN

- Electrical systems.
- Fuel systems.
- Interior finishes.
- Ignition system.

Slide 9-7

B. Modern vehicle safety design.

1. Electrical overload protection helps limit short-circuit damage.

2. Damage from short circuits usually is limited to the wiring between the short and the first-line fuse.

3. Equipment and accessory short circuits usually cause only localized damage.

4. Materials used as electrical insulation seldom add to the overall fire damage.

5. Interior finishes and ignition systems also have built in safeguards to limit their role in fire causation.

6. Fuel systems that have protection to limit their ability to contribute to the fuel load or serve as a potential ignition source.

7. Newer fuel systems (nonvented) **may** pose explosion hazards.

8. Older fuel systems usually **do not** pose explosion hazards.

   a. Flammable vapors are released from the storage tank.

   b. Vapors usually burn away at or near the tank filler neck.

9. Metal fuel lines seldom melt if they contain liquids to help dissipate absorbed heat.

10. Fabrics often are flame retardant. Foam padding **often** is manufactured to resist attack from fire.

11. Vehicle designs **usually** provide the maximum separation between fuel and ignition sources. Overall **moderate** ignition fire possibilities.

THINGS TO REMEMBER

- Small compartment size in vehicles may result in more rapid fire growth, depending on fuel and ignition source.
- Just because it has wheels, doesn't mean you can forget fire behavior.
- Many fire dynamics principles apply the same as in a structure fire.

Slide 9-8

C. Personnel should remember that basic fire science and fire dynamics principles that impact fire behavior apply equally to vehicle fires and structure fires.

DVD PRESENTATION

"American Heat/FETN Vehicle Fire Investigation"

Slide 9-9

SAFETY

- Cold scenes can be as dangerous, if not more so, than hot ones.
- Personal protective equipment (PPE) is applicable (respirator, gloves, etc.).
- Getting under an object that may weigh several thousand pounds.
- Batteries, gas tanks, fuel leaks, and broken glass.

Slide 9-10

D. Personnel need to remember that working in and around vehicles may be potentially hazardous.

1. Batteries, fuel leaks and broken glass may be present. Personal protective equipment should be worn at all times to avoid injury or exposure.

2. These hazards exist regardless of when and where you initiate your examination.

SAFETY (cont'd)

- Sodium azide which is the expelling agent used in many airbags is a hazardous material; contact and inhalation may pose a problem.
- You may need a qualified mechanic to check if the systems are still active and could deploy.
- Everything must be rendered safe.

Slide 9-11

3. Sodium azide is the expelling agent typically used in airbags and is considered hazardous.

4. Personnel should exercise extreme caution when working in or around the passenger compartment where these devices are commonly found.

III. INCIDENT SCENE EXAMINATION

TWO EXAMINATIONS MAY BE NECESSARY

- Incident scene examination.
- Detailed vehicle examination.

Slide 9-12

A. Two examinations may be necessary.

1. Incident scene examination.

2. Detailed vehicle examination.

OBJECTIVES OF A VEHICLE INVESTIGATION

- Identify the fire's point of origin.
- Find the heat source.
- Determine the fuel source.
- Determine what action brought the heat source and fuel source together.

Slide 9-13

B. As is the case with structure fires, the primary objective of a vehicle fire investigation is to identify the fuel source, heat source and the actions or circumstances that brought them together.

CONDUCTING THE PROPER ORIGIN AND CAUSE INVESTIGATION

- A systematic approach divides the vehicle into three or four separate areas:
  - Engine compartment.
  - Passenger compartment.
  - Trunk.
  - Underside.

Slide 9-14

C. A proper vehicle origin and cause investigation must follow a systematic approach and should include an examination of the engine compartment, passenger compartment, trunk area and underside of the vehicle.

DOCUMENTING THE FIRE

- Vehicle left at scene is preferred, however if the vehicle is removed, the scene may have to be visited later.
- Use the same principles you would use when documenting a structure fire.
- The “backwards” theory applies, work from least to most damage.

Slide 9-15

D. Documenting the scene of a vehicle fire uses the same principles as documenting structure fires and should proceed from areas of least to most damage.

RECORDING THE SCENE

- Vehicle photographs.
- All surfaces top and underside.
- Damaged and undamaged areas.
- Floor photos prior to debris removal, showing position of items, contents, keys, etc.
- Patterns = direction.

Slide 9-16

E. Properly recording the fire scene should include a series of photographs that record all damaged and undamaged areas, burn patterns and the locations of any pertinent items of evidence.

RECORDING THE SCENE (cont'd)

- Photograph, photograph, photograph.
- Diagrams of the scene.
- Bird's-eye view if possible.
- Don't give up on forensics.
  – Blood, hair fibers, fingerprints, footprints, tire impressions, debris, containers, etc.

Slide 9-17

F. Recording the scene also involves preparing a sketch or diagram that emphasizes key facts that are captured in photographs.

HISTORIES

- Every person, place, building, vehicle etc., that come in contact with, needs to have history checked.
- Vehicle title history/search.
- Victims (defendants) witnesses.
- Witnesses are vital to the investigation.

Slide 9-18

G. An important component of a fire investigation is completing a background check on all persons, and a complete history on the vehicle involved in the fire.

ACCELERANT RESIDUE IN SOIL

Slide 9-19

H. Accelerant residue may be recovered from soil located under or near vehicle.

1. Accelerant may leak through from vehicle interior.

2. Accelerant may be used as a trailer to allow arsonist to start fire some distance from vehicle.

3. Accelerant residue may be several inches down into soil.

4. Accelerant container often recovered at incident area.

   a. Accelerant container may be discarded by throwing into nearby cover.

   b. Accelerant container may be thrown from vehicle used to transport arsonist after fire was set.

I. Damage to the surrounding area should be noted.

1. May be caused by ignitable liquids (accelerants) on the ground.

2. May be caused by intense burning.

SHOEPRINT/TIRE IMPRESSION

Slide 9-20

J. Shoeprints can place the owner at the incident scene.

1. May contradict story of vehicle being stolen and then burned.

2. May help to identify accomplices.

3. May indicate direction of departure from the incident scene by people and/or vehicles.

VEHICLE EXTERIOR EXAMINATION

Slide 9-21

K. Personnel should begin their investigation with a complete examination of the vehicle's exterior.

1. At one time, the sagging of the vehicle's roof as a result of an intense fire was thought to indicate an incendiary fire.

   a. The sagging of the roof should be noted.

   b. The sagging of the roof does **not** prove the fire was incendiary.

2. On newer vehicles, a sagging roof can be the result of the burning of certain types of seat padding.

3. Evidence of flammable accelerants on underside of vehicle.

   a. **Usually** indicated by soot on underside.

   b. Photograph and note.

4. Exterior fire damage — Flammable accelerants may show evidence of running or dripping on vehicle exterior.

MISSING FILLER TUBE CAP

Slide 9-22

L. Gas cap missing.

1. Search for missing cap, note and photograph location if found.

2. Examine for evidence of explosion damage — Driver may claim the missing cap was "blown off."

3. Discovery of gas cap may disprove owner's/operator's story or alibi.

COLLISION DAMAGE

Slide 9-23

M. Any collision damage should be noted and documented to determine if it was caused by a recent accident or if the damage occurred previously (i.e., weeks or months earlier).

MECHANICAL CONDITION OF VEHICLE

- The mechanical condition of the vehicle prior to the fire should be established.
- Visual observations and owner statements should be documented for investigators.

Slide 9-24

N. One of the key pieces of information to obtain in a vehicle fire investigation is the mechanical condition of the vehicle prior to the fire. Personnel can assist in this effort by documenting their observations and any statements obtained from the owner at the scene.

TIRE PADS

Slide 9-25

O. The protected area between the rim and the surface (ground) may provide an indication of the condition of the tire(s) prior to the fire.

1. Pads usually will remain under vehicle wheels (rims) and should be documented as evidence.

2. Check for off-color wheel rims that were changed prior to the fire.

TIRE WEAR/TREAD

Slide 9-26

P. The extent of tire wear/tread should be noted and documented for investigators. The presence or absence of any skid marks should be noted. The lack of skid marks may contradict driver's story.

1. Check tire tread for odd treads or uneven wear, which may indicate a change of tires prior to the fire.

2. Check for missing lugs that may indicate haste in fire preparations.

3. Check for jack impressions in ground around vehicle.

4. Original tires may be located on owner's/accomplice's property.

VEHICLE INTERIOR EXAMINATION

Slide 9-27

IV. EXAMINATION OF VEHICLE'S INTERIOR

EXAMINE VEHICLE INTERIOR

- Owner often removes accessories for later use.
- Owner may remove accessories to give or sell to accomplices, relatives, or friends.
- Extent of damage is related to time and suppression activities.

Slide 9-28

A. Examine vehicle's interior for evidence of accessories having been removed.

1. Owner often removes accessories for later use, give or sell to accomplices, relatives, or friends.

2. Examine vehicle's glove compartment.

a. An empty glove compartment usually is considered suspicious.

b. Glove compartment may contain records of the vehicle's repair history and may help to identify prior mechanical problems.

EXAMINE VEHICLE INTERIOR (cont'd)

- Most vehicle accessories will leave melted material in mount holes or brackets.
- Serial numbers and physical descriptions of all accessories should be recorded for investigators.

Slide 9-29

3. Most vehicle accessories do **not** totally burn or melt.

4. Most vehicle accessories will leave melted metal in mount holes or brackets.

5. Empty mounting brackets/holes should be considered suspicious.

COMPARTMENTS

- Engine, trunk and passenger.
- Each needs to be examined.
- Windshield delamination can play a pivotal role.
  – A passenger compartment fire will frequently cause failure at the top of the windshield and patterns that radiate on the hood.

Slide 9-30

B. The engine, trunk and passenger compartments need to always be carefully examined as they can contain important information related to the fire's origin and cause.

1. Windshield delamination may provide clues concerning fire origin.

2. A fire that originates in the passenger compartment usually causes failure at the top of the windshield and produces patterns on the hood.

ACCELERANT CONTAINERS

Slide 9-31

C. Accelerant container often left inside vehicle.

1. Arsonist often believes container will be totally consumed.

2. Most containers leave some evidence.

   a. Glass jugs — search for neck and/or carrying ring.

   b. Plastic jugs — search for melted plastic.

   c. Metal cans.

3. Discovery of accelerant container may help to discredit cover or story of owner.

4. Container may provide accelerant comparison sample.

D. Combustibles inside vehicle.

1. Often leave little evidence.

2. Combustibles under seats may survive fire suppression activities.

E. Accelerant residue may be recovered from vehicle interior.

1. Accelerants usually settle to lowest level and may be recovered.

   a. From floor carpets.

   b. On or under floor mats.

   c. In metal floor indentations.

d. Around rubber grommets.

2. The sense of smell may not be effective in locating accelerant residue. Gasoline odors are commonly found in vehicles.

ASHTRAYS

Slide 9-32

F. Ashtrays should be examined.

1. May contain accelerants.

2. May help to disprove owner's story of a discarded cigarette as the fire cause. An unused tray may indicate owner does not smoke.

AIR VENTS

Slide 9-33

G. Vehicle air vents may provide a means for an arsonist to intentionally spread fire from one part of the vehicle to another.

SEAT CUSHIONS

Slide 9-34

H. Vehicle seat cushions.

1. Many types of foam rubber or synthetic materials are difficult to ignite without an open flame.

2. Certain types of foam rubber, polyfoam, or foamed plastics may be ignited readily by an open flame.

3. Once ignited, these materials often produce large amounts of smoke and high heat.

COLLAPSE OF SPRINGS

Slide 9-35

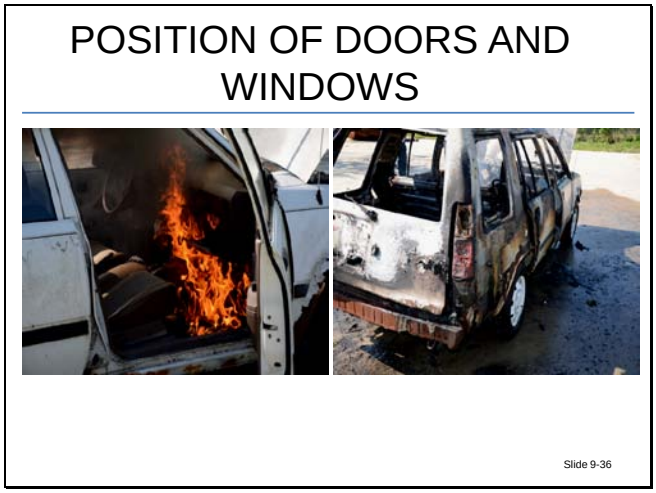
I. Loss of spring temper in seats.

1. Extreme heat required.

   a. May be due to the burning of foam or synthetic cushion or padding materials.

b. May be due to the presence of an accelerant or placement of combustible material, such as newspapers.

2. Loss of spring temper does not mean that the fire was incendiary.



J. Position of vehicle doors and windows.

1. Vehicle doors and windows often are left open when vehicle is **intentionally burned**.

2. Ask whether firefighters had to open doors.

3. Open windows during very cold weather.

4. Closed windows during very hot weather. However, air conditioning must be considered.

5. Fire may self-extinguish if windows are left closed.

6. If glass is melted, check window lift arms to determine position of windows at the time of the fire.

7. Melted window glass **does not** prove the fire was incendiary in nature.

STEERING LOCK ASSEMBLY

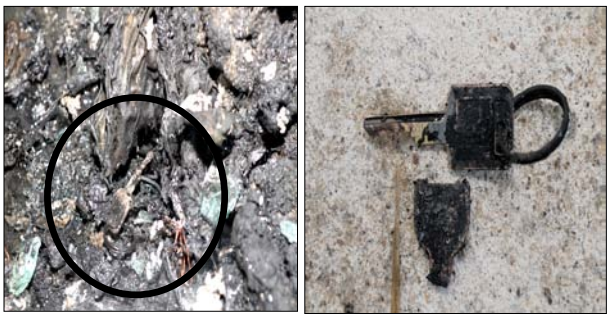
Slide 9-37

K. Steering lock assembly.

1. May discredit story of stolen vehicle.

2. May require examination by expert locksmith to determine if assembly was damaged.

KEY FOUND IN DEBRIS UNDER STEERING ASSEMBLY



Slide 9-38

L. Examination of debris in vehicle's interior.

1. Ignition key.

   a. Key may fall to floor when ignition switch melts, and remain embedded in the white metal of ignition assembly.

   b. Finding a single key usually is not normal, since most people carry more than one key.

2. Personal items.

   a. **All** passengers should be questioned to determine items in the vehicle at the time of the fire.

   b. Most items leave some type of evidence of their presence.

      - Buttons.

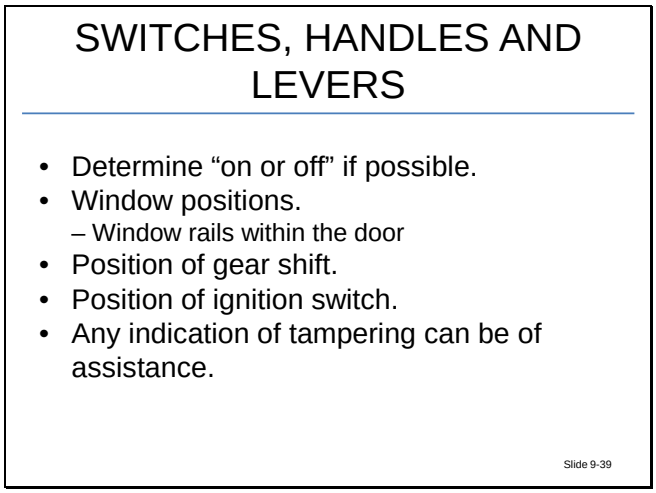
      - Zippers.

      - Shoe soles.

   c. Inventory of the remains of personal items may help to identify a possible fraud motive.

3. Evidence (remains) of incendiary devices may be recovered from vehicle's interior.

V. EXAMINATION OF VEHICLE'S EXTERIOR



A. Personnel need to determine the operating positions of windows, gear shifts and ignition switches to identify if they are normal or if there is any indication of tampering.

OXIDATION PATTERNS

- Metal components that are exposed to the most intense or prolonged heating will begin to oxidize (rust) soon after extinguishment.
- Oxidation patterns become more defined with time.

Slide 9-40

B. Metal and metal components that are exposed to fire begin to oxidize (rust) soon after the fire has been extinguished. These patterns may be helpful in determining the fire's origin, however their value diminishes with time.

SOFT METALS

- Soft metals and plastics can be a guide to direction of fire travel.
  - Movement patterns.
  - Intensity patterns.

Slide 9-41

C. Soft metals such as aluminum and plastic materials can help determine the direction of fire travel by displaying a combination of movement and intensity patterns.

EXAMINATION OF VEHICLE TRUNK

- Most new vehicles are equipped with a spare tire.
- Trunks are usually not empty.
- Personal effects may be present throughout the vehicle.
- Have tires been replaced?

Slide 9-42

VI. EXAMINATION OF VEHICLE'S TRUNK

A. Spare tire.

1. New vehicle usually has a new spare tire which often is only a temporary one.

2. Compare wheel color or check local dealer to determine proper wheel color.

B. Jack (tools) should be present.

EXAMINATION OF VEHICLE TRUNK (cont'd)

- Personal items.
- Vehicle accessories.
- Vehicle fuel systems.
- Other contents.

Slide 9-43

C. Empty trunk usually considered suspicious (except with very new vehicle).

EXAMINATION OF VEHICLE FUEL SYSTEM

- Tank fill cap and spout.
  - Often removed to allow fuel siphoning.
  - Cap may be discarded.
- Owner may claim fuel tank explosion blew cap off.
  - Check for damage to cap flanges.
  - Check for damage to filler spout.
- Fuel tank drain plug (may not be present in newer model cars).

Slide 9-44

VII. EXAMINATION OF VEHICLE'S FUEL SYSTEM

A. Examine tank fill cap and spout.

1. Often removed to allow fuel siphoning.

2. Cap may be discarded by throwing into nearby ground cover, inside vehicle or along the road way as the arsonist leaves the area.

3. Owner may claim fuel tank explosion blew cap off.

   a. Check for damage to cap flanges.

   b. Check for damage to filler spout.

FUEL SYSTEMS

- Fuel tanks are reservoirs that contain ignitable liquid fuels.
  - Most modern vehicles have plastic gas tanks that fail when exposed to an external fire.

Slide 9-45

B. Examine fuel tank drain plug (may not be present in newer model cars).

1. Often removed prior to fire.

   a. To obtain accelerant.

   b. To allow accelerant to drain under vehicle.

FUEL SYSTEMS (cont'd)

- When exposed to fire, the soldered seams of a metal tank may fail and separate, releasing the fuel.
- Fuel tanks do not explode.
  – Vapors burn at vents and fillers where air is available.

Slide 9-46

2. Owner may claim drain plug was blown out by explosion of fuel tank.

   a. If blown out, threads usually show signs of damage.

   b. Check for recent tool marks on plug.

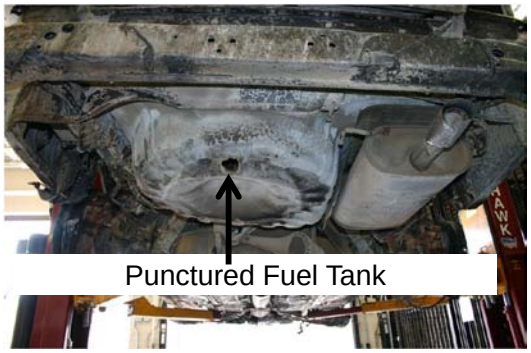
FUEL SYSTEMS (cont'd)

- Types of fuels.
  – Gasoline.
  – Diesel.
  – Liquid Petroleum Gas (LPG).
  – Compressed Natural Gas (CNG).

Slide 9-47

3. Vehicles may use different types of fuels to include gasoline, diesel, liquid petroleum gas, or compressed natural gas.

EXAMINE FUEL TANK AND EXHAUST SYSTEM



Slide 9-48

C. The fuel tank and exhaust system should be carefully inspected for evidence of intentional damage (puncture holes, etc.) to obtain fuel.

FUEL LINE TAMPERING

Slide 9-49

D. Examine fuel lines.

1. Connection may be loosened or fuel lines may be cut.

2. Check for evidence of tampering or recent tool marks.

E. Examine fuel pump and fuel line.

1. If connection comes off and the vehicle's motor is running, the fuel pump may continue to operate.

2. As long as the fuel pump is electrically operated it will continue to run.

GAS TANKS

- Should be checked for crushing or penetrations.
- Check for the presence or absence of the fuel cap.
- Fuel tanks exposed to heat or flame generally exhibit a line of demarcation that represents the fuel level at time of extinguishment.
  – Many fuel tanks are plastic or a composite material and are totally consumed by fire.
- Check all fuel lines for tampering.

Slide 9-50

F. Gas tanks should be checked for any signs of damage and whether they contain any fuel.

VEHICLE EXAMINATION

- Look for missing vehicle pieces in debris near the vehicle.
  – Gas cap.
  – Keys.
  – Door lock assemblies.

Slide 9-51

VIII. EXAMINATION OF VEHICLE'S ENGINE COMPARTMENT

A. Evidence of attempts to extinguish fire.

1. Check for dirt, sand or extinguishing agents.

2. Compare to owner's story.

B. Examine motor supports. Motor supports seldom receive extensive fire damage during accidental vehicle fires.

C. Examine radiator system. Solder in radiator joints usually does not melt out during accidental fire.

D. Examine fan, generator and air-conditioner belts. Belts seldom are destroyed in accidental vehicle fires.

E. Check for missing accessories in and around the vehicle. Battery, carburetor, generator, starter, etc., are **not** destroyed.

