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Fire and
Explosion
Deaths and
Injuries

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Knowledge Objectives (1 of 2)

- Identify the effects of fire and explosion on the human body.
- Discuss the various issues involved in fire or explosion death investigation.
- Identify additional personnel required to investigate a fatal or serious injury.

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Knowledge Objectives (2 of 2)

- Discuss several combustion products and their effects on health individuals.
- Describe the effects of hyperthermia on the body.
- List body materials that may be examined and tested postmortem.

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Skills Objectives

- Evaluate an injured victim for details about the fire scene.
- Evaluate a body for details about the fire scene.
- Secure a body as evidence.

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Introduction

- Investigations become more complex with serious injury or death.
- Injuries can lead to death weeks later.
- A full investigation for every fire scene involving a serious injury is necessary.

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Death Scene Considerations

- Two-part investigation
 - Origin and cause of fire/explosion
 - Cause and manner of death
 - Body of victim is most important piece of evidence
 - Autopsy by forensic pathologist

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Fire Suppression

- First responders preserve life and property.
- They should also preserve as much evidence as possible.
 - Powerful hose streams and overhaul could have an impact
 - Body should be left in original location
 - Only move body if damage will occur

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Notification

- Law enforcement
- Medical examiner
- Coroner
- Forensic laboratory staff
- Others

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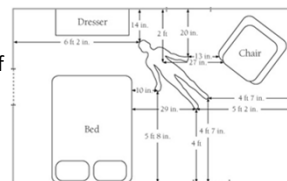
Documentation (1 of 2)

- Photography is effective and quick.
 - Particularly if body must be moved because of the environment
- Photograph before and during process of debris and body removal
 - Exits, alarm systems, fire/explosion patterns, etc.

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Documentation (2 of 2)

- Make sketches and diagrams.
 - Physical dimensions of the scene, contents, body location
 - Outline of the body



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Recovery of Bodies and Evidence

(1 of 2)

- Team may include homicide detective, medical examiner, coroner, forensic personnel
- Grid system divides scene into sections
- Consider chain of custody and cross-contamination.
 - Clothing should be preserved.
 - Search for all remains.

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Recovery of Bodies and Evidence

(2 of 2)

- This room has been marked off into sectors to ensure complete coverage.



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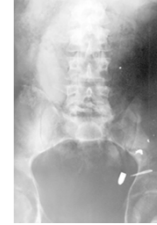
Injury Fires

- Determine nature, location, and degree of injuries.
 - Valuable evidence
 - The injuries may later result in death.
- Law may require you to report burn injuries

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Death-Related Pathological and Toxicological Examination (1 of 2)

- Full autopsy to determine cause of death
 - Full-body X-ray
 - Identifies foreign matter, such as a bullet



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Death-Related Pathological and Toxicological Examination (2 of 2)

- Testing for:
 - Carbon monoxide levels in blood and tissue
 - May be evidence due to lividity
 - Soot or smoke in various areas of body
 - Presence of other toxic products
 - Hydrogen cyanide and hydrogen chloride
 - Drugs
 - Alcohol

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Burns

- Burns take place before and after death.
- After death, heat dehydrates muscle tissue.
 - Distorts facial features
 - Causes pugilistic attitude (boxer-type stance)
- Blood on body may indicate non-fire-related trauma

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Consumption of the Body by Fire

- Examine burn patterns and extent of burns.
 - Skin and muscles are eventually consumed.
 - Fat is combustible.
 - Bones shrink and fracture.
 - Bones change color.
 - The skull may fracture.
 - “Spontaneous human combustion” does not exist.

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Fundamental Issues of Death Investigation (1 of 5)

- Remains and victim identification
 - Distinguish human from animal remains
 - Consider remains of infants and children
 - Use clothing and personal effects as circumstantial evidence of identification
 - Recover dental remains
 - Use DNA evidence

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Fundamental Issues of Death Investigation

(2 of 5)

- Coroner and Medical Examiner
 - Determining cause of death
 - Determining manner of death
 - Facilitate autopsy

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Fundamental Issues of Death Investigation

(3 of 5)

- Cause and Manner of Death
 - The *cause of death* is the actual event or injury that brings about cessation of life.
 - The *manner of death* is the course of events that led up to the death.
 - Accidental
 - Homicidal
 - Suicidal
 - Natural
 - Undetermined

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Fundamental Issues of Death Investigation

(4 of 5)

- Victim activity
 - Location of body
 - Items found on the body
 - Patterns of damage
 - Evidence, such as smoking materials or food left out for cooking

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Fundamental Issues of Death Investigation

(5 of 5)

- Postmortem changes
 - Lividity sets in 6 to 9 hours after death
 - Rigor mortis: Stiffening of the joints
 - Climate and other factors affect rate of change.
 - Create a victim timeline
 - Record environmental conditions

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Mechanism of Death

- Combustion products can affect victim:
 - Carbon monoxide binds with hemoglobin more readily than oxygen, forming COHb
 - Hydrogen cyanide affects use of oxygen by the body.
 - Other toxic gases
 - Hydrogen chloride
 - Acrolein

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Thermal Effects (1 of 2)

- Can result in death or injury.
 - Simple or acute hyperthermia
- Skin burns
- Inhalation of hot gases
- Inhalation of soot and smoke
 - Can lead to edema
 - May transport toxins into body
 - May block airway

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Thermal Effects (2 of 2)

- Hypoxia: result of breathing in a reduced oxygen environment
 - Disorientation, unconsciousness, eventual cessation of breathing
- Effects on mental and psychomotor abilities
 - Hinder ability to escape
 - Hinders vision

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Postmortem Tests and Documentation

(1 of 2)

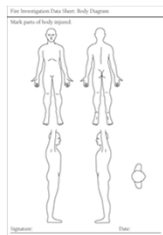
- May help investigator identify victim and establish cause and manner of death
 - Blood tests
 - Examination of stomach contents and airways
 - X-rays
 - Evidence of sexual assault
 - Documentation by photography and sketching

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Postmortem Tests and Documentation

(2 of 2)

- This chart can be used to diagram injuries.



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Fire and Explosion Injuries

- Investigate serious injury fires as if they were fatal investigations.
 - Deaths can occur well after the event.
 - Examine and document many items.
- Law may require you to report serious injuries

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