F. Motor and drivetrain.

1. Check for missing or loose head bolts around motor.

2. Check for missing or loose oil pan bolts under the vehicle.

3. Check for damage to engine such as holes in block, cracked heads, etc.

4. Parts of drivetrain may be missing (such as the universal).

5. Check to see if drivetrain is connected.

G. Mechanical examination of engine and drivetrain (may require services of an expert mechanic).

1. Attempt to start and run engine.

2. Disassemble and examine engine, transmission, etc.

VEHICLE EXAMINATION (cont'd)

- Direct exposure of hood/trunk struts to fire can cause explosions.
  - Tires.
  - Shock absorbers.
  - Gas-filled struts.
  - Hood or hatch.
  - Suspension.

Exploded gas strut

Slide 9-52

H. Hood (trunk) struts are under continuous pressure that can cause an explosion if directly exposed to fire.

NEW VEHICLE FUEL SYSTEMS

- Clean Air Act of 1970.
  – Vehicle emission control.
  – Fuel system vapor recovery.

Slide 9-53

IX. NEW VEHICLE FUEL SYSTEMS

A. Clean Air Act of 1970 required new vehicle designs.

1. Vehicle emission control.

2. Fuel system vapor recovery.

B. Vehicle emission control systems.

1. Uses catalytic converters to convert hydrocarbons and carbon monoxide to safer compounds.

2. Converter construction and operation.

a. Usually covered by stainless steel shell.

b. Contains clay-like compounds that are treated to react with hydrocarbon emissions.

c. Converters have very large interior surface area.

d. When operating, catalytic converters generate heat (up to 1,600 °F (871 °C)).

- Usually, vehicle must have heat shields to protect from excess heat.

- Some States require converter to be covered on bottom.

e. Fire dangers from converters.

- Undercoating near converter.

- Installation near converter.

f. If engine is **not** operating properly, the converter may reach temperatures of up to 2,500 °F (1,371 °C) and may cause ignition of nearby combustibles.

- Ground cover.

- Undercoating.

- Combustibles inside vehicle.

g. Converters and arson investigations.

- May be difficult to determine cause.

- May appear to be incendiary.

C. Fuel vapor recovery systems.

1. In some vehicles, fuel vapors escape illegally from the tank.

2. Newer design may use closed fuel systems.

a. Recirculates vapor.

b. Vapor collected for later burning by vehicle engine.

c. Fuel tanks not vented through filler cap.

3. Fire hazards.

a. May allow extreme pressure buildup.

b. May result in explosion of fuel tank.

HOT SURFACE IGNITION SOURCES

Surface temperatures can reach in excess of 1,020 ºF (550 ºC).

- Exhaust manifolds.
- Turbochargers.
- Catalytic converters.
- Brake rotors.

Slide 9-54

D. Vehicles contain many metal surfaces such as exhaust manifolds, turbochargers, catalytic converters and brake rotors that can generate sufficient heat energy to ignite combustible materials in close proximity to them.

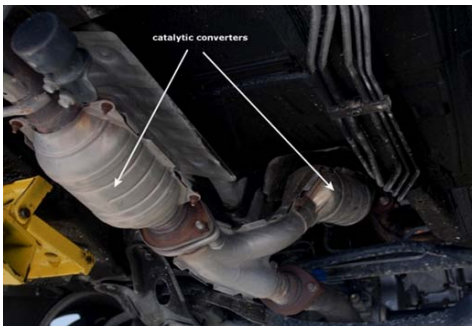
CATALYTIC CONVERTERS

- Catalytic converters have very high external temperatures — greater than 2,000 ºF (1,093 ºC) (especially if malfunctioning).
- They can ignite combustible liquids (brake/transmission fluid).
- They can also ignite ordinary combustibles that come in contact.

Slide 9-55

E. Catalytic converters typically operate at very high temperatures (i.e., greater than 2,000 °F (1,093 °C)) and under certain conditions, can ignite combustible liquids such as brake or transmission fluids or ordinary combustibles.

CATALYTIC CONVERTERS (cont'd)



Slide 9-56

HEAT SHIELD

Slide 9-57

HOT SURFACES

- Gasoline vapors will normally ignite by an electrical arc, spark, or open flame.
- A hot surface ignition of vehicle fluids is not "impossible" but very improbable.
- Testing the hypothesis of a hot surface ignition may be difficult.

Slide 9-58

F. A hot surface ignition of fluids commonly found in vehicles is not impossible, however, it rarely occurs.

1. Gasoline vapors may ignite by an arc, spark or open flame.

2. Determining whether a hot surface ignition can occur may be difficult to confirm.

ENGINE HOSES AND BELTS

Slide 9-59

G. The condition of hoses and belts located in the engine compartment should be carefully inspected for signs of wear, tampering, etc.

FUEL INJECTION

Slide 9-60

H. Components of the fuel injection systems may be tampered with or malfunction which can play a role in the cause of the fire. Certified mechanics should be consulted to rule out the fuel injection system as a potential fire cause.

ALUMINUM ALLOY CARBURETOR

Slide 9-61

I. Examine carburetor.

1. Accidental carburetor fires may self-extinguish without damage to the entire vehicle.

2. Engine backfires can cause some damage to the carburetor and surrounding area (check for missing air filter).

3. Evidence of a carburetor fire may be observed by the evidence of burn patterns located on the hood of the vehicle directly above the carburetor's location.

INTERPRETATIONS

- **Don't** assume the presence of melted metals as an indicator of accelerants.
- Metals melt at different temperatures, especially alloyed metals, which will show varying degrees of damage when exposed to heat.
- Remember, no one indicator makes a case.
- Common combustibles and ignitable liquids can produce the same flame temperatures.

Slide 9-62

J. The proper interruption of all the information collected from examination of the vehicle is based on the totality of all the circumstances and not on a single piece of data.

ELECTRICAL SYSTEMS

- Most passenger vehicles are 12 volts, and current is limited to a few amps (except for starters).
- Commercial vehicles and many recreational vehicles have 24 volt systems.
- Electrical causes of fires.
  - Sparks/Arcs.
  - Resistance heating.

Slide 9-63

X. EXAMINATION OF VEHICLE'S ELECTRICAL SYSTEMS

A. Examine fuses and fusible links.

ELECTRICAL SYSTEMS (cont'd)

- In modern vehicles, there are overcurrent devices which shut down current when there are short circuits.
  - Fuses.
  - Fusible links.

Slide 9-64

1. Modern vehicles are **well protected** from electrical short circuits and current overloads; most accidental fires result in only localized damage.

FUSIBLE LINKS

Located in the wiring harness, often not visible without destruction or removal of the harness covering.

Slide 9-65

2. All fuses and fusible links should be examined and noted. Local automobile dealerships may provide assistance as to location of fusible links.

ELECTRICAL SYSTEMS (cont'd)

- Was the battery in place?
- Are the engine components and accessories present?

Slide 9-66

B. Examine battery.

1. Battery may drain rapidly when short circuit occurs.

   a. Battery that remains fully charged probably was not involved.

BATTERY DAMAGE

Slide 9-67

b. Check battery with tester or by shorting terminals. **(Be extremely cautious of explosion potential.)**

2. Fires that occur in the engine compartment may result in extensive fire damage to the battery, however its role in the fire must be evaluated.

LAMPS AND BULBS

- Can possibly be an ignition source, however, the 2,500 ºF (1,371 ºC) generated is normally short lived and in open air.
- Think about what you are being told, does it all add up?
- Think about what possible fuels could be receptive to the ignition source.

Slide 9-68

C. Lamps and bulbs can serve as potential ignition sources, however, their ability to sustain sufficient energy is limited and therefore does not commonly occur.

ACCIDENTS, RECALLS, SHORTS AND ARCS

- Ask or attempt to determine if the vehicle has ever been wrecked, salvaged, or recalled.
- A **true victim** may not know, especially on a recently purchased vehicle.
- Arcs can result from worn insulation going to ground.
- Don't forget batteries can hold large amounts of energy and deliver excessive amperage.

Slide 9-69

D. The vehicle owner should be asked if the vehicle has ever been involved in an accident or subject to a recall. A true victim may not know the answers to these questions especially if they have only owned the vehicle for a short period of time.

ELECTRICAL QUESTIONS

- Was the vehicle running at the time of the fire?
- When was it last running?
- As in a structure, what was tampered with or bypassed?
- Has any equipment been added, altered, or worked on?
- Who did the work and when?

Slide 9-70

E. Shorts and arcs can result from worn insulation or improper installation of accessories.

1. Personnel should establish if the vehicle was running prior to and at the time of the fire.

2. The vehicle owner should be asked whether they recently did any work on the vehicle or if the vehicle has been serviced or is subject to a recall.

3. Check with neighbors of vehicle owner.

   a. May have witnessed vehicle being towed.

b. May have witnessed repair work.

c. May have reported vehicle idle for long period.

d. May report complaints about vehicle made by owner.

VEHICLE EXAMINATION

- It is better to examine the vehicle **before** it is moved.
- Valuable evidence is nearly always destroyed when the vehicle is moved.

Slide 9-71

F. The vehicle should be examined at the scene prior to being moved since movement may destroy or alter valuable evidence.

PHOTOGRAPH PRIOR TO REMOVAL

Slide 9-72

G. The vehicle should be photographed prior to removal and the names of the individuals and/or company and the location where the vehicle is being taken should be recorded.

VEHICLE IDENTIFICATION NUMBER

- The vehicle identification number (VIN) plate is normally in front of the driver on the dash.
- If it survives the fire, it should be recorded and photographed, and the Rosette rivets that hold it in place should be closely examined for authenticity.

Slide 9-73

XI. OWNERSHIP AND VEHICLE IDENTIFICATION NUMBERS

A. The vehicle identification number (VIN) plate is normally found at the front corner of the driver's side dashboard and should be photographed if it is present and/or survives the fire.

VEHICLE IDENTIFICATION NUMBER (cont'd)

- National Insurance Crime Bureau (NICB).
- Police.
- Insurance company.
- NCIC.
- Confidential VINs.
- Partial VINs.
- You need to know where to go for help.
- Police department auto theft units are a good resource.

Slide 9-74

B. VINs.

1. Prior to 1969, VINs were located in various places on the vehicle (hidden VIN).

   a. Contact police department auto theft division.

VEHICLE IDENTIFICATION NUMBER PLATE

Slide 9-75

b. Contact National Insurance Crime Bureau (NICB).

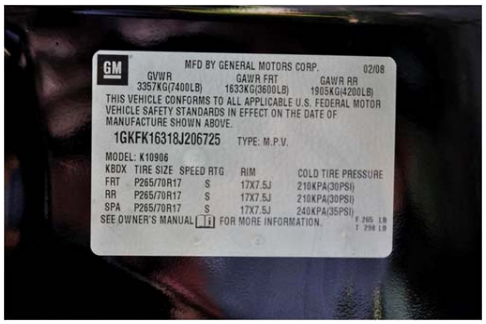
c. Contact local dealership.

2. Since 1969, VINs are located on left side of dash.

a. Visible from outside vehicle.

b. Also found in other locations (hidden).

VEHICLE IDENTIFICATION NUMBER PLATE ON DOOR



Slide 9-76

3. Numbers found on door edge or door jamb after 1969 model year.

a. May be warranty number.

b. May not be VIN.

c. Environmental Protection Agency (EPA) and VINs should match.

VEHICLE IDENTIFICATION NUMBER PLATE ON DOOR (cont'd)

Slide 9-77

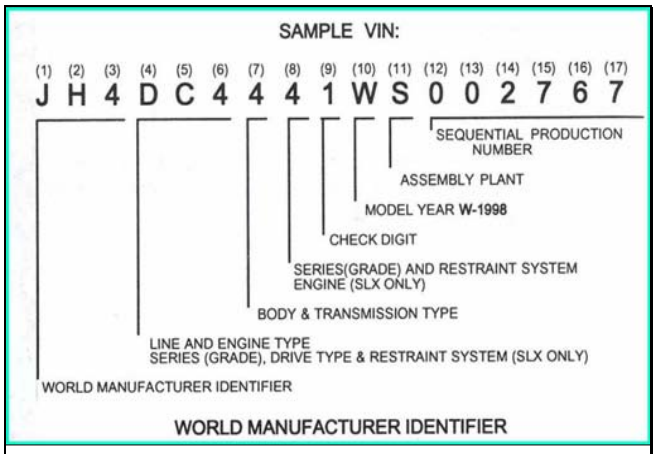
C. Compare VIN to insurance policy — The burned vehicle may not be the insured vehicle.

D. Altered or missing VINs (indicators of tampering).

1. Grind, file, or sanding marks.

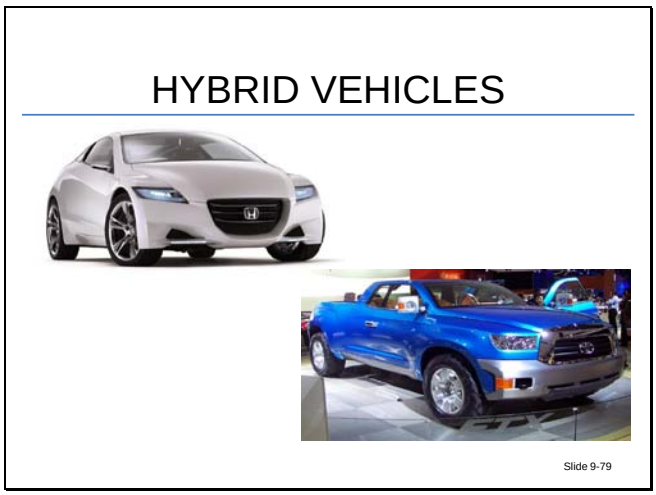
2. Over stamps.

3. Plastic replacement numbers (check Department of Motor Vehicles (DMV) for regulations covering new VIN and how to display it).



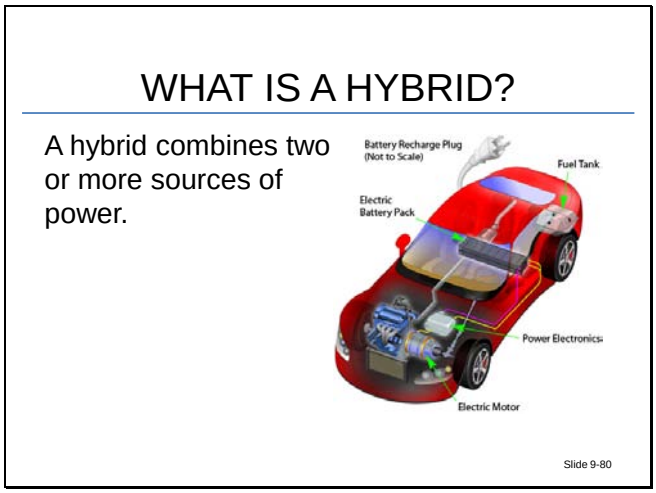
Slide 9-78

E. The common format for a VIN is a 17-digit combination of alphanumeric characters that specify critical information in respect to the origin and history of the vehicle (e.g., assembly plant, model year, body type, engine size, manufacturer, etc.).



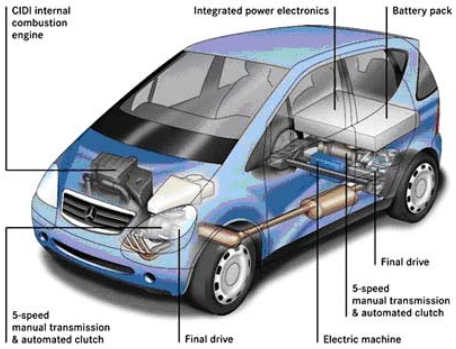
XII. HYBRID VEHICLES

A. Hybrid vehicles are becoming more common throughout the United States due to the high cost of fuel.



B. A hybrid is vehicle that combines two or more power sources.

DIAGRAM



Slide 9-81

HOW DO HYBRID CARS WORK?

- A hybrid car is a passenger vehicle that is driven by a hybrid engine, which is an engine that combines two or more sources of power, generally gasoline and electricity.
- There are two types of gasoline-electric hybrids:
  – Parallel.
  – Series.

Slide 9-82

C. Generally hybrid cars use gasoline and electricity as their sources of power.

1. Parallel hybrid — Both power sources (gasoline- and electric-powered) operate concurrently. The wheels are turned by both types of power through a direct connection.

2. Series hybrid — Two power sources are grouped in sequence. Generally, this means that the electric motor serves as the sole direct power source for moving the vehicle. The internal combustion engine is used to power the electric motor when the battery is depleted and also to charge the battery.

HOW DO HYBRID CARS WORK? (cont'd)

- Both use gasoline-electric hybrid technology, but in radically different ways.
- Both have small gasoline engines.
- Both produce much less pollution than standard gasoline cars.
- Both produce much less power — generally between 60 to 90 hp. (The average gasoline engine produces double that.)

Slide 9-83

D. Both types of hybrids generally have smaller gasoline engines and produce less pollution and power than standard gasoline-powered vehicles.

HOW DO HYBRID CARS WORK? (cont'd)

- Both are constructed of ultra-lightweight materials such as carbon fiber or aluminum to overcome the power gap.
- Both are generally designed to be more aerodynamic than most cars.
- Both use electric power at starts and stops, low speeds (generally below 15 mph).
- Both use gasoline power at cruising or highway speeds.

Slide 9-84

E. Both are designed to be more aerodynamic than most vehicles, use gasoline power at cruising or highway speeds, and use electric power starting and stopping (less than 15 mph).

HOW DO HYBRID CARS WORK? (cont'd)

- Gasoline engine and electric motor work **together** to move the car forward.

Slide 9-85

F. Gasoline engine and electric motor work together to move the vehicle forward.

HOW DO HYBRID CARS WORK? (cont'd)

- Gasoline engine either directly powers an electric motor that powers the vehicle, or charges batteries that will power the battery.

Slide 9-86

G. The gasoline engine either powers the electric motor or charges the battery that powers the motor.

GAS VERSUS ELECTRIC

- A gas-powered car has a fuel tank, which supplies gasoline to the engine. The engine then turns a transmission, which turns the wheels.
- An electric car has a set of batteries that provides electricity to an electric motor. The motor turns a transmission, and the transmission turns the wheels.

Slide 9-87

H. Gasoline-powered vehicles have a fuel tank that powers gasoline to the engine which drives the transmission. An electric car has a set of batteries that provides electricity to an electric motor that drives the transmission.

BATTERIES

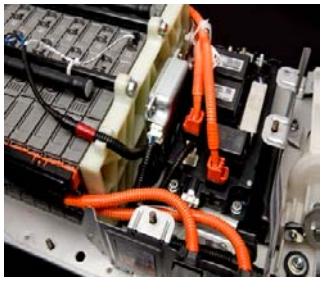
- The batteries in a hybrid car are the energy storage devices for the electric motor.
- Unlike the gasoline in the fuel tank, the electric motor on a hybrid can put energy into the batteries as well as draw energy from them.

Slide 9-88

I. Batteries located in a hybrid vehicle are the storage devices for the electric motor that is used to help power the vehicle.

SAFETY CONCERNS

- High voltages may exist after fire.
- Additional storage batteries, fuel cells, etc.
- CAUTION…make sure the vehicle battery system is de-energized before working on it.



Slide 9-89

J. Personnel should remember that the batteries used in hybrid vehicles may contain high voltages that can be hazardous even after the fire has been extinguished. Extreme caution should be used at all times when working around this equipment.

ACTIVITY 9.1
Vehicle Fire Examination

Slide 9-90

Slide 9-91

Slide 9-92

Slide 9-93

Slide 9-94

Slide 9-95

Slide 9-96

Slide 9-97

Slide 9-98

DVD PRESENTATION

"NFA Vehicle Fire Burn Exercise at Frederick County Fire Training Academy"

Slide 9-99

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ACTIVITY 9.1

Vehicle Fire Examination

Purpose

To apply fire investigation skills to vehicle fires.

Directions

1. You will be divided into small groups.
2. Select a group representative.
3. Read the vehicle fire scenario and then examine the photos that accompany it.
4. You will have 20 minutes to record your observations.
5. Be prepared to report your findings to the class.

Vehicle Fire Scenario

In mid April, at 0700 hours, you are dispatched to the report of a vehicle fire.

Arriving on the scene, you find an older model Subaru wagon with heavy smoke/fire coming from the passenger compartment of the vehicle. The vehicle was parked at the end of a cul-de-sac.

In conversations with the owner, the vehicle was reported stolen less than 24 hours ago. It has had no mechanical problems, and no one has done any work on the vehicle for two months. It is owned outright and insured. The last time the vehicle was seen, it was parked in the driveway after work the day before.

Slide 9-91 (Photo 1)

_____

_____

_____

Slide 9-92 (Photo 2)

Slide 9-93 (Photo 3)

Slide 9-94 (Photo 4)

Slide 9-95 (Photo 5)

Slide 9-96 (Photo 6)

Slide 9-97 (Photo 7)

Slide 9-98 (Photo 8)

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SUMMARY

- Reasons for vehicle fire investigation and motives.
- Probability of accidental vehicle fires.
- Incident scene examination.
- Examination of vehicle's interior.
- Examination of vehicle's exterior.
- Examination of vehicle's trunk.
- Examination of vehicle's fuel system.

Slide 9-99

SUMMARY (cont'd)

- Examination of vehicle's engine compartment.
- New vehicle fuel systems.
- Examination of vehicle's electrical systems.
- Ownership and VIN.
- Hybrid vehicles.

Slide 9-100

XIII. SUMMARY

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APPENDIX

VEHICLE FIRE INSPECTION CHECKLIST

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Vehicle Fire Inspection Checklist

General Information

Date of Fire _____ Location _____
Time of Fire _____ _____

Operator's Name _____ Phone _____
Address _____ City _____ ZIP _____
Driver's License Number _____ Birthday _____
Hair _____ Eyes _____ Height _____ Weight _____

Legal Owner _____ Phone _____
Address _____ City _____ ZIP _____
R/O (if not the operator) _____
Address _____ City _____ ZIP _____

Insurance Company _____
Policy Number _____ Coverage _____

Vehicle Make _____ Year _____ Color _____
Body Type _____ License _____ State _____
VIN _____ Motor Serial Number _____
Transmission Number _____ Mileage _____
Special Equipment _____
_____

Amount Owed on Vehicle _____ Bank _____
Amount of Payment_____ Is it current? [ ] yes [ ] no

Photographs taken? [ ] yes [ ] no Sketch made? [ ] yes [ ] no

Search made for [ ] cans [ ] bottles [ ] matches
[ ] other (describe) _____
_____
_____

Describe footprints, tire marks, other evidence _____
_____

Witnesses

Name _____ Address _____
City/ZIP _____ Phone _____

Name _____ Address _____
City/ZIP _____ Phone _____

Name _____ Address _____
City/ZIP _____ Phone _____

Notes

Exterior Examination

Body

Evidence of prior damage? [ ] yes [ ] no

Describe _____

_____

Where was heat concentrated? _____

Did the top panel sag or lose its temper? [ ] yes [ ] no

Did the door panels sag or buckle? [ ] yes [ ] no

Which bumper was damaged? [ ] front [ ] rear

Which fender skirt was damaged? [ ] rf [ ] lf [ ] rr [ ] lr

Under which fender was there fire damage? [ ] rf [ ] lf [ ] rr [ ] lr

Was the hood burned? [ ] yes [ ] no

Was the hood raised? [ ] yes [ ] no

Was there a pattern of paint damage? [ ] yes [ ] no

Describe _____

_____

Which doors were open during the fire? [ ] rf [ ] lf [ ] rr [ ] lr

Was trunk compartment burned? [ ] yes [ ] no

Was trunk cover burned? [ ] yes [ ] no

Was trunk forced open? [ ] yes [ ] no

How? _____

By whom? _____

Did spare fit the vehicle? [ ] yes [ ] no

Were jack and lug wrench present? [ ] yes [ ] no

Did they fit the vehicle? [ ] yes [ ] no

Was gas cap on? [ ] yes [ ] no

Was it burned? [ ] yes [ ] no

Was it blown off? [ ] yes [ ] no

Were the flanges damaged? [ ] yes [ ] no

Were the license plates on the car? [ ] yes [ ] no

If “no,” were they found? [ ] yes [ ] no

Was the antenna on? [ ] yes [ ] no

Were the mirrors on? Right: [ ] yes [ ] no

Left: [ ] yes [ ] no

Were they melted away? Right: [ ] yes [ ] no

Left: [ ] yes [ ] no

Were any accessories removed before fire? [ ] yes [ ] no

After? [ ] yes [ ] no

Was dirt or sand thrown on car during fire? [ ] yes [ ] no

After? [ ] yes [ ] no

Examination of Glass

	Windshield		Front Door		Front Vent		Rear Door		Rear Vent	
	Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt	Rt	Lt
Smoked	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Cracked	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Left open	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Closed	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Melted	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]

	Rear Quarter		Back Window	
	Rt	Lt	Rt	Lt
Smoked	[ ]	[ ]	[ ]	[ ]
Cracked	[ ]	[ ]	[ ]	[ ]
Left open	[ ]	[ ]	[ ]	[ ]
Closed	[ ]	[ ]	[ ]	[ ]
Melted	[ ]	[ ]	[ ]	[ ]

Examination of Wheels and Tires

Wheels, Tires, and Hub Caps

	Right Front		Left Front		Right Rear		Left Rear		Spare	
	Yes	no	yes	no	yes	no	yes	no	yes	no
Signs of recent removal?	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Burned?	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Underneath burned?	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
Percent of wear?	_____		_____		_____		_____		_____	

Notes

_____

_____

_____

Interior Examination

Positive vehicle identification through VIN? [ ] yes [ ] no
Floor boards burned? [ ] yes [ ] no
Evidence? _____
Evidence of fire **underneath** floor board? _____
_____
Front floor mat burned? [ ] yes [ ] no
Rear floor mat? [ ] yes [ ] no
Front seat cushion burned? [ ] yes [ ] no
Rear seat cushion? [ ] yes [ ] no
Temper gone from front seat springs? [ ] yes [ ] no
Rear seat? [ ] yes [ ] no
Condition of instrument panel? _____
Is there an odor of accelerants under the debris? [ ] yes [ ] no
If "yes," where? _____
Were there unusual objects in the vehicle? [ ] yes [ ] no
If "yes," where?_____
Was the headliner burned? [ ] yes [ ] no
Was any upholstery left unburned? [ ] yes [ ] no
If "yes," where?_____
Are there signs of excessive heat? [ ] yes [ ] no
If "yes," where?_____
Is there evidence of personal belongings? [ ] yes [ ] no
If "yes," what? _____
_____
Were keys found? [ ] yes [ ] no
If so, which ones? _____ How many? _____
Who is known to have keys? _____
_____

Notes

_____
_____
_____
_____

Examination of Accessories

Is there a radio?	[ ] yes	[ ] no
If "yes," is it burned?	[ ] yes	[ ] no
Is there a tape deck?	[ ] yes	[ ] no
If "yes," is it burned?	[ ] yes	[ ] no
Is there a CD player?	[ ] yes	[ ] no
If "yes," is it burned?	[ ] yes	[ ] no
Is there a cellular phone?	[ ] yes	[ ] no
If "yes," is it burned?	[ ] yes	[ ] no
Other_____	[ ] yes	[ ] no
If "yes," is it burned?	[ ] yes	[ ] no

Notes

_____

_____

_____

_____

Mechanical Condition of Vehicle

Radiator:	Core melted?	[ ] yes	[ ] no
	Water in core?	[ ] yes	[ ] no
	Upper hose burned?	[ ] yes	[ ] no
	Lower?	[ ] yes	[ ] no
	Radiator cap in place?	[ ] yes	[ ] no
	Fan belt burned?	[ ] yes	[ ] no
	Other belts?	[ ] yes	[ ] no

Which? _____

_____

Air ducts damaged or burned?		[ ] yes	[ ] no
Soot under hood?		[ ] yes	[ ] no
Oil level?		[ ] normal	[ ] low [ ] empty
Block?		[ ] broken	[ ] intact
Heads?		[ ] bolts loose	[ ] cracked
Oil pan?		[ ] broken	[ ] cracked
Manifold?		[ ] loose	[ ] secure
Does engine run?		[ ] yes	[ ] no
Gaskets recently removed?	head:	[ ] yes	[ ] no
	oil pan:	[ ] yes	[ ] no
	valve plate:	[ ] yes	[ ] no

Electrical System

Spark plug wires connected?	[ ] yes	[ ] no
Wires burned?	[ ] yes	[ ] no
Distributor damaged?	[ ] yes	[ ] no
Distributor burned?	[ ] yes	[ ] no
Battery present?	[ ] yes	[ ] no
Battery with power?	[ ] yes	[ ] no
Battery burned?	[ ] yes	[ ] no
Battery cover present?	[ ] yes	[ ] no
Cover burned?	[ ] yes	[ ] no
Cables intact?	[ ] yes	[ ] no
Ignition system operational?	[ ] yes	[ ] no
System shorted out?	[ ] yes	[ ] no
Distributor points fused?	[ ] yes	[ ] no
Voltage regulator intact?	[ ] yes	[ ] no
Regulator burned?	[ ] yes	[ ] no

Evidence of “hot wiring”? _____

_____

Notes

_____

_____

_____

_____

_____

_____

_____

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UNIT 10: FATAL FIRES

TERMINAL OBJECTIVE

The students will be able to describe the appropriate measures that should be taken to properly secure the fire scene and preserve the victim's body for evidentiary purposes.

ENABLING OBJECTIVES

The students will be able to:

1. *Explain the importance of scene security as related to a fatal fire.*
2. *Explain the reasons why fires that result in serious burn injuries should be investigated as thoroughly as fatal fires.*
3. *Explain the importance of the fire victim's location, position and appearance.*

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UNIT 10:
FATAL FIRES

Slide 10-1

ENABLING OBJECTIVES

- Explain the importance of scene security as related to a fatal fire.
- Explain the reasons why fires that result in serious burn injuries should be investigated as thoroughly as fatal fires.
- Explain the importance of the fire victim's location, position and appearance.

Slide 10-2

FIRE OFFICER RESPONSIBILITIES AT FATAL FIRE SCENES

- Security of incident scene.
- Notification of appropriate agencies.
- Provide assistance to fire investigators as required.

Slide 10-3

I. FIRE OFFICER RESPONSIBILITIES AT FATAL FIRE SCENES

A. Security of incident scene.

1. Fatal fires may attract more spectators than other fires.

   a. Media.

   b. Religious leaders.

   c. Local government officials.

   d. Relatives desiring to confirm safety of occupants.

   e. Neighbors and friends.

   f. Thrill seekers.

2. Security of scene more difficult.

3. Officer in charge (OIC)/Incident commander (IC) may have to request additional assistance.

   a. Additional fire companies.

   b. Police.

B. Notification of appropriate agencies.

1. Follow current policy of local jurisdiction.

2. **Any** indication of nonaccidental death or of nonaccidental fire requires contacting other agencies.

   a. Police.

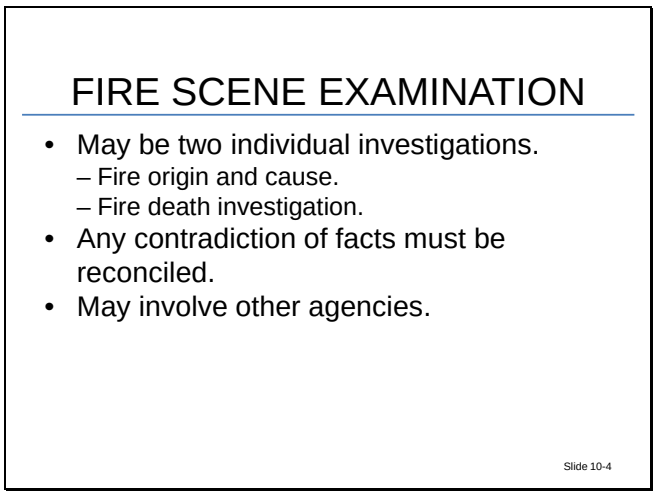
   b. Coroner or medical examiner.

C. Provide investigative assistance.

1. Fire officer often is best qualified to provide information to investigators to help determine fire origin and cause.

2. A team approach is necessary to conduct effective and successful fatal fire investigations.

3. Share all information with investigators, police, and coroner or medical examiner.



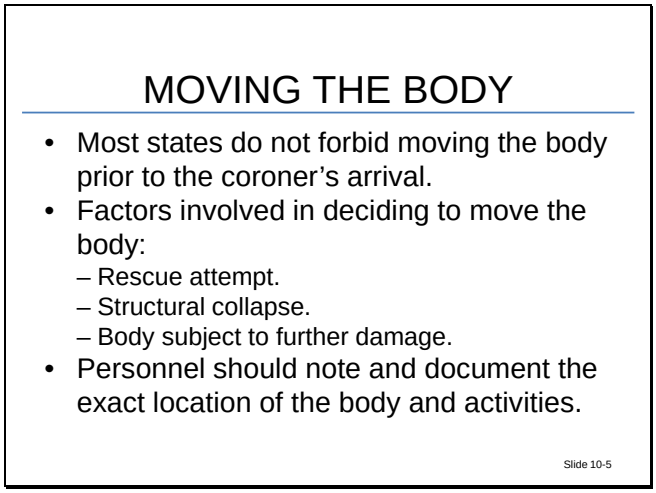
II. FIRE SCENE EXAMINATION

A. Two individual investigations may be required.

1. Fire origin and cause.

2. Fire death (manner and cause of death).

B. Treat the fire scene as a potential crime scene and preserve all potential physical evidence.



C. Moving the body.

1. It **never** can be replaced as it was originally found.

2. First responders should remember to note and document the exact location of the body prior to removing it. This information should be provided to investigators as soon as possible (ASAP).

BODY IN DEBRIS

Slide 10-6

3. Most states do not forbid moving a body prior to the coroner's arrival.

4. Local policy will dictate available options.

5. When to move body.

   a. Uncertainty as to whether the victim actually is dead.

   b. If in doubt, remove and transport to hospital. This prevents negligence claims.

VICTIM PRIOR TO REMOVAL

Slide 10-7

6. If additional damage to the body is probable, remove it.

   a. Remove body if further destruction is likely due to fire spread, falling debris or building collapse.

   b. The body and the area around the body should be photographed or videotaped prior to disturbing the scene.

c. The ability of coroner to determine identity of victim and cause of death decreases with extent of damage to body.

d. If additional damage to body is unlikely.

- Leave body as discovered for scene examination by coroner or medical examiner.

AFTER DEBRIS REMOVAL

Slide 10-8

7. Remove debris near body.

a. Use extreme care.

b. Photograph before and after clearing area.

c. Keep debris nearby for sifting and examination.

DEBRIS AFTER BODY WAS REMOVED

Slide 10-9

8. Photograph location where body was discovered after its removal.

a. Identify objects/materials found under victim.

b. Photograph to show outline of victim, if present.

9. Location of body.

a. Does the location of the body fit the surroundings?

b. Is the body located near an exit? If not, why not?

NOTE AND DOCUMENT HOW VICTIM WAS DRESSED

Slide 10-10

10. How was victim dressed?

a. Was it appropriate for the time of day/year?

b. Does it show signs of foul play (i.e., ripped or torn, blood, trace evidence, etc.)?

c. Does it have any identifying markings (i.e., initials or name)?

SECURITY BARS

Slide 10-11

11. **Note** and **photograph** obstacles that block victim's attempts to escape.

    a. Building contents.

    b. Locked, blocked, or closed doors or windows.

NOTE AND DOCUMENT ANY ESCAPE ROUTES

Slide 10-12

12. **Note** and **photograph** normal exit paths or escape routes available to victim.

    a. Doors.

    b. Windows.

    c. Fire escapes/Stairs.

    d. Note any attempts to exit or escape.

NOTE AND DOCUMENT LOCATION AND POSITION OF VICTIM

Point of origin

Slide 10-13

D. Facts concerning victim's location, position and appearance.

1. Where was victim found?
2. Was location of victim normal to occupancy?
3. What was location of body in reference to the area/point of fire origin?
4. Was there evidence of violence (trauma) on body?

NOTE AND DOCUMENT ANY PHYSICAL DISABILITIES

Slide 10-14

E. Physical and mental conditions.

1. Disabilities.
2. Physical defects/Medical conditions.
3. Emotional problems.
4. Injuries.
5. Influence of alcohol and/or drugs.

SOOT AROUND NOSE, MOUTH AND NOSTRILS

Slide 10-15

F. The presence of soot around the nose, mouth and nostrils may indicate that the victim was alive (breathing) at the time of the fire. Most victims die of smoke inhalation (carbon monoxide).

BLISTERING OF SKIN INDICATES VICTIM WAS ALIVE DURING FIRE

Slide 10-16

G. Blistering of skin on the victim can help determine if the victim was alive at the time of the fire. This fact can be extremely important to the investigation with regard to the cause of death.

NOTE HABITS OF OCCUPANTS/VICTIMS

Slide 10-17

H. Habits of occupant(s) and/or victim(s).

1. Smoking.
2. Drinking.
3. Drugs and prescription medication.
4. Possible conflicts.
   a. Employment.
   b. Criminal.
   c. Love affairs.

OTHER INFORMATION NEEDED FOR INVESTIGATORS

- Individual discovering victim.
- Last individual in area of origin.
- Individual discovering fire.
- Individual(s) reporting fire.
- Last individual to see deceased alive.

Slide 10-18

I. Other information needed for investigators.

1. Individual(s) discovering victim.

    a. Full name.

    b. Address.

    c. Date of birth, sex and race.

    d. Employment status.

    e. Relationship to or association with deceased.

    f. Reason for being in area.

    g. Activities or actions prior to discovery.

    h. Actions taken after discovery.

    i. Circumstances of discovery.

    j. Last individual in the area of origin.

    k. Individual discovering and reporting the fire.

    l. Last individual to see deceased alive.

2. Victim's personal information.

    a. Full name.

    b. Address (if different from address of fire).

    c. Date of birth, sex and race.

    d. Income sources (employment).

    e. Marital status.

J. Investigative questions to be answered:

1. Who — Identify victim?

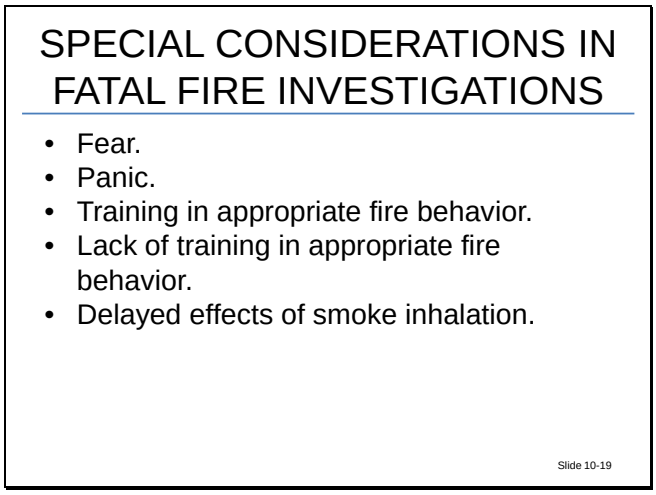
2. What — Cause of death?

3. When — Did victim die?

4. Where — Did victim die?

5. Why — Did victim die?

6. How — Did victim die (manner of death)?



K. Special considerations in fatal fire investigations. Consider human behavior in a fire situation.

1. **Fear** causes people to act irrationally. A delayed fear reaction may cause people to do unexplainable things, such as jumping from upper floors to the street.

2. **Panic** usually does not take place in life-threatening situations if people believe they can escape.

   a. People become barbaric when panic sets in. It is a common military experience that a soldier may be brave with other soldiers but, when alone, may freeze/run.

   b. In a fire, panic causes a person to run aimlessly, losing all sense of logic.

3. **Trained fire behavior** — How people react in a fire can be affected by whether or not they have participated in fire drills.

4. **Untrained fire behavior** — Many times individuals move toward fire. They tend to re-enter a building before fire is extinguished for various reasons (e.g., saving a pet or thinking the fire was not severe). Studies indicate if little smoke is present, people tend to re-enter the building.

5. **Delayed effects of smoke inhalation** may make people act heroic and/or appear to be carrying out normal activities.

DVD PRESENTATION

"Station Nightclub Fire"

Slide 10-20

ACTIVITY 10.1
Fatal Fire Scene Examination

Slide 10-21

Slide 10-22

Slide 10-23

Slide 10-24

Slide 10-25

Slide 10-26

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Slide 10-28

Slide 10-29

ACTIVITY 10.1

Fatal Fire Scene Examination

Purpose

To identify the considerations that first responders should note to assist investigators in the successful investigation of a fatal fire.

Directions

1. You should identify and document key factors, such as security of the fire scene and steps to preserve and protect the body(ies) and other evidence.

2. Your group will discuss your findings and select a representative to debrief the class.

Slide 10-22 (Photo 1)

_____

_____

_____

Slide 10-23 (Photo 2)

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Slide 10-24 (Photo 3)

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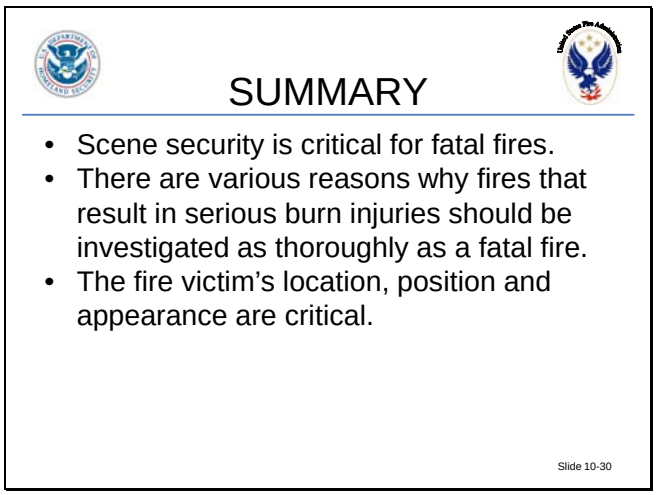
Slide 10-25 (Photo 4)

Slide 10-26 (Photo 5)

Slide 10-27 (Photo 6)

Slide 10-28 (Photo 7)

Slide 10-29 (Photo 8)


SUMMARY
• Scene security is critical for fatal fires.
• There are various reasons why fires that result in serious burn injuries should be investigated as thoroughly as a fatal fire.
• The fire victim's location, position and appearance are critical.
Slide 10-30

III. SUMMARY

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UNIT 11: LEGAL ASPECTS

TERMINAL OBJECTIVE

The students will be able to recognize the legal considerations related to fire cause determination, including applicable arson laws covering search and seizure, evidence collection, spoliation and courtroom testimony.

ENABLING OBJECTIVES

The students will be able to:

1. *List and describe the various types of arson laws in use in the United States.*
2. *State the major legal considerations affecting arrest, search and seizure.*
3. *List and describe the appropriate legal considerations that apply to fire scene examination.*
4. *Explain the significance of spoliation and the steps that should be taken to avoid potential problems.*
5. *Describe the difference between lay testimony and expert testimony.*

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UNIT 11:
LEGAL ASPECTS

Slide 11-1

ENABLING OBJECTIVES

- List and describe the various types of arson laws in use in the United States.
- State the major legal considerations affecting arrest, search and seizure.

Slide 11-2

ENABLING OBJECTIVES (cont'd)

- List and describe the appropriate legal considerations that apply to fire scene examination.
- Explain the significance of spoliation and the steps that should be taken to avoid potential problems.
- Describe the difference between lay testimony and expert testimony.

Slide 11-3

ARSON LAWS IN THE UNITED STATES

- U.S. Supreme Court decisions have a direct impact on a fire officer's duty.
- Fire officer must understand how local and state courts fit into the entire judicial system.
- Certain amendments to the U.S. Constitution define the rights of all individuals and limit the powers of government.

Slide 11-4

I. ARSON LAWS IN THE UNITED STATES

A. U.S. Supreme Court decisions have a direct impact on a fire officer's daily duties and responsibilities. They must understand how local and state courts fit into the entire judicial system.

B. Certain amendments to the U.S. Constitution define the rights of all individuals and limit the powers of government.

THREE ELEMENTS OF ARSON

- A fire did occur.
- Fire was incendiary.
- Accused is guilty of the crime.

Slide 11-5

C. There are three individual elements that must be proved in court to obtain an arson conviction.

1. A fire did occur.

2. The fire was incendiary.

3. The accused is guilty of the crime.

BURDENS OF PROOF

- Government has burden of proof on every element of a crime "beyond a reasonable doubt."
- Civil case burden is preponderance and proponent of a fact has the burden.

Slide 11-6

D. Specific requirements have been developed to control the activities of government officials regarding arrest, search and seizure.

1. In a criminal case, the government must prove all elements of the crime(s) charged beyond a reasonable doubt.

2. In civil proceedings, the burden of proof is by a preponderance of the evidence, or in some states, the burden is clear and convincing evidence.

COMMON-LAW ARSON

Elements of common-law arson are "willful and malicious burning of the dwelling of another."

Slide 11-7

E. Originally, arson was a common-law offense.

1. Common law is court-made law.

2. Based on accepted standards of the community.

3. Originated in England.

4. Arson at common law was "the burning of the dwelling of another."

COMMON LAW AND STATUTES

- Common law grows out of individual case decisions. It is law "found" by judges.
- Statutory law is made by legislatures.

Slide 11-8

F. Arson law has evolved in recent years.

1. Most states have enacted specific laws dealing with current arson issues.

2. A few states still recognize arson at common law.

3. Arson at common law did influence the way some state statutes were written (e.g., some state statutes still refer to arson as the "burning of the dwelling of another").

CONSTITUTIONAL PROVISIONS

- Fifth Amendment against self-incrimination applies to persons acting under federal law.
- "Due Process of Law" language of the 14th Amendment makes the Fourth and Fifth applicable to the states.
- Fourth Amendment governs searches and seizures.
  – To be lawful, any search must be "reasonable."

Slide 11-9

G. Constitutional provisions.

1. The Fifth Amendment against self-incrimination directly applies to persons acting under federal law.

2. Persons acting under state law also are bound by its requirements because the "due process of law" language of the 14th Amendment to the Constitution makes the Fourth and Fifth Amendments applicable to the states.

3. The Fourth Amendment governs searches and seizures of persons and searches and seizures of property.

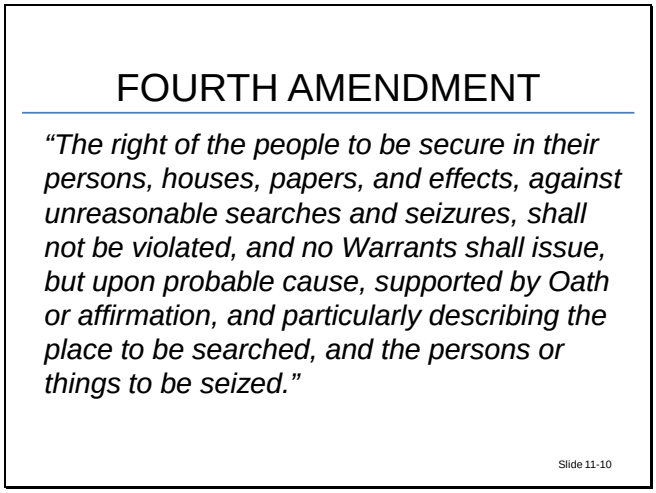
4. To be lawful, any search or seizure must be reasonable under the circumstances.

5. Conditions for a lawful search or arrest warrant.

   a. Based on probable cause.

   b. Made under oath or affirmation.

   c. With particularity, naming any and all persons, places, or things to be searched or seized.



6. Fourth Amendment.

   "The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated, and no Warrants shall issue, but upon probable cause, supported by Oath or affirmation, and particularly describing the place to be searched, and the persons or things to be seized."

FOURTH AMENDMENT PURPOSE

Prohibits unreasonable searches and seizures by law enforcement officers.

Slide 11-11

7. The Fourth Amendment does not prohibit all searches and seizures but only those that are deemed **unreasonable** by the courts, which are evaluated on a case-by-case basis.

WARRANTS/ REASONABLENESS

- Two clauses to Fourth Amendment: “reasonableness” and “warrants.”
- Search warrants can be either administrative or criminal.
- Warrant search still must be reasonable.

Slide 11-12

H. There are two basic types of search warrants used in fire/arson investigations.

1. Administrative: The standard of proof required is that a fire of undetermined origin occurred and officials need to conduct a preliminary investigation to determine the cause.

2. Criminal: The issuance of a criminal search warrant is based on a showing of probable cause.

WARRANT REQUIREMENTS

- Oath.
- Probable cause.
- Particularity (description) of places and things.
- Neutral and detached magistrate.

Slide 11-13

I. Criminal search warrants are issued by judges based on a sworn affidavit submitted by law enforcement officials.

1. The affidavit must contain sufficient probable cause that particularly describes the location to be searched and items to be seized.

2. Once legally on the premises, officials may seize evidence or contraband that is in plain view which is not included in the scope of the warrant.

PROBABLE CAUSE

- Measured by “totality of the circumstances” test.
- Facts must support a reasonable likelihood that the described evidence of a crime will be present at a particular place.

Slide 11-14

J. The determination of probable cause is measured by the totality of the circumstances as outlined in the search warrant application (affidavit).

K. The facts and circumstances supporting probable cause must be sufficient to persuade a reasonable person to believe that a crime (arson) has been committed and that evidence of the crime will be found in the specified location.

PARTICULARITY

- Limits scope of search authority to specific places and things.
- Applies to both the place and the thing.

Slide 11-15

L. The Fourth Amendment requires not only that a warrant be supported by probable cause offered by a sworn law enforcement officer but also that a warrant "particularly" describe the person or place to be searched or seized.

M. For most residences, a street address usually satisfies the particularity requirement, unless the warrant designates an apartment complex, hotel or other multiple-unit building; in this case, the warrant must describe the specific subunit to be searched. Warrants must describe locations or individuals with sufficient particularity so that a reasonable person can distinguish them from others in the general population.

EXCLUSIONARY RULE WARRANTS AND PRESUMPTIONS

- Searches and seizures made with a warrant are presumed "constitutional."
- Searches and seizures without a warrant are presumed to violate the constitution.

Slide 11-16

N. All searches and seizures made under the auspices of a properly issued and executed warrant are deemed to be constitutional. The U.S. Supreme Court has ruled that warrantless police conduct may comply with the Fourth Amendment so long as it is reasonable under the circumstances.

EXCLUSIONARY RULE

- Judicially created — constitutionally based.
- Reflects Supreme Court perception that law enforcement routinely abuses search and seizure principles.

Slide 11-17

O. Designed to deter police misconduct, the exclusionary rule enables courts to exclude incriminating evidence from introduction at trial upon proof that the evidence was obtained illegally. The rule allows defendants to challenge the admissibility of evidence by bringing a pretrial motion to suppress the evidence.

EXCLUSIONARY RULE APPLICATION

- "Equals" a violation of constitutionally-guaranteed rights.
- Bars the use of the seized evidence for all purposes.
- Bars the use of all derivative evidence ("fruit of the poisonous tree").

Slide 11-18

P. A companion to the exclusionary rule is the "fruit of the poisonous tree" doctrine. Under this doctrine, a court may exclude from trial not only evidence that itself was seized in violation of the Constitution but also any other evidence that is derived from the same illegal search.

GOOD FAITH EXCEPTION TO EXCLUSIONARY RULE

- Magistrate's mistakes do not exclude warrant items unless:
  - Misleading.
  - Not neutral and detached.
  - Lacks particularity.
  - Probable cause belief unreasonable.

Slide 11-19

Q. One of the exceptions to the exclusionary rule is known as "good faith." Evidence obtained with a warrant that is later found to be unsupported by probable cause is admissible if the investigating officers acted under a reasonable assumption that the warrant was valid.

EXIGENCY

- Warrant exceptions generally based on exigency.
- Exigency is the need for immediate action to prevent irreparable harm to persons or property/emergency.
- A fire is an example of exigency.
  - The fire department does not need a warrant to enter a burning building.

Slide 11-20

R. Warrantless searches and seizures may be justified under the doctrine of "exigent" circumstances. A court must review the totality of the circumstances, including the immediate need for government officials to enter on to private property without a warrant. However, the underlying circumstances must justify the need (i.e., fire suppression and related emergency action such as conducting a fire investigation).

PLAIN VIEW EXCEPTION

- Lawful observation of obvious evidence.
- Legal right to be on the premises.
- Items are in plain sight.

Slide 11-21

S. Another exception to the Fourth Amendment search warrant requirement is known as "plain view." This doctrine allows law enforcement officers to seize evidence without a warrant provided that they have a legal right to be on the premises and the items are in plain sight (e.g., gasoline container in the driveway).

CONSENT

- Consent is not an exigency-based exception.
- The capacity to give consent is based on a reasonable expectation of privacy in the place or thing to be searched.
- Consent is subject to revocation or limitation at any time by the person with the authority to consent.

Slide 11-22

T. Consent to search must be given voluntarily and by someone who has the authority to consent. It should be noted that the person can withdraw his or her consent at any time; then, a warrant is required to continue the search.

1. You have a responsibility to conduct an investigation to determine the cause of a fire (*Michigan v. Tyler et al.*).

2. As soon as the fire has been suppressed and overhaul has started, you should find the owner or occupant and gather the information needed (Unit 2: Collection and Documentation of Information).

   a. After fire department units have left the scene, investigators must obtain consent or a warrant to conduct an investigation.

b. If consent is obtained, investigators will usually have the owner or occupant sign a consent-to-search form.

3. While officials have an administrative duty to conduct a fire cause determination, the consent form provides additional coverage during a trial.

a. Owner/Occupant was aware of investigative activities.

b. Impossible for owner/occupant to charge that activities were not legally performed.

FIFTH AMENDMENT

- "No person…shall be compelled in any Criminal Case to be a witness against himself…."
- The *Miranda* decision intended to "overcome" coercive effects of custodial interrogation.
- Custody + Interrogation = Miranda

Slide 11-23

4. Fifth Amendment.

"No person shall be held to answer for a capital, or otherwise infamous crime, unless on a presentment or indictment of a grand jury, except in cases arising in the land or naval forces, or in the Militia, when in actual service in time of War or public danger; nor shall any person be subject for the same offense to be twice put in jeopardy of life or limb; nor shall be compelled in any Criminal Case to be a witness against himself; nor be deprived of life, liberty, or property, without due process of law; nor shall private property be taken for public use, without just compensation."

a. Custody + Interrogation = Miranda.

MIRANDA WARNINGS

"You have the right to remain silent. Anything you say can and will be used against you in a court of law. You have the right to an attorney. If you cannot afford an attorney, one will be provided for you. Do you understand the rights I have just read to you? With these rights in mind, do you wish to speak to me?"

**Requires valid waiver.

Slide 11-24

b. Requires valid waiver.

SIXTH AMENDMENT

- In all criminal prosecutions, the accused shall enjoy the right to:
  – A speedy and public trial, by an impartial jury.
  – Be informed of the nature and cause of the accusation.
  – Be confronted with the witness against him.
  – Have the assistance of counsel for his defense.

Slide 11-25

5. Sixth Amendment.

"In all criminal prosecutions, the accused shall enjoy the right to a speedy and public trial, by an impartial jury of the state and district wherein the crime shall have been committed, which district shall have been previously ascertained by law, and to be informed of the nature and cause of the accusation; to be confronted with the witnesses against him; to have compulsory process for obtaining Witnesses in his favor, and to have the Assistance of Counsel for his defense."

SEARCH AND SEIZURE

- U.S. Supreme Court in 1914 held evidence obtained unlawfully cannot be used against the accused.
- Supreme Court rulings in 1961 required that all state courts observe the same rules of evidence.

Slide 11-26

II. LEGAL REQUIREMENTS RELATED TO ARREST, SEARCH AND SEIZURE

Search and seizure of property.

A. In 1914, the U.S. Supreme Court held that evidence obtained unlawfully could not be used against the accused (*Weeks v. U.S.*).

1. This is known as the exclusionary rule that states evidence gained unlawfully can be excluded from use in court.

SEARCH AND SEIZURE (cont'd)

- Related to fire investigations, "search" consists of:
  – Investigation (search) for origin and cause of the fire.
  – Investigation (search) as to the circumstances of the fire (follow-up investigation).

Slide 11-27

2. This rule applies not only to evidence directly found during an unlawful search but also to that which flows from the excluded evidence.

B. U.S. Supreme Court rulings in 1961 required that all state courts observe the same rules of evidence (*Mapp v. Ohio*).

1. Evidence obtained in violation of the Fourth Amendment may not be used in federal courts.

2. The evidence may not be used in criminal prosecutions in state courts.

C. In relation to fire investigations, “search” is subdivided.

1. Investigation (search) for origin and cause of the fire.

a. Origin and cause investigations are required by most fire prevention codes.

b. Authority to search due to exigency or emergency.

c. Forced entry to burning or exposed structures.

d. Forced removal of endangered occupants.

2. Investigation (search) as to the circumstances of the fire (the follow-up investigation).

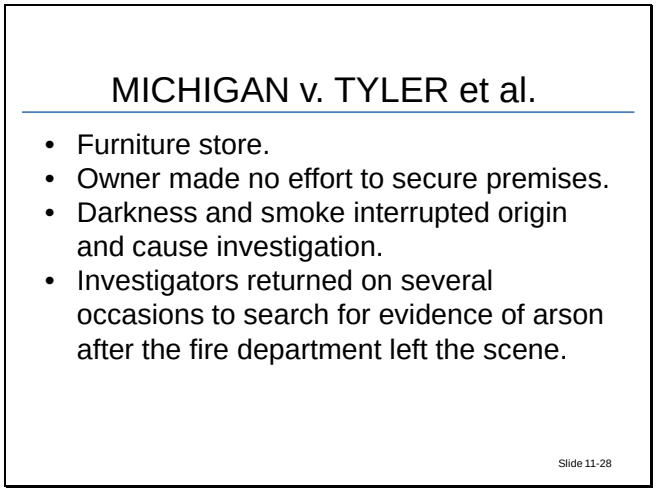
a. After evidence of arson is discovered.

b. Same as any other criminal investigation. Must observe all rules of arrest, search and seizure.

D. Right to privacy.

1. Real and personal property is protected by the Constitution.

2. Owners of fire-damaged property may object to a search of the property. The courts vary in rulings on these types of searches.



E. In 1978, the U.S. Supreme Court laid down minimum constitutional requirements for post-fire searches (*Michigan v. Tyler et al.*, 436 U.S. 499, 98 S. Ct. 1842 56 L. Ed. 2d 486).

1. No search warrant is necessary.

a. Activities to determine origin and cause may continue for a reasonable time after the fire is extinguished or when a re-entry is a continuation of an initial valid search.

b. Under any of these circumstances, evidence gained is admissible in court to convict a person of arson (under the plain view and exigent circumstances doctrine).

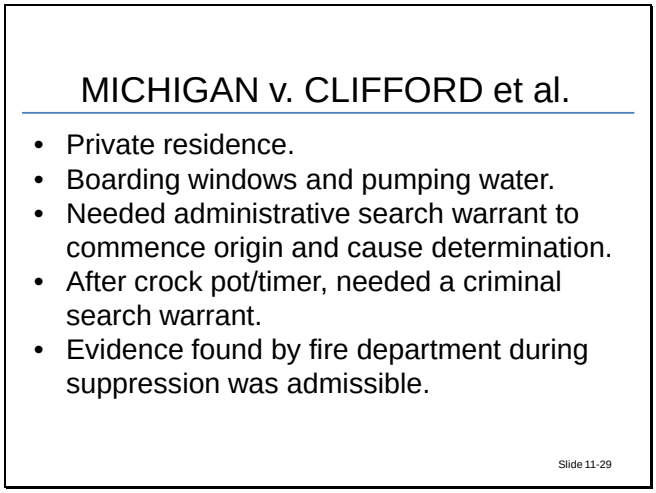
2. A return to the scene for additional examination is permissible with consent of owner/occupant.

3. Abandoned property still is protected, and permission is required.

F. Criminal search warrants are necessary.

1. Upon re-entry that is not for fire suppression or administratively to determine fire cause, and upon re-entry for the purpose of gaining evidence to be used in a criminal prosecution.

2. Assuming a proper criminal search warrant is issued and executed, the evidence gained from such a search would be admissible in court to convict a person of arson.



G. In 1984, the U.S. Supreme Court held that post-fire investigations must adhere to stringent requirements with respect to the constitutional rights of owners/occupants. (*Michigan v. Clifford et al.*, Cert. to the Court of Appeals of Michigan, 82-pp. 357).

H. In doing so, the court reconfirmed its *Tyler* decision and further defined the rights of citizens in private dwellings (residential occupancies).

1. The court affirmed the need to investigate to determine the cause of a fire.

2. The "reasonable time" approach as identified in *Tyler* remains in place.

3. Certain occupancies may involve a greater "Expectation of Privacy" than other occupancies (i.e., private residence versus commercial building).

ADMINISTRATIVE SEARCH WARRANT

- Recent fire, undetermined origin — (when).
- Efforts to secure/continuing use/entries to scene — (what/who).
- Evidence gained would be admissible under plain view doctrine.

Slide 11-30

I. Administrative (inspection) search warrants may be necessary to legally enter onto the premises.

1. Upon re-entry of the premises, when the re-entry is not a continuation of an initial valid search and when the purpose of a search is to determine the cause of the fire.

2. Evidence gained from such searches would be admissible to convict a person of arson under the plain view doctrine.

RULES OF EVIDENCE

Evidence is generally defined as any matter, the effect, tendency, or design of which is to produce in the mind a persuasive affirmation, or disaffirmation, of the existence of some other matter of fact.

Slide 11-31

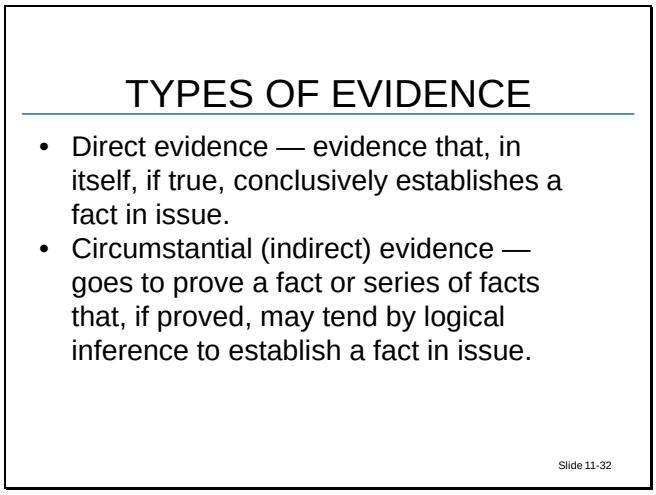
III. RULES OF EVIDENCE

A. Evidence is generally defined as any matter, the effect, tendency, or design of which is to produce in the mind a persuasive affirmation, or disaffirmation, of the existence of some other matter of fact. Testimony, writings, material objects, or other things presented to the senses that are offered to prove the existence or nonexistence of a fact.

B. Evidence versus proof.

1. Proof is the effect or result of evidence.

2. Evidence is the medium of proof.



C. Types of evidence.

1. Direct evidence is defined as evidence that, in itself, if true, conclusively establishes a fact in issue (e.g., individual seen on surveillance tape committing a crime).

2. Circumstantial (indirect) evidence proves a fact or series of facts that may tend by logical inference to establish a fact in issue (e.g., alarm system that requires someone to enter a code to access a building which is documented by an alarm company).

CORROBORATING EVIDENCE

- An “out-of-court confession” convicts only if admissible into evidence.
- Confession of the accused will not stand alone to obtain a conviction.

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D. Corroborating evidence.

1. An out-of-court confession is only sufficient to convict someone if it is properly obtained and admitted into evidence.

2. The confession of the accused will **not** stand alone to obtain a conviction.

3. Corroborating evidence must be presented to support the confession.

   a. Physical evidence, such as ignitable liquid residue, incendiary devices, etc., can carry a great deal of weight with the court.

   b. Circumstantial evidence, such as testimony placing the accused at the scene shortly before, during or after the fire, is also extremely helpful.

   c. Testimony of an expert in fire origin and cause confirming the confession is invaluable.

E. Relevance of evidence.

1. Evidence is relevant when the factual information communicated to the court would be helpful in the determination of the factual matter that is in dispute.

2. Evidence may pertain to some chain of facts if that chain leads to the fact or question before the court.

3. Evidence may be introduced into court on the condition that:

   a. It must later prove relevant.

b. If later-relevance is not proved, evidence may be withdrawn or stricken from the records.

F. Competence and credibility of evidence.

1. Competence: Determined before evidence (testimony) is given.

2. Credibility: Evaluated after evidence (testimony) is given.

SPOLIATION OF EVIDENCE

- The willful destruction of evidence or the failure to preserve potential evidence for another's use in pending or future litigation.
- Loss, destruction, or material alteration of an object or document that is evidence or potential evidence in a legal proceeding by one who has the responsibility for its preservation.

—NFPA 921, *"Guide for Fire and Explosion Investigations"*

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IV. SPOLIATION OF EVIDENCE AND SUBROGATION

A. Spoliation is the failure to preserve property for another's use as evidence in pending or reasonably foreseeable litigation.

WHEN DOES IT APPLY?

- Intentional or malicious destruction of evidence.
- Negligent destruction of evidence.
- Mainly concerns civil litigation and subrogation issues.
- But can occur in criminal cases.

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B. Spoliation applies when intentional or negligent actions destroy physical evidence.

HOW IS IT APPLIED?

- To establish "spoliation" the party alleging must show that the party being grieved had a duty to preserve evidence and that it nonetheless destroyed the evidence.
- Translation — you knew that the widget caused the fire, but you still took it apart and destroyed it without notifying all responsible parties; you can be held liable — **Fire departments are not exempt**!

Slide 11-36

C. Spoliation can be alleged when someone who had a duty to preserve a piece of evidence he or she collected at a fire scene destroyed it before notifying all responsible parties.

WHAT CAN BE DONE TO REMEDY?

- Dismiss court action.
- Exclude evidence.
- Apply evidentiary inferences or limitations.
- Tort actions for destruction of evidence.
- Prosecution for obstruction of justice.
- These remedies are primarily used in civil cases not involving government entities.

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D. Spoliation can have several consequences.

1. In jurisdictions where the (intentional) act is criminal by statute, it may result in fines and incarceration for the parties involved.

2. In jurisdictions where relevant case law precedent has been established, evidence possibly altered by spoliation may be interpreted under a spoliation inference.

ADDITIONAL SPOLIATION CONCERNS

- Fire investigation team intentionally destroys scene after examination purposely to not allow subsequent investigators to determine a cause.
- This must be “willful and negligent” destruction and not just normal scene processing or normal fire department overhaul.

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E. Spoliation can also occur by the willful and negligent actions by fire service and fire investigation personnel that result in destroying or altering a piece of evidence.

FINAL THOUGHTS ON SPOLIATION

- Be aware of spoliation issues.
- If you feel that the fire cause was due to a certain piece of equipment, **do not take apart the item unless you are an expert on that item.**
- If you are an expert and you do take it apart, then prepare to defend your actions in court.

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F. Extreme care must be exercised by all personnel at the fire scene when handling evidence to avoid possible claims of spoliation for improper handling and examination. In other words, do not attempt to take apart any piece of equipment unless you know exactly what you are doing and can defend your actions in a court of law.

SUBROGATION

- The right of a person to assume a legal claim of another; the right of a person who has paid a liability or obligation of another to be indemnified by that person; an insurer's substitution in place of the insured in regard to a claim against a third party for indemnification of a loss paid by the insurer.

—Black's Law Dictionary

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G. Subrogation is the legal right of an individual to assume responsibility for payment of a claim of another.

SUBROGATION (cont'd)

- Translation — the company that manufactured the "widget" is held responsible for the malfunction.
- The insurance company sues the manufacturer to cover the loss of the insured.

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H. Typically, an insurance company that pays its insured (client) for injuries and losses, then sues the party which the injured person contends caused the damages to him or her.

Example: John Smith negligently builds a bonfire, which gets out of control and starts a grass fire that spreads to Ned Nitwit's barn. American Insurance Co. has insured the barn, pays Nitwit his estimated cost of reconstruction of the barn, and then sues John Smith for that amount. John Smith will have all the "defenses" to the insurance company's suit that he would have had against Nitwit, including the contention that the cost of repairing the barn was less than Nitwit was paid or that Nitwit negligently got in the way of firefighters trying to put out the grass fire.

FIRE OFFICER, INVESTIGATOR AND PROSECUTOR COOPERATION

- Prosecutors are reluctant to attempt prosecution of arson cases.
- Prosecutors must be presented specific, detailed information to prosecute successfully.
- Information must be detailed.
- Prosecutors can guide the investigator as to what additional evidence/witnesses are needed.

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V. FIRE OFFICER, INVESTIGATOR AND PROSECUTOR COOPERATION

A. Many district attorneys are reluctant to attempt prosecution of arson due to:

1. Lack of specific training concerning arson prosecution.

2. Lack of arson cases coming to trial that are not supported by substantial evidence.

B. Prosecutors must be presented specific, detailed information to allow for successful prosecution.

1. Date of the incident.

2. Owner/Occupant of involved property.

3. Extent of damage (sketch and photos).

4. Identification of suspect(s).

5. Evidence to prove each element of the crime.

6. Motive.

7. Existence of nonaccidental causes.

8. Evidence of incendiarism.

9. Witnesses available.

a. What witnesses can testify to or against.

b. Copies of statements of witnesses.

10. Copies of documents collected during investigation.

11. Suggested questions that could be asked of witnesses.

12. Background investigations of suspect(s) and witnesses.

13. Background information describing the experience, education and training of the investigator(s).

14. A summary of facts showing the relevance of the above.

C. All information must be detailed and complete.

D. If necessary, the prosecutor can guide the investigator as to what additional evidence/witnesses are needed.

E. Lay testimony.

1. Often provides a vital link in a trial by providing information about important aspects of the fire.

2. Emergency services personnel are in the best position to make critical observations about the incident, occupants, or persons who were at and/or were observed leaving the scene.

3. Lay (fact) witnesses may testify about observations of the fire, entry, items discovered during the suppression or overhaul of the fire, or their role in fire cause determination.

a. Will not be able to offer opinions.

b. Will not testify on hearsay, only on what was directly observed or heard in person.

c. Will need to speak in plain terms that the jury can understand, not fire department jargon.

EXPERT TESTIMONY

- "Experts" have special training and experience that the jury must hear to understand the evidence. (Federal Rules of Evidence 701/702.)
- Testifying as an expert exposes fire investigators to cross-examination on all aspects of fire and explosion investigation.

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F. Expert witness and opinion testimony.

1. Person must possess special or unique knowledge or skills in a given field, art or profession.

2. Person must have acquired expertise through experience, education, training, study or a combination of the above.

3. Person does not have to have a certain level of education.

4. Person must have knowledge not found in most individuals.

5. Prospective expert witnesses can be questioned by both the defense and the prosecution.

6. The expert witness is permitted to express an opinion within his or her expertise in court testimony.

7. Although the rule is relaxed, witnesses who do not qualify as experts usually only testify to facts without stating their impressions, conclusions or opinions.

DEVELOPING A "FACT SHEET"

The prosecutor must know both the case and all personnel involved in the investigation prior to accepting a case for prosecution.

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VI. DEVELOPING A "FACT SHEET"

A. The prosecutor must know both the case and the investigator prior to taking a case to court.

INCIDENT FACT SHEET

- Incident date.
- Incident number.
- Owner/Occupant of property.
- Type of occupancy.
- Extent of damage.
- Circumstances concerning fire department operations and activities.

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B. Emergency services personnel should complete a fact sheet for all incidents to assist prosecutors.

1. Incident fact sheet.

   a. Date of incident.

   b. Incident number.

   c. Owner/Occupant of property.

   d. Type of occupancy.

e. Extent of fire damage.

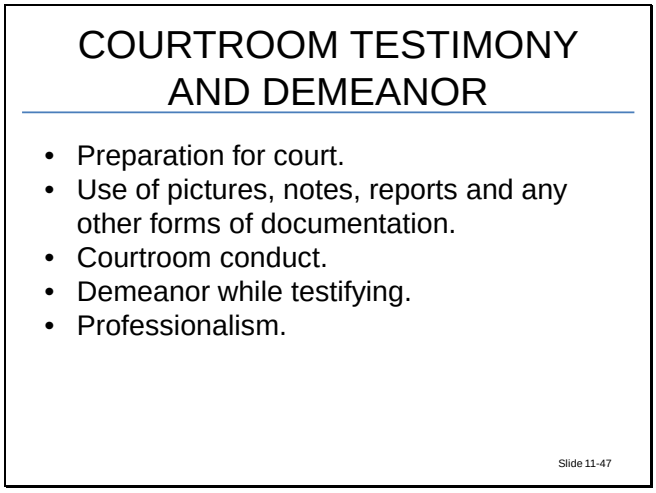
f. Motive.

2. Evidence to prove each element of the crime.

a. Evidence of nonaccidental cause.

b. Evidence of incendiary origin.

c. Names of available witnesses.



VII. COURTROOM TESTIMONY AND DEMEANOR

A. Fire officer's and investigator's preparation for court.

1. Review records, reports and evidence.

2. Appearance.

a. Professional.

b. Conservative.

3. Uniform versus civilian dress.

a. Follow department policy and/or advice of prosecuting attorney.

b. Civilian dress recommended.

B. Use of pictures, slides, charts and documents.

1. When possible, photographs should be large enough to be seen by jury members.

2. Charts.

   a. Contrasting colors.

   b. Large, bold print: But evidentiary conclusions (e.g., burn patterns, points of origin, etc.) are left off the diagram until designated in court.

C. Courtroom conduct.

1. Follow prosecutor's directions.

2. Impression on jury is vital.

3. Officials should appear professional at all times.

4. Duty ends with a jury verdict.

5. You are a professional fire officer, not a crusader. No vendettas are allowed; this will lower your conduct to that of the defendant.

D. While on the stand.

1. Sit upright with both feet on the floor; speak to the jury, not to the attorney(s).

2. Keep hands in a natural position; avoid gesturing.

3. Do not play with a pen or pencil.

4. When referring to the defendant, say "defendant."

5. Exercise courtesy and patience at all times.

6. Never argue with defense counsel.

7. Testify with the confidence gained by the complete and full knowledge of the facts of a case.

8. Do not hesitate or fail to answer questions; however, take enough time to understand the question fully. If the question is not understood, have the question repeated.

9. Be alert at all times and listen attentively to all questions, remarks or statements made by counsel and court.

10. An accurate statement of facts is desired, and there should be no guesswork or speculation. If the facts are not known, say so. If exact times, distances, etc. are not known, qualify the statement with the word "about." If the **exact** words are known, use them; if not, qualify the statement with the words, "In substance, he said…."

11. **Tell the truth**. You are obligated by your oath and, more importantly, by your personal integrity. Your integrity as a witness is your most valuable possession. **Never lie to obtain a conviction**. The loss of your reputation and integrity are not worth a conviction.

12. Avoid the use of slang or improper language unless it is absolutely necessary to the issue at hand.

13. Remember, the jury is composed of lay people, so if technical language is used, follow it up by explaining it in simple terms.

14. Speak clearly and loudly enough to be heard, and do not hesitate to correct mistakes or errors.

15. Do not give the impression that the conviction of the accused is a personal desire (vendetta).

16. Do not volunteer information; only answer the questions that are asked.

17. If either attorney objects during a question, do not answer until the court has ruled on the objection and until the question has been repeated. If the objection is to your answer, do not complete the answer until directed to do so by the court.

18. Notes may be used to refresh your memory; however, the permission of the court must be obtained before the notes are used. The defense has the absolute right to be provided with a copy of your notes.

19. The object of cross-examination is to test the credibility, knowledge, recollection, bias, prejudices, or interest of a witness relative to his or her testimony on direct examination.

SUMMARY

- Arson laws in the United States.
- Legal requirements related to arrest, search and seizure.
- Rules of evidence.
- Spoliation of evidence and subrogation.
- Fire officer, investigator and prosecutor cooperation.
- Developing a fact sheet.
- Courtroom testimony and demeanor.

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VIII. SUMMARY

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APPENDIX A

CONSENT FORM TO SEARCH THE FIRE SCENE

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CONSENT FORM TO SEARCH THE FIRE SCENE

I, _____ , consent to an examination of my
(print full name)

property located at _____.

This property is _____
(provide brief description)

_____.

This examination is being conducted as part of an investigation of the fire which occurred at this property on

_____.
(date)

I am the lawful owner of this property. I have been advised of my Constitutional rights to refuse such consent and to require that a search warrant be obtained prior to any examination.

I have further been advised that if I do consent to an examination, any evidence found as a result of such examination may be seized and used against me in any court of law and that I may withdraw my consent at any time prior to the conclusion of the examination.

After having been advised of my Constitutional rights as stated above, I hereby voluntarily waive those rights and consent to an examination. I authorize the following person(s) to conduct a complete examination of the property described above.

_____ _____
(name) (agency/office)

_____ _____
(name) (agency/office)

I further grant permission to photograph, videotape or remove from this property any materials deemed pertinent to the investigation of the origin and cause of the fire for evidence or possible laboratory analysis.

_____
(Signature) (Date)

_____
(Address if different than above) (ZIP)

Witnesses

_____ _____
(Signature) (Date) (Signature) (Date)

_____ _____
(Address) (ZIP) (Address) (ZIP)

_____ _____
(Phone number) (Phone number)

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APPENDIX B

MICHIGAN v. TYLER et al.

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MICHIGAN v. TYLER et al.

Supreme Court of the United States, May 31, 1978

No. 76-1608

Mr. Justice Stewart delivered the opinion of the Court.

The respondents, Loren Tyler and Robert Tompkins were convicted in a Michigan trial court of conspiracy to burn real property in violation of Mich. Comp. Laws Sec. 750.157a.[1] Various pieces of physical evidence and testimony based on personal observation, all obtained through unconsented and warrantless entries by police and fire officials onto the burned premises, were admitted into evidence at the respondents' trial. On appeal, the Michigan Supreme Court reversed the convictions, holding that "the warrantless searches were unconstitutional and that the evidence obtained was therefore inadmissible." 399 Mich. 564, 584, 250 N.W. 2d 467, 477 (1977). We granted certiorari to consider the applicability of the Fourth and Fourteenth Amendments to official entries onto fire-damaged premises. ---U.S.---.

I

Shortly before midnight on January 21, 1970, a fire broke out at Tyler's Auction, a furniture store in Oakland County, Michigan. The building was leased to respondent Loren Tyler, who conducted the business in association with respondent Robert Tompkins. According to the trial testimony of various witnesses, the fire department responded to the fire and was "just watering down smoldering embers" when Fire Chief See arrived on the scene around 2 a.m.

It was Chief See's responsibility to determine the cause and make out all reports. Chief See was met by Lieutenant Lawson, who informed him that two plastic containers of flammable liquid had been found in the building. Using portable lights, they entered the gutted store, which was filled with smoke and steam, to examine the containers. Concluding that the fire "could possibly have been an arson," Chief See called Police Detective Webb, who arrived around 3:30 a.m. Detective Webb took several pictures of the containers and of the interior of the store, but finally abandoned his efforts because of the smoke and steam. Chief See briefly "looked throughout the rest of the building to see if there was any further evidence, to determine what the cause of the fire was." By 4 a.m. the fire had been extinguished and the firefighters departed. See and Webb took the two containers to the fire station, where they were turned over to Webb for safekeeping. There was neither consent nor a warrant for any of these entries into the building, nor for the removal of the containers. The respondents challenged the introduction of these containers at the trial, but abandoned their objection in the State Supreme Court. 399 Mich., at 570, 250 N.W. 2d, at 470.

Four hours after he had left Tyler's Auction, Chief See returned with Assistant Chief Somerville, whose job was to determine the "origin of all fires that occur within the Township." The fire had been extinguished and the building was empty. After a cursory examination they left, and Somerville returned with Detective Webb around 9 a.m. In Webb's words, they discovered suspicious "burn marks in the carpet, which (Webb) could not see earlier that morning, because of the heat, steam, and the darkness." They also found "pieces of tape, with burn marks, on the

stairway." After leaving the building to obtain tools, they returned and removed pieces of the carpet and sections of the stairs to preserve these bits of evidence suggestive to a fuse trail. Somerville also searched through the rubble "looking for any other signs or evidence that showed how this fire was caused." Again, there was neither consent nor a warrant for these entries and seizures. Both at trial and on appeal, the respondents objected to the introduction of evidence thereby obtained.

On February 16 Sergeant Hoffman of the Michigan State Police Arson Section returned to Tyler's Auction to take photographs.[2] During this visit or during another at about the same time, he checked the circuit breakers, had someone inspect the furnace, and had a television repairman examine the remains of several television sets found in the ashes. He also found a piece of fuse. Over the course of his several visits, Hoffman secured physical evidence and formed opinions that played a substantial role at trial in establishing arson as the cause of the fire and in refuting the respondents' testimony about what furniture had been lost. His entries into the building were without warrants or Tyler's consent, and were for the sole purpose "of making an investigation and seizing evidence." At the trial, respondents' attorney objected to the admission of physical evidence obtained during these visits, and also moved to strike all of Hoffman's testimony "because it was got in an illegal manner."[3]

The Michigan Supreme Court held that with only a few exceptions, any entry onto fire-damaged private property by fire or police officials is subject to the warrant requirements of the Fourth and Fourteenth Amendments. "(Once) the blaze (has been) extinguished and the firefighters have left the premises, a warrant is required to reenter and search the premises, unless there is consent or the premises have been abandoned." 399 Mich., at 583, 250 N.W. 2d, at 477.

Applying this principle, the court ruled that the series of warrantless entries that began after the blaze had been extinguished at 4 a.m. on January 22 violated the 4th and 14th amendments.[4] It found that the "record does not factually support a conclusion that Tyler had abandoned the fire-damaged premises" and accepted the lower court's finding that "'(c)onsent for the numerous searches was never obtained from defendant Tyler.'" 1d., at 583, 570, 250 N.W. 2d, at 476, 470. Accordingly, the court reversed the respondents' convictions and ordered a new trial.

II

The decisions of this Court firmly establish that the fourth amendment extends beyond the paradigmatic entry into a private dwelling by a law enforcement officer in search of the fruits or instrumentalities of crime. As this Court stated in **Camara v. Municipal Court**, 387 U.S., at 528, the "basic purpose of this Amendment… is to safeguard the privacy and security of individuals against arbitrary invasions by government officials." The officials may be health, fire, or building inspectors. Their purpose may be to locate and abate a suspected public nuisance, or simply to perform a routine periodic inspection. The privacy that is invaded may be sheltered by the walls of a warehouse or other commercial establishment not open to the public. **See v. City of Seattle**, 387 U.S. 541; **Marshal v. Barlow's Inc.**, ---U.S.---(slip op., at 3-5). These deviations from the typical police search are thus clearly within the protection of the Fourth Amendment.

The petitioner argues, however, that an entry to investigate the cause of a recent fire is outside that protection because no individual privacy interests are threatened. If the occupant of the premises set the blaze, then, in the words of the petitioner's brief, his "actions show that he has no expectation of privacy" because "he has abandoned those premises within the meaning of the Fourth Amendment." And if the fire had other causes, "the occupants of the premises are treated as victims by police and fire officials." In the petitioner's view, "(t)he likelihood that they will be aggrieved by a possible intrusion into what remains of their privacy in badly burned premises is negligible."

This argument is not persuasive. For even if the petitioner's contention that arson establishes abandonment be accepted, its second proposition--that innocent fire victims inevitably have no protectable expectations of privacy in whatever remains of their property--is contrary to common experience. People may go on living in their homes or working in their offices after a fire. Even when that is impossible, private effects often remain on the fire-damaged premises. The petitioner may be correct in the view that most innocent fire victims are treated courteously and welcome inspections of their property to ascertain the origin of the blaze, but "even if true, (this contention) is irrelevant to the question whether the…inspection is reasonable within the meaning of the Fourth Amendment." **Camara, supra**, at 536. Once it is recognized that innocent fire victims retain the protection of the Fourth Amendment, the rest of the petitioner's argument unravels. For it is of course impossible to justify a warrantless search on the ground of abandonment by arson when that arson has not yet been proved, and a conviction cannot be used **ex post facto** to validate the introduction of evidence used to secure that same conviction.

Thus, there is no diminution in a person's reasonable expectation of privacy nor in the protection of the Fourth Amendment simply because the official conducting the search wears the uniform of a firefighter rather than a policeman, or because his purpose is to ascertain the cause of a fire rather than to look for evidence of a crime, or because the fire might have been started deliberately. Searches for administrative purposes, like searches for evidence of crime, are encompassed by the Fourth Amendment. And under that Amendment, "one governing principle, justified by history and by current experience, has consistently been followed: except in certain carefully defined classes of cases, a search of private property without proper consent is 'unreasonable' unless it has been authorized by a valid search warrant." **Camara, supra**, at 528-529. The showing of probable cause necessary to secure a warrant may vary with the object and intrusiveness of the search,[5] but the necessity for the warrant persists.

The petitioner argues that no purpose would be served by requiring warrants to investigate the cause of fire. This argument is grounded on the premise that the only fact that need be shown to justify an investigatory search is that a fire of undetermined origin has occurred on those premises. The petitioner contends that this consideration distinguishes this case from **Camara**, which concerned the necessity for warrants to conduct routine building inspections. Whereas the occupant of premises subjected to an unexpected building inspection may have no way of knowing the purpose or lawfulness of the entry, it is argued that the occupant of burned premises can hardly question the factual basis for fire officials wanting access to his property. And whereas a magistrate performs the significant function of assuring that an agency's decision to conduct a routine inspection of a particular dwelling conforms with reasonable legislative or administrative standards, he can do little more than rubber stamp an application to search fire-

damaged premises for the cause of the blaze. In short, where the justification for the search is as simple and as obvious to everyone as the fact of a recent fire, a magistrate's review would be a time-consuming formality of negligible protection to the occupant.

The petitioner's argument fails primarily because it is built on a faulty premise. To secure a warrant to investigate the cause of a fire, an official must show more than the bare fact that a fire has occurred. The magistrate's duty is to assure that the proposed search will be reasonable, a determination that requires inquiry into the need for the intrusion on the one hand, and the threat of disruption to the occupant on the other. For routine building inspections, a reasonable balance between these competing concerns is usually achieved by broad legislative or administrative guidelines specifying the purpose, frequency, scope, and manner of conducting the inspections. In the context of investigatory fire searches, which are not programmatic but are responsive to individual events, a more particularized inquiry may be necessary. The number of prior entries, the scope of the search, the time of day when it is proposed to be made, the lapse of time since the fire, the continued use of the building, and the owner's efforts to secure it against intruders might all be relevant factors. Even though a fire victim's privacy must normally yield to the vital social objective of ascertaining the cause of the fire, the magistrate can perform the important function of preventing harassment by keeping that invasion to a minimum. See **See v. City of Seattle, supra**, at 544-545; **United States v. Chadwick**, 433 U.S. 1,9; **Marshal v. Barlow's Inc.,** at---(slip op., at 15).

In addition, even if fire victims can be deemed aware of the factual justification for investigatory searches, it does not follow that they will also recognize the legal authority for such searches. As the Court stated in **Camara**, "when the inspector demands entry (without a warrant), the occupant has no way of knowing whether enforcement of the municipal code involved requires inspection of his premises, no way of knowing the lawful limits of the inspector's power to search, and no way of knowing whether the inspector himself is acting under proper authorization." 387 U.S., at 532. Thus, a major function of the warrant is to provide the property owner with sufficient information to reassure him of the entry's legality. See **United States v. Chadwick**, supra, at 9.

In short, the warrant requirement provides significant protection for fire victims in this context, just as it does for property owners faced with routine building inspections. As a general matter, then, official entries to investigate the cause of a fire must adhere to the warrant procedures of the Fourth Amendment. In the words of the Michigan Supreme Court: "Where the cause (of the fire) is undetermined, and the purpose of the investigation is to determine the cause and to prevent such fires from occurring or recurring, a…search may be conducted pursuant to a warrant issued in accordance with reasonable legislative or administrative standards; if evidence of wrongdoing is discovered, it may, of course, be used to establish probable cause for the issuance of a criminal investigative search warrant or in prosecution." But "(i)f the authorities are seeking evidence to be used in a criminal prosecution, the usual standard (of probable cause) will apply." 399 Mich., at 584, 250 N.W. 2d, at 477. Since all the entries in this case were "without proper consent" and were not "authorized by a valid search warrant," each one is illegal unless it falls within one of the "certain carefully defined classes of cases" for which warrants are not mandatory. **Camara, supra**, at 528-529.

III

Our decisions have recognized that a warrantless entry by criminal law enforcement officials may be legal when there is compelling need for official action and no time to secure a warrant. **Warden v. Hayden**, 387 U.S. 294 (warrantless entry of house by police in hot pursuit of armed robber); **Kerr v. California**, 374 U.S. 23 (warrantless and unannounced entry of dwelling by police to prevent imminent destruction of evidence). Similarly, in the regulatory field, our cases have recognized the importance of "prompt inspections even without a warrant, …in emergency situations." **Camara, supra,** at 539, citing **North American Cold Storage v. City of Chicago**, 211 U.S. 306 (seizure of unwholesome food); **Jacobson v. Massachusetts**, 197 U.S. 11 (compulsory smallpox vaccination); **Compagnie Francaise v. Board of Health**, 186 U.S. 380 (health quarantine).

A burning building clearly presents an exigency of sufficient proportions to render a warrantless entry "reasonable." Indeed, it would defy reason to suppose that firefighters must secure a warrant or consent before entering a burning structure to put out the blaze. And once in a building for this purpose, firefighters may seize evidence of arson that is in plain view. **Coolidge v. New Hampshire**, 403 U.S. 443, 465-466. Thus, the Fourth and Fourteenth Amendments were not violated by the entry of the firefighters to extinguish the fire at Tyler's Auction, nor by Chief See's removal of the two plastic containers of flammable liquid found on the floor of one of the showrooms.

Although the Michigan Supreme Court appears to have accepted this principle, its opinion may be read as holding that the exigency justifying a warrantless entry to fight a fire ends, and the need to get a warrant begins, with the dousing of the last flame. 399 Mich., at 579, 250 N.W. 2d, at 475. We think this view of the firefighting function is unrealistically narrow, however. Fire officials are charged not only with extinguishing fires, but with finding their causes. Prompt determination of the fire's origin may be necessary to prevent its recurrence, as through the detection of continuing dangers such as faulty wiring or a defective furnace. Immediate investigation may also be necessary to preserve evidence from intentional or accidental destruction. And, of course, the sooner the officials complete their duties, the less will be their subsequent interference with the privacy and the recovery efforts of the victims. For these reasons, officials need no warrant to remain in a building for a reasonable time to investigate the cause of a blaze after it has been extinguished.[6] And if the warrantless entry to put out the fire and determine its cause is constitutional, the warrantless seizure of evidence while inspecting the premises for these purposes also is constitutional.

IV

A

The respondents argue, however, that the Michigan Supreme Court was correct in holding that the departure by the fire officials from Tyler's Auction at 4 a.m. ended any license they might have had to conduct a warrantless search. Hence, they say that even if the firemen might have been entitled to remain in the building without a warrant to investigate the cause of the fire, their departure and reentry four hours later that morning required a warrant.

On the facts of this case, we do not believe that a warrant was necessary for the early morning re-entries on January 22. As the fire was being extinguished, Chief See and his assistants began their investigation, but visibility was severely hindered by darkness, steam, and smoke. Thus they departed at 4 a.m. and returned shortly after daylight to continue their investigation. Little purpose would have been served by their remaining in the building, except to remove any doubt about the legality of the warrantless search and seizure later that same morning. Under these circumstances we find that the morning entries were no more than an actual continuation of the first, and the lack of a warrant thus did not invalidate the resulting seizure of evidence.

B

The entries occurring after January 22, however, were clearly detached from the initial exigency and warrantless entry. Since all of these searches were conducted without valid warrants and without consent, they were invalid under the Fourth and Fourteenth Amendments, and any evidence obtained as a result of those entries must, therefore, be excluded at the respondents' retrial.

V

In summation, we hold that an entry to fight a fire requires no warrant, and that once in the building, officials may remain there for a reasonable time to investigate the cause of the blaze. Thereafter, additional entries to investigate the cause of the fire must be made pursuant to the warrant procedures governing administrative searches. See **Camara, supra**, at 534-539, **See v. City of Seattle, supra**, at 544-545; **Marshal v. Barlow's, Inc., supra**, at---(slip op., at 12-13). Evidence of arson discovered in the course of such investigations is admissible at trial, but if the investigating officials find probable cause to believe that arson has occurred and require further access to gather evidence for a possible prosecution, they may obtain a warrant only upon a traditional showing of probable cause applicable to searches for evidence of crime. **United States v. Ventresca**, 380 U.S. 102.

These principles require that we affirm the judgment of the Michigan Supreme Court ordering a new trial.[7]

Affirmed.

Mr. Justice Blackmun joins the judgment of the Court and Parts I, II, and IV-A of its opinion.

Mr. Justice Brennan took no part in the consideration or decision of this case.

FOOTNOTES

[1]In addition, Tyler was convicted of the substantive offenses of burning real property, Mich. Comp. Laws Sec. 750.73, and burning insured property with intent to defraud, Mich. Comp. Laws Sec. 750.75.

[2]Sergeant Hoffman had entered the premises with other officials at least twice before, on January 26 and 29. No physical evidence was obtained as a result of these warrantless entries.

[3]The state's case was substantially buttressed by the testimony of Oscar Frisch, a former employee of the respondents. He described helping Tyler and Tompkins move valuable items from the store and old furniture into the store a few days before the fire. He also related that the respondents had told him there would be a fire on January 21, and had instructed him to place mattresses on top of other objects so that they would burn better.

[4]Having concluded that warrants should have been secured for the post-fire searches, the court explained that different standards of probable cause governed searches to determine the cause of a fire and searches to gather evidence of crime. It then described what standard of probable cause should govern all the searches in this case:

"While it may be no easy task under some circumstances to distinguish as a factual matter between an administrative inspection and a criminal investigation, in the instant case the Court is not faced with that task. Having lawfully discovered the plastic containers of flammable liquid and other evidence of arson before the fire was extinguished, Fire Chief See focused his attention on assembling proof of arson and began a criminal investigation. At that point there was probable cause of issuance of a criminal investigative search warrant." 399 Mich., at 577, 250 N.W. 2d, at 474 (citations omitted).

[5]For administrative searches conducted to enforce local building, health, or fire codes, "'probable cause' to issue a warrant to inspect…exist(s) if reasonable legislative or administrative standards for conducting an area inspection are satisfied with respect to a particular dwelling. Such standards, which will vary with the municipal program being enforced, may be based upon the passage of time, the nature of the building (e.g., a multifamily apartment house), or the condition of the entire area, but they will not necessarily depend upon specific knowledge of the condition of the particular dwelling." **Camara, supra**, at 538; **Marshal v. Barlow's, Inc.**,---U.S.---,---(slip op., at 12-13). See LaFave, Administrative Searches and the Fourth Amendment: The Camara and See Cases, 1967 Sup. Ct. Rev. 1. 18-20.

[6]The circumstances of particular fires and the role of firefighters and investigating officials will vary widely. A fire in a single-family dwelling that clearly is extinguished at some identifiable time presents fewer complexities than those likely to attend a fire that spreads through a large apartment complex or that engulfs numerous buildings. In the latter situations, it may be necessary for officials--pursuing their duty both to extinguish the fire and to ascertain its origin--to remain on the scene for an extended period of time repeatedly entering or re-entering the building or buildings, or portions thereof. In determining what constitutes a "reasonable time to investigate," appropriate recognition must be given to the exigencies that confront officials serving under these conditions, as well as to individuals' reasonable expectations of privacy.

[7]The petitioner alleges that respondent Tompkins lacks standing to object to the unconstitutional searches and seizures. The Michigan Supreme Court refused to consider the State's argument, however, because the prosecutor failed to raise the issue in the trial court or in the Michigan Court of Appeals. 399 Mich., at 571, 250 N.W. 2d, at 470-471. We read the state court's opinion to mean that in the absence of a timely objection by the state, a defendant will be presumed to have standing. Failure to present a federal question in conformance with state procedure constitutes an adequate and independent ground of decision barring review in this Court, so long as the State has a legitimate interest in enforcing its procedural rule. **Henry v. Mississippi**, 379 U.S. 443, 447. See **Safeway Stores v. Oklahoma Grocers**, 360 U.S. 334, 342 n.7; **Cardinale v. Louisiana**, 394 U.S. 437, 438. The petitioner does not claim that Michigan's procedural rule serves no legitimate purpose. Accordingly, we do not entertain the petitioner's standing claim which the state court refused to consider because of procedural default.

NOTE: Fire Chief See who is identified within the opinion is not the same "See" referred to in **See v. City of Seattle**.

APPENDIX C

MICHIGAN v. CLIFFORD et al.

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SECTION 1

SUPREME COURT OF THE UNITED STATES

Syllabus

MICHIGAN vs. CLIFFORD et al.

Certiorari To The Court of Appeals of Michigan

No. 82-357.

Argued October 5, 1983--Decided January 11, 1984

Respondents' private residence was damaged by an early morning fire while they were out of town. Firefighters extinguished the blaze at 7:04 a.m., at which time all fire officials and police left the premises. Five hours later, a team of arson investigators arrived at the residence for the first time to investigate the cause of the blaze. They found a work crew on the scene boarding up the house and pumping water out of the basement. The investigators learned that respondents had been notified of the fire and had instructed their insurance agent to send the crew to secure the house. Nevertheless the investigators entered the residence and conducted an extensive search without obtaining either consent or an administrative warrant. Their search began in the basement where they found two Coleman fuel cans and a crock pot attached to an electrical timer. The investigators determined that the fire had been caused by the crock pot and timer and had been set deliberately. After seizing and marking the evidence found in the basement, the investigators extended their search to the upper portions of the house where they found additional evidence of arson. Respondents were charged with arson and moved to suppress all the evidence seized in the warrantless search on the ground that it was obtained in violation of their rights under the 4th and 14th amendments. The Michigan trial court denied the motion on the ground that exigent circumstances justified the search. On interlocutory appeal, the Michigan Court of Appeals found that no exigent circumstances existed and reversed.

Held: The judgment is affirmed in part and reversed in part.

Justice Powell, joined by Justice Brennan, Justice White, and Justice Marshall, concluded that where reasonable expectations of privacy remain in fire-damaged premises, administrative searches into the cause and origin of a fire are subject to the warrant requirement of the fourth amendment absent consent or exigent circumstances.

MICHIGAN vs. CLIFFORD

Syllabus

There are especially strong expectations of privacy in a private residence and respondents here retained significant privacy interests in their fire-damaged home. Because the warrantless search of the basement and upper areas of respondents' home was authorized neither by consent nor exigent circumstances, the evidence seized in that search was obtained in violation of respondents' rights under the 4th and 14th amendments and must be suppressed. Pp. 4-11.

a) Where a warrant is necessary to search fire-damaged premises, an administrative warrant suffices if the primary object of the search is to determine the cause and origin of the fire, but a criminal search warrant, obtained upon a showing of probable cause, is required if the primary object of the search is to gather evidence of criminal activity. Pp. 4-7.

b) The search here was not a continuation of an earlier search, and the privacy interests in the residence made the delay between the fire and the midday search unreasonable absent a warrant, consent, or exigent circumstances. **Michigan vs. Tyler**, 436 U.S. 499, distinguished. Because the cause of the fire was known upon search of the basement, the search of the upper portions of the house could only have been a search to gather evidence of arson requiring a criminal warrant absent exigent circumstances. Even if the basement search had been a valid administrative search, it would not have justified the upstairs search, since as soon as it had been determined that the fire originated in the basement, the scope of the search was limited to the basement area. Pp. 8-11.

Justice Stevens concluded that the search of respondents' home was unreasonable in contravention of the fourth amendment because the investigators made no effort to provide fair advance notice of the inspection to respondents. A non-exigent, forceful, warrantless entry cannot be reasonable unless the investigator has made some effort to give the owner significant notice to be present while the investigation is made. Pp. 5-7.

Powell, J., announced the judgment of the Court, and delivered an opinion, in which Brennan, White, and Marshall, JJ., joined. Stevens, J., filed an opinion concurring in the judgment. Rehnquist, J., filed a dissenting opinion, in which Burger, C.J. and Blackmun and O'Connor, JJ., joined.

SECTION 2

SUPREME COURT OF THE UNITED STATES

No. 82-357

MICHIGAN, PETITIONER vs. RAYMOND CLIFFORD
and EMMA JEAN CLIFFORD

ON WRIT OF CERTIORARI TO THE COURT OF APPEALS
OF MICHIGAN

(January 11, 1984)

Justice Powell announced the judgment of the Court and delivered an opinion in which Justices Brennan, White, and Marshall joined.

This case presents questions as to the authority of arson investigators in the absence of exigent circumstances or consent, to enter a private residence without a warrant to investigate the cause of a recent fire.

I

Respondents Raymond and Emma Jean Clifford were arrested and charged with arson in connection with a fire at their private residence. At the preliminary examination held to establish probable cause for the alleged offense, the state introduced various pieces of physical evidence, most of which was obtained through a warrantless and non-consensual search of the Cliffords' fire-damaged home. Respondents moved to suppress this evidence on the ground that it was obtained in violation of their rights under the 4th and 14th amendments. That motion was denied and respondents were bound over for trial. Before trial, they again moved to suppress the evidence obtained during the search. The trial court conducted an evidentiary hearing and denied the motion on the ground that exigent circumstances justified the search. The court certified its evidentiary ruling for interlocutory appeal and the Michigan Court of Appeals reversed.

That court held that there were no exigent circumstances justifying the search. Instead, it found that the warrantless entry and search of the Clifford residence was conducted pursuant to a policy of the Arson Division of the Detroit Fire Department that sanctioned such searches as long as the owner was not present, the premises were open to trespass, and the search occurred within a reasonable time of the fire. The Court of Appeals held that this policy was inconsistent with **Michigan vs. Tyler**, 436 U.S. 499 (1978), and that the warrantless non-consensual search of the Cliffords' residence violated their rights under the 4th and 14th amendments. We granted certiorari to clarify doubt that appears to exist as to the application of our decision in **Tyler**.

II

In the early morning hours of October 18, 1980, a fire erupted at the Clifford home. The Cliffords were out of town on a camping trip at the time. The fire was reported to the Detroit Fire Department and fire units arrived on the scene at about 5:42 a.m. The fire was extinguished and all fire officials and police left the premises at 7:04 a.m.

At 8 a.m. on the morning of the fire, Lieutenant Beyer, a fire investigator with the arson section of the Detroit Fire Department, received instructions to investigate the Clifford fire. He was informed that the Fire Department suspected arson. Because he had other assignments, Lieutenant Beyer did not proceed immediately to the Clifford residence. He and his partner finally arrived at the scene of the fire about 1 p.m. on October 18.

When they arrived, they found a work crew on the scene. The crew was boarding up the house and pumping some six inches of water out of the basement. A neighbor told the investigators that he had called Clifford and had been instructed to request the Cliffords' insurance agent to send a boarding crew out to secure the house. The neighbor also advised that the Cliffords did not plan to return that day. While the investigators waited for the water to be pumped out, they found a Coleman fuel can in the driveway that was seized and marked as evidence.[1]

By 1:30 p.m., the water had been pumped out of the basement and Lieutenant Beyer and his partner, without obtaining consent or an administrative warrant, entered the Clifford residence and began their investigation into the cause of the fire. Their search began in the basement and they quickly confirmed that the fire had originated there beneath the basement stairway. They detected a strong odor of fuel throughout the basement, and found two more Coleman fuel cans beneath the stairway. As they dug through the debris, the investigators also found a crock pot with attached wires leading to an electrical timer that was plugged into an outlet a few feet away. The timer was set to turn on at approximately 3:45 a.m. and to turn back off at approximately 9 a.m. It had stopped somewhere between 4 and 4:30 a.m. All of this evidence was seized and marked.

After determining that the fire had originated in the basement, Lieutenant Beyer and his partner searched the remainder of the house. The warrantless search that followed was extensive and thorough. The investigators called in a photographer to take pictures throughout the house. They searched through drawers and closets and found them full of old clothes. They inspected the rooms and noted that there were nails on the walls but no pictures. They found wiring and cassettes for a video tape machine but no machine.

Respondents moved to exclude all exhibits and testimony based on the basement and upstairs searches on the ground that they were searches to gather evidence of arson, that they were conducted without a warrant, consent, or exigent circumstances, and that they therefore were per se unreasonable under the 4th and 14th amendments. Petitioner, on the other hand, argues that the entire search was reasonable and should be exempt from the warrant requirement.

III

In its petition for certiorari, the state does not challenge the state court's finding that there were no exigent circumstances justifying the search of the Clifford home. Instead, it asks us to exempt from the warrant requirement all administrative investigations into the cause and origin of a fire. We decline to do so.

In **Tyler**, we restated the Court's position that administrative searches generally require warrants. 436 U.S., at 504-508. See **Marshall vs. Barlow's, Inc.**, 436 U.S. 307 (1978); **Camara vs. Municipal Court**, 387 U.S. 523 (1967); **See vs. City of Seattle**, 387 U.S. 541 (1967). We reaffirm that view again today. Except in certain carefully defined classes of cases,[2] the non-consensual entry and search of property is governed by the warrant requirement of the 4th and 14th amendments. The constitutionality of warrantless and non-consensual entries onto fire-damaged premises, therefore, normally turns on several factors: whether there are legitimate privacy interests in the fire-damaged property that are protected by the fourth amendment; whether exigent circumstances justify the government intrusion regardless of any reasonable expectations of privacy; and, whether the object of the search is to determine the cause of the fire or to gather evidence of criminal activity.

We observed in **Tyler** that reasonable privacy expectations may remain in fire-damaged premises. "People may go on living in their homes or working in their offices after a fire. Even when that is impossible private effects often remain on the fire-damaged premises." **Tyler**, 436 U.S., at 505. Privacy expectations will vary with the type of property, the amount of fire damage, the prior and continued use of the premises, and in some cases the owner's efforts to secure it against intruders. Some fires may be so devastating that no reasonable privacy interests remain in the ash and ruins, regardless of the owner's subjective expectations. The test essentially is an objective one: whether "the expectation [is] one that society is prepared to recognize as 'reasonable.'" **Katz vs. United States**, 389 U.S. 347, 361(1967) (Harlan, J., concurring). See also **Smith vs. Maryland**, 442 U.S. 735, 739-741 (1979). If reasonable privacy interests remain in the fire-damaged property, the warrant requirement applies, and any official entry must be made pursuant to a warrant in the absence of consent or exigent circumstances.

B

A burning building of course creates an exigency that justifies a warrantless entry by fire officials to fight the blaze. Moreover, in **Tyler** we held that once in the building, officials need no warrant to remain for "a reasonable time to investigate the cause of the blaze after it has been extinguished." 436 U.S., at 510. Where, however, reasonable expectations **of privacy** remain in the fire-damaged property, additional investigations begun after the fire has been extinguished and fire and police officials have left the scene, generally must be made pursuant to a warrant or the identification of some new exigency.

The aftermath of a fire often presents exigencies that will not tolerate the delay necessary to obtain a warrant or to secure the owner's consent to inspect fire-damaged premises.[4] Because

determining the cause and origin of a fire serves a compelling public interest, the warrant requirement does not apply in such cases.

C

If a warrant is necessary, the object of the search determines the type of warrant required. If the primary object is to determine the cause and origin of a recent fire, an administrative warrant will suffice.[5] To obtain such a warrant, fire officials need show only that a fire of undetermined origin has occurred on the premises, that the scope of the proposed search is reasonable and will not intrude unnecessarily on the fire victim's privacy, and that the search will be executed at a reasonable and convenient time. If the primary object of the search is to gather evidence of criminal activity, a criminal search warrant may be obtained only on a showing of probable cause to believe that relevant evidence will be found in the place to be searched. If evidence of criminal activity is discovered during the course of a valid administrative search, it may be seized under the "plain view" doctrine. **Coolidge vs. New Hampshire**, 403 U.S. 443, 465-466 (1971). This evidence then may be used to establish probable cause to obtain a criminal search warrant. Fire officials may not, however, rely on this evidence to expand the scope of their administrative search without first making a successful showing of probable cause to an independent judicial officer.

The object of the search is important even if exigent circumstances exist. Circumstances that justify a warrantless search for the cause of a fire may not justify a search to gather evidence of criminal activity once that cause has been determined. If, for example, the administrative search is justified by the immediate need to ensure against rekindling, the scope of the search may be no broader than reasonably necessary to achieve its end. A search to gather evidence of criminal activity not in plain view must be made pursuant to a criminal warrant upon a traditional showing of probable cause.[6]

The searches of the Clifford home, at least arguably, can be viewed as two separate ones: the delayed search of the basement area, followed by the extensive search of the residential portion of the house. We now apply the principles outlined above to each of these searches.

IV

The Clifford home was a two-and-one-half story brick and frame residence. Although there was extensive damage to the lower interior structure, the exterior of the house and some of the upstairs rooms were largely undamaged by the fire, although there was some smoke damage. The firefighters had broken out one of the doors and most of the windows in fighting the blaze. At the time Lieutenant Beyer and his partner arrived, the home was uninhabitable. But personal belongings remained, and the Cliffords had arranged to have the house secured against intrusion in their absence. Under these circumstances, and in light of the strong expectations of privacy associated with a home, we hold that the Cliffords retained reasonable privacy interests in their fire-damaged residence and that the post-fire investigations were subject to the warrant requirement. Thus, the warrantless and non-consensual searches of both the basement and the

upstairs areas of the house would have been valid only if exigent circumstances had justified the object and the scope of each.

A

As noted, the state does not claim that exigent circumstances justified its post-fire searches. It argues that we either should exempt post-fire searches from the warrant requirement or modify **Tyler** to justify the warrantless searches in this case. We have rejected the state's first argument and turn now to its second.

In **Tyler** we upheld a warrantless post-fire search of a furniture store, despite the absence of exigent circumstances, on the ground that it was a continuation of a valid search begun immediately after the fire. The investigation was begun as the last flames were being doused, but could not be completed because of smoke and darkness. The search was resumed promptly after the smoke cleared and daylight dawned. Because the post-fire search was interrupted for reasons that were evident, we held that the early morning search was "no more than an actual continuation of the first, and the lack of a warrant thus did not invalidate the resulting seizure of evidence." 436 U.S., at 511.

As the State conceded at oral argument, this case is distinguishable for several reasons. First, the challenged search was not a continuation of an earlier search. Between the time the firefighters had extinguished the blaze and left the scene and the arson investigators first arrived about 1 p.m. to begin their investigation, the Cliffords had taken steps to secure the privacy interests that remained in their residence against further intrusion. These efforts separate the entry made to extinguish the blaze from that made later by different officers to investigate its origin. Second, the privacy interests in the residence--particularly after the Cliffords had acted--were significantly greater than those in the fire-damaged furniture store, making the delay between the fire and the mid-day search unreasonable absent a warrant, consent, or exigent circumstances. We frequently have noted that privacy interests are especially strong in a private residence.[7] These facts--the interim efforts to secure the burned-out premises and the heightened privacy interests in the home--distinguish this case from **Tyler**. At least where a homeowner has made a reasonable effort to secure his fire-damaged home after the blaze has been extinguished and the fire and police units have left the scene, we hold that a subsequent post-fire search must be conducted pursuant to a warrant, consent, or the identification of some new exigency.[8] So long as the primary purpose is to ascertain the cause of the fire, an administrative warrant will suffice.

Because the cause of the fire was then known, the search of the upper portions of the house, described above, could only have been a search to gather evidence of the crime of arson. Absent exigent circumstances, such a search requires a criminal warrant.

Even if the mid-day basement search had been a valid administrative search, it would not have justified the upstairs search. The scope of such a search is limited to that reasonably necessary to determine the cause and origin of a fire and to ensure against rekindling. As soon as the investigators determined that the fire had originated in the basement and had been caused by the crock pot and timer found beneath the basement stairs, the scope of their search was limited to the basement area. Although the investigators could have used whatever evidence they

discovered in the basement to establish probable cause to search the remainder of the house, they could not lawfully undertake that search without a prior judicial determination that a successful showing of probable cause had been made. Because there were no exigent circumstances justifying the upstairs search, and it was undertaken without a prior showing of probable cause before an independent judicial officer, we hold that this search of a home was unreasonable under the 4th and 14th amendments, regardless of the validity of the basement search.[9]

The warrantless intrusion into the upstairs regions of the Clifford house presents a telling illustration of the importance of prior judicial review of proposed administrative searches. If an administrative warrant had been obtained in this case, it presumably would have limited the scope of the proposed investigation and would have prevented the warrantless intrusion into the upper rooms of the Clifford home. An administrative search into the cause of a recent fire does not give fire officials license to roam freely through the fire victim's private residence.

V

The only pieces of physical evidence that have been challenged on this interlocutory appeal are the three empty fuel cans, the electric crock pot, and the timer and attached cord. Respondents also have challenged the testimony of the investigators concerning the warrantless search of both the basement and the upstairs portions of the Clifford home. The discovery of two of the fuel cans, the crock pot, the timer and cord--as well as the investigators' related testimony--were the product of the unconstitutional post-fire search of the Cliffords' residence. Thus, we affirm that portion of the judgment of the Michigan Court of Appeals that excluded that evidence. One of the fuel cans was discovered in plain view in the Cliffords' driveway. This can was seen in plain view during the initial investigation by the firefighters. It would have been admissible whether it had been seized in the basement by the firefighters or in the driveway by the arson investigators. Exclusion of this evidence should be reversed.

It Is So Ordered.

FOOTNOTES

[1]The can had been found in the basement by the fire officials who had fought the blaze. The firefighters removed the can and put it by the side door where Lieutenant Beyer discovered it on his arrival.

[2]See e.g. **Donovon vs. Dewey**, 452 U.S. 594 (1981) (heavily regulated business); **United States**, 406 U.S. 311 (1972) (same); **Colonnade vs. United States**, 397 U.S. 72 (1970) (same). The exceptions to the warrant requirement recognized in these cases are not applicable to the warrantless search in this case.

[3]We do not suggest that firemen fighting a fire normally remain within a building. The circumstances, of course, vary. In many situations actual entry may be too hazardous until the fire has been wholly extinguished, and even then the danger of collapsing walls may exist. Thus, the effort to ascertain the cause of a fire may extend over a period of time with entry and re-entry. The critical inquiry is whether reasonable expectations of privacy exist in the fire-damaged premises at a particular time, and if so, whether exigencies justify the re-entries.

[4]For example, an immediate threat that the blaze might rekindle presents an exigency that would justify a warrantless and non-consensual post-fire investigation. "Immediate investigation may also be necessary to preserve evidence from intentional or accidental destruction." See **Tyler**, 436 U.S., at 510.

[5]Probable cause to issue an administrative warrant exists if reasonable legislative, administrative, or judicially prescribed standards for conducting an inspection are satisfied with respect to a particular dwelling. See particularly **Tyler**, 436 U.S., see also **Camara vs. Municipal Court**, 387 U.S., at 538.

[6]The plain view doctrine must be applied in light of the special circumstances that frequently accompany fire damage. In searching solely to ascertain the cause, firemen customarily must remove rubble or search other areas where the causes of fires are likely to be found. An object that comes into view during such a search may be preserved without a warrant.

[7]See e.g. **Payton vs. New York**, 445 U.S. 537, 589-90 (1980); **United States vs. United States District Court**, 407 U.S. 297, 313 (1972). Reasonable expectations of privacy in fire-damaged premises will vary depending particularly on the type and use of the building involved. Expectations of privacy are particularly strong in private residences and offices. There may be, depending upon the circumstances, diminished privacy expectations in commercial premises.

[8]This is not to suggest that individual expectations of privacy may prevail over interests of public safety. For example, when fire breaks out in an apartment unit of an apartment complex, the exigency exception may allow warrantless post-fire investigations where necessary to ensure against an immediate danger of future fire hazard.

[9]In many cases, there will be no bright line separating the firefighters' investigation into the cause of a fire from a search for evidence of arson. The distinction will vary with the circumstances of the particular fire and generally will involve more than the lapse of time or the number of entries and re-entries. For example, once the cause of a fire in a single-family dwelling is determined, the administrative search should end and any broader investigation should be made pursuant to a criminal warrant. A fire in an apartment, on the other hand, may present complexities that make it necessary for officials to conduct more expansive searches, to remain on the premises for longer periods of time, and to make repeated entries and re-entries into the building. See **Tyler**, 436 U.S., at 510, n.6.

SECTION 3

SUPREME COURT OF THE UNITED STATES

No. 82-357

MICHIGAN, PETITIONER vs. RAYMOND CLIFFORD
and EMMA JEAN CLIFFORD

ON WRIT OF CERTIORARI TO THE COURT OF APPEALS
OF MICHIGAN

(January 11, 1984)

JUSTICE STEVENS, concurring in the judgment.

Because I continue to hold the views expressed in my separate opinions in **Michigan vs. Tyler**, 436 U.S. 499, 512 (1978), **Marshall vs. Barlow's, Inc.**, 436 U.S. 307, 325 (1978), **Zurcher vs. Stanford Daily**, 436 U.S. 547, 577-578, 583 (1978), and **Donovan vs. Dewey**, 452 U.S. 594, 606-608 (1981), I am unable to join JUSTICE POWELL'S opinion. I do agree with him, however, that the holding in **Tyler** supports the judgment commanded by his opinion.

There is unanimity within the Court on three general propositions regarding the scope of fourth amendment protection afforded to the owner of a fire-damaged building. No one questions the right of the firefighters to make a forceful, unannounced, non-consensual, warrantless entry into a burning building. The reasonableness of such an entry is too plain to require explanation. Nor is there any disagreement concerning the firefighters' right to remain on the premises, not only until the fire has been extinguished and they are satisfied that there is no danger of rekindling, but also while they continue to investigate the cause of the fire. We are also unanimous in our opinion that after investigators have determined the cause of the fire and located the place it originated, a search of other portions of the premises may be conducted only pursuant to a warrant, issued upon probable cause that a crime has been committed, and specifically describing the places to be searched and the items to be seized. The issues that divide us in this case are (1) whether the entry by Lieutenant Beyer and his partner at 1:30 p.m. should be regarded as a continuation of the original entry or a separate post-fire search, and (2) whether a warrantless entry to make a post-fire investigation into the cause of a fire without the owner's consent is constitutional.

I

I agree with JUSTICE POWELL'S conclusion that Lieutenant Beyer's entry at 1:30 p.m. was a post-fire search rather than merely a continuation of an earlier valid entry, **ante**, at 8-9, and disagree with JUSTICE REHNQUIST'S position that our decision in **Tyler** is indistinguishable

in this regard, **post**, at 2-3. In **Tyler** the Court was willing to treat early morning reentries by the same officers who had been on the premises a few hours earlier as a "continuation" of their earlier valid investigation into the cause of the fire. 436 U.S., at 511. The attempt to ascertain the cause of the fire was temporarily suspended in **Tyler** because visibility was severely hindered by darkness, steam, and smoke. Under these circumstances, the return of the same investigators shortly after daybreak to ascertain the cause of the fire was indeed "no more than an actual continuation" of their earlier valid search. Ibid. Unlike **Tyler**, in this case the challenged entry was made by officers who had not been on the premises at the time of an earlier valid search. Moreover, in contrast to **Tyler**, an investigation of the fire's origin was not temporarily suspended on account of the conditions at the scene and resumed at the first opportunity when the conditions hampering the investigation subsided. While the investigators in this case waited for the work crew on the scene to pump water out of the basement before making their entry, the delay in their arrival at the scene apparently had nothing to do with the fact that water had collected in the basement. While that fact might have justified a temporary suspension of an investigative effort commenced by investigators at the scene before the premises were abandoned by fire officials, in this case it amounts to a **post hoc** justification without apparent basis in reality. In general, unless at least some of the same personnel are involved in a return to the premises and the temporary departure was justifiably and actually occasioned by the conditions at the premises, I would apply the test expressed by JUSTICE WHITE for measuring the scope of the emergency that justified the initial entry and search: "Once the fire has been extinguished and the firemen have left the premises, the emergency is over." 436 U.S., at 516. I would only add that the departure of the firemen should also establish a presumption that the fire has been extinguished and that any danger of rekindling is thereafter too slight to provide an independent justification for a second entry, a presumption that could only be rebutted by additional information demonstrating a previously unknown or unrecognized danger of rekindling.

II

Presumably most post-fire searches are made with the consent of the property owner. Once consent is established, such searches, of course, raise no fourth amendment issues. We therefore are concerned with the fire investigator's right to make an entry without the owner's consent, by force if necessary. The problem, then, is to identify the constraints imposed by the fourth amendment on an officer's authority to make such an entry.

In this context, the amendment might be construed in at least four different ways. First, the Court might hold that no warrantless search of premises in the aftermath of a fire is reasonable and that no warrant may issue unless supported by probable cause that a crime has been committed. Such a holding could be supported by reference to the text of the two clauses of the Fourth Amendment.[3] No member of the Court, however, places such a strict construction on the amendment.

Second, the Court might hold that no warrantless search is reasonable but allow post-fire searches conducted pursuant to a warrant issued without a showing of probable cause. Following **Marshall vs. Barlow's Inc., supra**, JUSTICE POWELL takes this position. In my judgment that position is at odds with the text of the Fourth Amendment and defeats the purpose

of the Warrant Clause, enabling a magistrate's rubber stamp to make an otherwise unreasonable search reasonable.

Third, the Court might hold that no warrant is ever required for a post-fire search. If the search is conducted promptly and if its scope is limited to a determination of the cause of the fire, it is reasonable with or without probable cause to suspect arson. JUSTICE REHNQUIST has persuasively outlined the basis for that position,[4] and has noted that in certain cases there may be some justification for requiring the inspectors to notify the building's owners of the inspection. **Post**, at 6, n.4.

A fourth position--the one I believe the two clauses of the fourth amendment command--would require the fire investigator to obtain a traditional criminal search warrant in order to make an unannounced entry, but would characterize a warrantless entry as reasonable whenever the inspector had either given the owner sufficient advance notice to enable him or an agent to be present, or had made a reasonable effort to do so.[5]

Unless fire investigators have probable cause to believe the crime of arson has been committed, I believe that the home owner is entitled to reasonable advance notice that officers are going to enter his premises for the purpose of ascertaining the cause of the fire. Such notice would give the owner a fair opportunity to be present while the investigation is conducted, virtually eliminating the need for a potentially confrontational forcible entry. Advance notice of the search is the best safeguard of the owner's legitimate interests in the privacy of his premises, allowing him to place certain possessions he would legitimately prefer strangers not to see out of sight, and permitting him to be present during the search to assure that it does not exceed reasonable bounds. Moreover, the risk of unexplained harm or loss to the owner's personal effects would be minimized and the owner would have an opportunity to respond to questions about the premises or to volunteer relevant information that might assist the investigators. It is true, of course, that advance notice would increase somewhat the likelihood that a guilty owner would conceal or destroy relevant evidence, but it seems fair to assume that the criminal will diligently attempt to cover his traces in all events. In any event, if probable cause to believe that the owner committed arson is lacking, and if the justifications for a general policy of unannounced spot inspections that obtain in some regulatory contexts are also lacking, a mere suspicion that an individual has engaged in criminal activity is insufficient to justify the intrusion on an individual's privacy that an unannounced, potentially forceful entry entails.

Since there was no attempt to give any kind of notice to respondent, this case does not provide a proper occasion for defining the character of the notice that must be given. I am convinced, however, that a non-exigent, forceful, warrantless entry cannot be reasonable unless the investigator has made some effort to give the owner sufficient notice to be present while the investigation is made. Naturally, if the owner is given reasonable notice and then attempts to interfere with the legitimate performance of the fire investigators' duties, appropriate sanctions would be permissible.

If there is probable cause to believe that a crime has been committed, the issuance of a valid warrant by a neutral magistrate will enable the entry and subsequent search to be conducted in the same manner as any other investigation of suspected criminal conduct, without advance

notice to the property owner. In such a case, the intrusive nature of the potentially forceful entry without prior notice is justified by the demonstrated reasonable likelihood that the owner of the property will conceal or destroy the object of the search if prior notice is provided. **Zurcher vs. Stanford Daily**, 436 U.S., at 582 (STEVENS, J., dissenting).

In this case, as JUSTICE REHNQUIST has pointed out, **post**, at 6, n.3, an argument may be made that the notice requirement is inapplicable because the owners were out of town. But no attempt whatever was made to provide them with notice, or even to prove that it would have been futile to do so. The record does not foreclose the possibility that an effort to advise them, possibly through the same party that notified the representatives of the insurance company to board up the building, might well have resulted in a request that a friend or neighbor be present in the house while the search was carried out and thus might have avoided the plainly improper search of the entire premises after the cause of the fire had already been identified.

I therefore conclude that the search in this case was unreasonable in contravention of the fourth amendment because the investigators made no effort to provide fair notice of the inspection to the owners of the premises. Accordingly, I concur in the Court's judgment.

FOOTNOTES

[1]Fire Chief See entered with Assistant Chief Sommerville at 8 a.m. and Detective Webb accompanied Sommerville at 9 a.m. See had been on the scene at 2 a.m. and Webb had arrived at 3:30 a.m. See 436 U.S., at 501-502.

[2]It is true that in **Tyler**, Assistant Chief Sommerville first arrived on the scene at 8 a.m., but presumably he did not observe anything that was not also seen by Chief See or Detective Webb, both of whom had been on the scene earlier.

[3]As I noted in **Marshall vs. Barlow's, Inc., supra**, "The first Clause states that the right to be free from unreasonable searches shall not be violated"; 1/ the second unequivocally prohibits the issuance of warrants except 'upon probable cause.' 2/"' 436 U.S., at 326.

"1/ 'The right of the people to be secure in their persons, houses, papers, and effects, against unreasonable searches and seizures, shall not be violated….'

"2/ 'And no Warrants shall issue, but upon probable cause, supported by Oath of affirmation, and particularly describing the place to be searched, and the persons or things to be seized.'" 436 U.S., at 326.

[4]To the extent, however, that he relies on the danger of rekindling I believe his analysis is flawed. I would suppose that JUSTICE POWELL would also dispense with a warrant requirement if that danger were present. Surely I would. For analytical purposes I believe we must assume that the post-fire investigation cannot be supported on an emergency rationale but rather is justified by the general regulatory interest in preventing similar fires, including those set by arsonists.

[5]By prohibiting the issuance of any warrant to make an unannounced, non-consensual entry into the home, unless there is probable cause to believe a crime has been committed, my reading of the Fourth Amendment carries out the express purpose of the Warrant Clause. JUSTICE POWELL'S view that a so-called administrative warrant will suffice does not, I submit, provide the protection contemplated by that clause. On the other hand, because I am persuaded that a post-fire investigatory search is reasonable--even without either suspicion or probable cause--when advance notice is given to the home owner, the purpose of the Reasonableness Clause can be satisfied without obtaining an administrative warrant that is nothing more than a rubber stamp.

SECTION 4

SUPREME COURT OF THE UNITED STATES

No. 82-357

MICHIGAN, PETITIONER vs. RAYMOND CLIFFORD
and EMMA JEAN CLIFFORD

ON WRIT OF CERTIORARI TO THE COURT OF APPEALS
OF MICHIGAN

(January 11, 1984)

JUSTICE REHNQUIST, with whom THE CHIEF JUSTICE, JUSTICE BLACKMUN, and JUSTICE O'CONNOR join, dissenting.

Six terms ago in **Michigan vs. Tyler**, 436 U.S. 499 (1978), we first addressed the applicability of the fourth amendment's Warrant Clause to the activities of firefighters and inspectors following a fire at a warehouse. A divided Court held that the fire itself was an "exigent circumstance" which allowed entry to extinguish the fire and authorized investigators to remain for a reasonable time to investigate the cause of the blaze. Id., at 509-510. We also held that a "re-entry" a few hours after these officials had departed was an "actual continuation" of the earlier investigation, but that subsequent visits more than three weeks after the fire required an administrative warrant. Id., at 511. These precepts of **Tyler** have not proved easy to apply, and we are told in the Court's opinion in this case that "we granted certiorari to clarify doubt that appears to exist as to the application of our decision in **Tyler**." Ante, at 2. But that same opinion demonstrates beyond peradventure that if that was our purpose, we have totally failed to accomplish it: today's opinion, far from clarifying the doubtful aspects of **Tyler**, sows confusion broadside. I would hold that the "exigent circumstances" doctrine enunciated in **Tyler** authorized the search of the basement of the Clifford home, although the remaining parts of the house could not have been searched without the issuance of a warrant issued upon probable cause.

I

Judging simply by comparison of these facts to those in **Tyler**, I believe that the basement inspection conducted by Lt. Beyer about 1:30 p.m. on October 18th--some six hours after the fire was extinguished and the fire officials and police had left the Clifford premises--was an "actual continuation" of the original entry to fight the fire, as that term is used in **Tyler**. The firefighters who fought the blaze at the Clifford house had removed a can containing Coleman lantern fuel and placed it in the driveway of the home, where it was later seized and marked as evidence by the inspectors who arrived about 1 p.m. Thus here, as in **Tyler**, the investigation into the cause of the fire went on contemporaneously with the efforts to fight it before the firefighters first left

the premises in the early morning. I see no reason to treat the six-hour delay between the departure of the firefighters and the arrival of the investigators in this case any differently than the Court treated the five-hour delay between the departure of the investigators at 4 a.m. from the Tyler warehouse and their return to the same premises at 9 a.m.

The Court seeks to distinguish the two situations on the basis of differences which seem to me both trivial and immaterial. It says that in that interim in our case, the Cliffords "had taken steps to secure their privacy interests that remained in their residence against further intrusion." Ante, at 8. While this may go to the question of whether or not there was an invasion of a privacy interest amounting to a search, it has no bearing on the question of whether there were exigent circumstances which constitute an exception to the warrant requirement for what is concededly a search. The Court also intimates that the "firefighters" did nothing but fight the fire, and that the arson investigation did not begin until the arson investigators arrived at 1 in the afternoon. Ante, at 8-9. But firefighting and fire investigation are obviously not this neatly compartmentalized, as is shown by the fact that the firefighters themselves were alert to signs of the cause of the fire and had removed the Coleman lantern fuel can for inspection by the later team of arson investigators.

The Court also purports to distinguish the facts in **Tyler** about the statement that "the privacy interests in the residence--particularly after the Cliffords had acted--were significantly greater than those in the fire-damaged furniture store…." Ante, at 9. But if the furniture store in **Tyler** is to be characterized as "fire damaged," surely the Cliffords' residence deserves the same characterization; it too was "fire-damaged." It is also well established that private commercial buildings in this context are as much protected by the Fourth Amendment as are private dwellings. See **See vs. City of Seattle**, 387 U.S. 541, 542-543 (1967) (citing cases). And certainly the public interest in determining the cause and origin of a fire in a commercial establishment applies with equal, if not greater, force to the necessity of determining the cause and origin of a fire in a home.

On the authority of **Tyler**, therefore, I would uphold the search of the Clifford basement and allow use of the evidence resulting from that search in the arson trial.

II

In **Camara vs. Municipal Court**, 387 U.S. 523 (1967), and **See vs. City of Seattle**, 387 U.S. 541 (1967), this Court imposed a warrant requirement on city housing and fire inspectors requiring them to obtain an administrative search warrant prior to entering a building to inspect for possible health or fire code violations. To protect the privacy interests of building owners from the unbridled discretion of municipal inspectors, the Court held that administrative searches had to be conducted pursuant to a warrant obtained from an independent magistrate. **Camara**, 387 U.S., at 534. But in light of the important public interest in abating public health hazards, the relatively limited invasion of privacy inhering in administrative searches, and the essentially non-criminal focus of the inspection, a different kind of warrant was established, a warrant described by the dissenters in that case as "newfangled." See, 387 U.S., at 547 (Clark, J., dissenting). Probable cause to issue this kind of warrant did not sound in terms of suspicion of criminal activity, but in terms of reasonable legislative or administrative standards governing the decision to search a particular building. Id., at 538.

One may concede the correctness of the **Camara-See** line of cases without agreeing that those cases should be applied to a prompt post-fire inspection conducted to determine the cause and origin of a fire. The practice of investigating the cause and origin of fires has long-standing and widespread acceptance. The public interest in conducting a prompt and careful investigation of the cause and origin of all fires is also undeniably strong. An investigation can reveal whether there is a danger of the fire rekindling and assess the effectiveness of local building codes in preventing and limiting the spread of fire. It may bring to light facts suggesting the crime of arson. Entry is also necessary because the causes of a fire may also not be observable from outside a building or by an uninformed occupant. See **United States vs. Green**, 474 F. 2d 1385, 1388-89 (CA5 1973). Certainly these reasons justify a search to determine the cause and origin of a fire.

The concerns regarding administrative searches expressed in **Camara** and **See** to justify the imposition of a warrant requirement simply do not apply to a post-fire investigation conducted within a reasonable time of a fire.[1] Under the emergency doctrine, it is beyond dispute that firefighters may enter a building in order to extinguish the flames. **Michigan vs. Tyler**, 436 U.S. 499, 509 (1976). In their efforts to control the blaze firefighters may knock in doors and windows, chop holes in roofs and walls, and generally take full control of a structure to extinguish a fire. In the aftermath of a fire, an individual is unlikely to have much concern over the limited intrusion of a fire inspector coming into his premises to learn why there had been a fire. Fire victims, unlike occupants at ordinary times, generally expect and welcome the intrusions of fire, police, and medical officials in the period following a fire. Likewise, as here, relative strangers such as insurance agents will frequently have authority to enter the structure. In these circumstances the intrusion of the fire inspector is hardly a new or substantially different intrusion from that which occurred when the firefighters first arrived to extinguish the flames. Instead, it is analogous to intrusions of medical officials and insurance investigators who may arrive at the scene of the fire shortly after its origin.

Ample justification exists for a state or municipality to authorize a fire inspection program that would permit fire inspectors to enter premises to determine the cause and origin of the fire. But in no real sense can the investigation of the Cliffords' home be considered the result of the unbridled discretion of the city fire investigators who came to the Cliffords' home.[2] No justification existed to inspect the Cliffords' home until there was a fire. The fire investigators were not authorized to enter the Cliffords' home until the happening of some fortuitous or exigent event over which they had no control. Thus, if the warrant requirement exists to prevent individuals from being subjected to an unfettered power of government officials to initiate a search, a warrant is simply not required in these circumstances to limit the authority of a fire investigator, so long as his authority to inspect is contingent upon the happening of an event over which he has no control.[3]

In my view, the utility of requiring a magistrate to evaluate the grounds for a search following a fire is so limited that the incidental protection of an individual's privacy interests simply does not justify imposing a warrant requirement. Here the inspection was conducted within a short time of extinguishing of the flames, while the owners were away from the premises, and before the premises had been fully secured from trespass. In these circumstances the search of the basement to determine the cause and origin of the fire was reasonable.

FOOTNOTES

[1]What constitutes a reasonable time would have been determined on a case-by-case basis. Fire investigators may have more than one fire to investigate on any given day. In addition, fire investigators are entitled to wait until the embers and gases of the fire have cooled, or as here, until the water pumped into the structure by the firefighters is pumped out.

[2]This is made abundantly clear by the Detroit Fire Department's policy regulating post-fire investigations. That policy encourages investigators to conduct an investigation as promptly as possible. If the property is occupied or is a place of business trying to conduct business, inspectors are instructed to obtain consent or an administrative warrant. If the premises are occupied by children, inspectors must obtain consent from an adult before entry. To inspect premises secured from trespass, investigators must obtain consent or an administrative warrant. Only if the owners are away and the building open to trespass may fire investigators enter without consent or a warrant. Joint Appendix, at 9a, 12a, 19a, (testimony of Lt. Beyer and Capt. Monroe).

[3]The **Tyler** majority stated that a major junction of the warrant requirement was to provide a property owner with sufficient information to reassure him of the legality of the entry. **Michigan vs. Tyler**, 436 U.S. 499, 508 (1976). The relationship of this informational function and the privacy interest protected by the Fourth Amendment is not clear. Proper identification or some attempt at notifying the owners could allay any reasonable fears that the inspectors are impostors or lack authority to inspect for the origin and cause of the fire.

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UNIT 12:
FIRE CAUSE DETERMINATION

TERMINAL OBJECTIVE

The students will be able to assess a fire scene, given a fire scenario, and apply proper investigative techniques and procedures in determining the origin and cause of a fire.

ENABLING OBJECTIVES

The students will be able to:

1. *Determine the area or point of origin and the cause of a fire when given fire scenarios.*

2. *Defend the conclusions reached regarding the fire origin and cause determination when given fire scenarios.*

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UNIT 12: FIRE CAUSE DETERMINATION

Slide 12-1

ENABLING OBJECTIVES

- Determine the area or point of origin and the cause of a fire when given fire scenarios.
- Defend the conclusions reached regarding the fire origin and cause determination when given fire scenarios.

Slide 12-2

FIRE CAUSE DETERMINATION

- Often it is the responsibility of the fire officer to determine the cause of all fires to which they respond.
- Knowing the process of fire origin and cause determination will help them to make more accurate decisions on the circumstances of the fire.

Slide 12-3

I. FIRE CAUSE DETERMINATION

A. Often it is the responsibility of the fire officer to determine the cause of all fires to which they respond.

B. Knowing the process of fire origin and cause determination will help them to make more accurate decisions on the circumstances of the fire.

FIRE CAUSE DETERMINATION (cont'd)

- Key fire investigation aspects.
  - Fire officer observations.
    - -- Information gathered en route and during all on-scene operations.
  - Collection and documentation of information.
    - -- Data obtained from all sources at the scene and documented that is necessary to file an incident report.

Slide 12-4

C. Key fire investigation aspects.

1. Fire officer observations.

   a. En route to the incident.

   b. Upon arrival.

   c. During size-up.

   d. During suppression.

   e. During overhaul.

2. Collection and documentation of information.

   a. About the owner or occupant.

   b. About the building.

   c. About the fire.

   d. From witnesses.

FIRE CAUSE DETERMINATION (cont'd)

- Key fire investigation aspects (cont'd).
  - Behavior of fire.
    - -- Understanding of basic scientific principles related to fire ignition, growth and spread.
  - Securing the fire scene.
    - -- Procedures necessary to prevent unauthorized access and loss or contamination of evidence.
  - Determination of area of fire origin.
    - -- Methodology required to successfully determine fire origin and cause.

Slide 12-5

3. Behavior of fire.
   a. Did fire behave normally for the materials or area involved?
   b. What was different about this fire?
4. Securing the fire scene.
   a. From entry.
   b. Determination about safety.
   c. Dealing with the owner or occupant.
   d. Calling for an investigator.
5. Determination of area of fire origin.
   a. Understanding and evaluating "V" patterns.
   b. Interpreting heat patterns.
   c. Determining the path of fire travel.

FIRE CAUSE DETERMINATION (cont'd)

- Key fire investigation aspects (cont'd).
  - Accidental fire causes.
    - -- Understanding the most common causes of accidental fires.
  - Incendiary fire causes and devices.
    - -- Understanding the most common causes of incendiary fires and devices that may be used.
  - Motivation of the firesetter.
    - -- Knowledge of the six basic types of motives associated with firesetting behavior.

Slide 12-6

6. Accidental fire causes.
   a. Accidental fire causes found at the area or point of origin.
   b. Evaluating other factors to conclude fire cause was accidental.
7. Incendiary fire causes and devices.
   a. Incendiary fire causes found at the area or point of origin.
   b. Absence of any accidental fire cause at the area or point of origin.
8. Motivation of the firesetter.
   a. Evaluation of motives.
   b. Matching fire scene observations with possible motives.

FIRE CAUSE DETERMINATION (cont'd)

- Key fire investigation aspects (cont'd).
  - Vehicle fires.
    - -- Understanding of the most common causes of vehicle fires and the recommended procedures for fire cause determination.
  - Fatal fires.
    - -- Understanding of the procedures required to properly secure and document a fatal fire scene.

Slide 12-7

9. Vehicle fires.

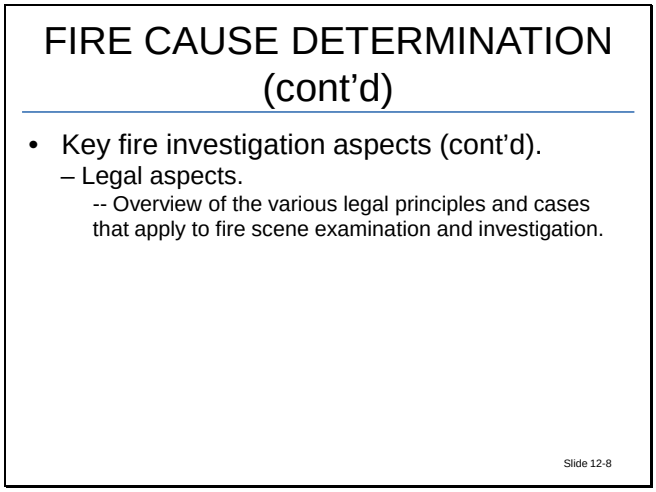
   a. Evaluating the extent of vehicle damage to determine origin and cause.

   b. Evaluating the compartmentation of fire in vehicles for deliberate fire spread.

10. Fatal fires.

   a. Need to document nature of fire.

   b. Scene security and evaluation for fire cause and activity of victim(s) prior to the fire.



11. Legal aspects.

   a. Constitutional laws and applicable court cases to fire scene investigation.

   b. Fire officer, investigator and prosecutor cooperation.

   c. Courtroom demeanor and testimony.

II. APPLICATION OF FIRE INVESTIGATION SKILLS

A. Application of skills.

1. They should help you to arrive at a conclusion about the circumstances of the fire.

   a. Accidental cause, no further action involved.

b. Accidental cause, follow-up required.

- Juvenile involvement needs follow-up.
- Appliance failure needs follow-up.

2. If you cannot reach a conclusion based upon the evidence found, you need an investigator.

3. Incendiary fires require an investigator.

B. Prepare report of fire response.

C. Prepare fire origin and cause determination report.

1. Write a report based on the findings, regardless of the outcome.

2. Write notes about the incident.

a. In case you are put on a witness stand 5 years later and are asked details about the fire.

b. In most cases, personal notes will not be admitted as evidence.

c. You will be allowed to consult them while on the stand.

3. The official report, plus other reports prepared by fire investigators, will be entered as official evidence.

a. They may become the proof that a fire did occur, and that all accidental fire causes were eliminated.

b. This information may lead investigators to conclude that the fire was caused intentionally.

ACTIVITY 12.1
Fire Scene Examination

Slide 12-9

SCENE 1
Residential Structure Fire

Slide 12-10

Slide 12-11

Slide 12-12

Slide 12-13

Slide 12-14

SCENE 2
Multifamily Dwelling Fire

Slide 12-15

Slide 12-16

Slide 12-17

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Slide 12-19

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SCENE 3
Residential Structure Fire

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Slide 12-26

SCENE 4
Residential Structure Fire

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Slide 12-30

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Slide 12-34

Slide 12-35

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ACTIVITY 12.1

Fire Scene Examination

Purpose

To assess a fire scene and apply proper investigative techniques and procedures in determining the origin and cause of a fire.

Directions

1. You will be divided into small groups and are to select a representative.
2. You will be given four scenarios and will read the brief written description of each one.
3. You will see a series of slides (photographs) related to each scenario.
4. You have 30 minutes to answer the questions accompanying each scenario and determine the area of fire origin and fire cause where required.
5. Report your findings and provide reasons for your conclusions.

Scenario 1: Residential Structure Fire

At 1000 hours, fire department units were on scene of a dwelling fire at 1900 W. 8th Street. The structure is approximately 25 feet by 50 feet. The building is a two-story, wood-frame structure. The weather conditions are dry and cool.

Slide 12-11 (Photo 1)

This picture is of side A showing exterior fire/burn damage in the upper quadrant.

Question

What would some of your initial actions be after fire suppression?

_____

_____

_____

Slide 12-12 (Photo 2)

This picture is of side A/B corner showing exterior fire/burn damage to the attic area under the roof line.

Questions

What do you notice in terms of fire/damage patterns to the upper floors of the structure?

What is the significance of the debris pile located directly below the area of fire damage?

Slide 12-13 (Photo 3)

This is a picture of a space heater located in the bedroom where the fire originated.

Question

In conducting the investigation of the scene, what would your actions be with respect to documenting and evaluating this item as a potential fire cause?

Slide 12-14 (Photo 4)

This is a close up photo of the space heater located in the suspected area of origin.

Question

How would you determine whether the space heater was operating at the time of the fire?

_____

_____

_____

Scenario 2: Multifamily Dwelling Fire

At 1530 hours, fire department units responded to a structure fire at 101 Clay Street. Upon arrival they found a three-story, multifamily dwelling with fire showing from the second floor.

Slide 12-16 (Photo 1)

This picture shows the building with a light haze of smoke showing from the second story on side D.

Question

Why would this information be important for the fire department personnel to document for investigators?

_____

_____

_____

Slide 12-17 (Photo 2)

Here we see flames at the second floor window on side D. Smoke is also showing from another second story window on side A.

Question

What are some of the factors that can affect fire growth, development and spread?

Slide 12-18 (Photo 3)

This photo shows heavy fire and dense, dark smoke coming from the second story windows of sides A and D.

Question

What does this picture tell you?

Slide 12-19 (Photo 4)

This picture shows a heavy volume of fire that has spread to a significant portion of the second story of the building.

Question

What method(s) of heat transfer are most likely responsible for fire spread from one area of the building/room to another?

Slide 12-20 (Photo 5)

This photo shows significant charring at floor level in the suspected area/room of origin.

Question

What are some of the possible reasons that would produce this type of damage/pattern?

_____

_____

_____

Slide 12-21 (Photo 6)

This picture shows a baseboard heater installed below a window in a living room of a residential structure.

Question

What is the correct interpretation of the burn pattern (inverted "V") on the wall directly above the heater and below the windowsill?

_____

_____

_____

Scenario 3: Residential Structure Fire

At 1635 hours, fire department units responded to a residential structure fire at 1412 Oxnard Street. The occupancy is a two-story, wood-frame structure.

Slide 12-23 (Photo 1)

This picture shows side B/C.

Question

What information may be important to document for investigators to assist in their investigation?

Slide 12-24 (Photo 2)

This picture is of side A/B.

Question

What does this picture indicate?

Slide 12-25 (Photo 3)

This picture is a close-up view of the fire damage around the second story window of side B.

Question

Why is it important to document any exterior burn patterns and fire damage during the 360-degree walk around of the structure?

Slide 12-26 (Photo 4)

This picture shows fire damage to a kitchen located on the second floor.

Question

Where do you think the area of origin is located and what is the most probable fire cause?

_____

_____

_____

Scenario 4: Residential Structure Fire

At 0915 hours, fire department units responded to a residential structure fire at 1680 Seton Street. The occupancy is a two-story, wood-frame, duplex-style townhouse.

Slide 12-28 (Photo 1)

This picture shows side A.

Question

What indicators would you document to assist in the investigation?

_____

_____

_____

Slide 12-29 (Photo 2)

This picture shows right front corner of living room area (side A/D).

Question

What does the significance of damage (or lack of damage) to the futon indicate?

_____

_____

_____

Slide 12-30 (Photo 3)

This picture shows the sofa, coffee table and chair located in the living room of the structure between the entrance to the kitchen and stairway leading to the second floor.

Question

Where do you think the area of origin is?

_____

_____

_____

Slide 12-31 (Photo 4)

This picture is a closer view of the burn pattern located in the area behind the chair.

Questions

Is this burn pattern consistent with a fire originating in or around the chair?

_____

_____

_____

What might be an alternative explanation for this damage and corresponding burn pattern?

_____

_____

_____

Slide 12-32 (Photo 5)

This picture shows the close-up view of the corner of the sofa located in the living room.

Question

What do you notice about the damage to the sofa and nearby coffee table?

Slide 12-33 (Photo 6)

This picture shows a downward view of the living room area.

Question

Based on what is depicted in the photograph, what is your opinion concerning the cause of the fire?

Slide 12-34 (Photo 7)

This picture is a closer view of the area behind the chair where the space heater was located.

Question

If you suspect the space heater as being the cause of the fire, how would you proceed?

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SUMMARY
• Fire cause determination.
• Application of fire investigation skills.
Slide 12-36

III. SUMMARY

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Stickney, C.W. "Recognizing Where Arson Exists." *Selected Articles for Fire and Arson Investigators*. Marlboro: International Association of Arson Investigators, 1976.

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BIBLIOGRAPHY OF UNITED STATES FIRE ADMINISTRATION ARSON-RELATED PUBLICATIONS

Adolescent Firesetter Handbook, Ages 14-18, FA-80, August 1988.

The third volume in a comprehensive three-volume series on juvenile firesetters. (Volumes I and II are listed below.) The third volume targets the adolescent firesetter and offers suggestions on programs to deal with this population.

AIMS: Arson Investigation Management System, FA-133, April 1993.

This is a 246-page tutorial manual to use the AIMS 6.0 software. AIMS maintains accurate records of cases and their interconnections. The mouse-supported, menu-driven program offers online help and verification of certain coded data fields. Software is available from the United States Fire Administration (USFA) at no cost.

Arson Forum Report: An Analysis and Recommendations for Federal Arson Policy and Priorities, FA-134, June 1993.

A 33-page report on a USFA-sponsored conference held at Emmitsburg, Maryland, in January 1993. The report lists the seven challenges the conferees identified. For each challenge, the group suggested a goal and related recommendations. A list of the participants is included.

Arson Prosecution: Issues and Strategies, FA-78, June 1988.

A 46-page handbook providing concise practical and technical guidance on arson prosecution. The material draws heavily on State arson prosecutors' guides and literature and on presentations made at a 1985 interagency conference at the Federal Law Enforcement Training Center (Glyncoe, GA).

Arson Resource Directory, FA-74, April 1993.

A 111-page resource guide intended to identify and describe organizations and individuals who are concerned with arson prevention and control. Part I lists major national programmatic areas. Part II groups miscellaneous public and private resources not included in Part I. Part III is an alphabetical index of the Directory.

Basic Tools and Resources for Fire Investigators: A Handbook, FA-127, January 1993.

A 45-page summary of basic information about the tools and techniques of fire investigation, specifically determining and verifying the origin and cause of incendiary fires. Includes a bibliography and glossary of forensic science terms.

Establishing an Arson Strike Force, FA-88, February 1989.

A 32-page booklet prepared by the International Association of Fire Chiefs for the USFA outlining how to develop, organize, operate, and manage an arson strike force.

Fire-Arson Investigation Training Resource Catalog, FA-131, March 1993.

A 247-page catalog listing professional, educational, and training opportunities for persons in the arson field prepared by the International Association of Arson Investigators for the USFA. Part One is a state-by-state listing of opportunities. Part Two catalogs training materials by primary topic. Part Three details certification requirements and procedures for certification in fire investigation and related fields. Part Four is a comprehensive bibliography.

Fire Arson Investigators' Field Index Directory, FA-91, January 1993.

A 180-page directory of available resources arranged in the following four sections: investigation; commercial; residential; and vehicles. Section V is an index.

Preadolescent Firesetter Handbook, Ages 0-7, FA-83, December 1988.

The first in a comprehensive three-volume series on juvenile firesetters. This first volume targets the very young firesetter and offers suggestions on programs to deal with this population.

Preadolescent Firesetter Handbook, Ages 7-13, FA-82, December 1988.

The second in a comprehensive three-volume series on juvenile firesetters. This second volume targets the preteen firesetter and offers suggestions on programs to deal with this population.

Rural Arson Control, FA-87, February 1989.

A 25-page report prepared by the International Association of Fire Chiefs for the USFA. The report evaluates 21 rural arson control needs and suggests strategies for responding to these needs.

For more information or to order, write or call:

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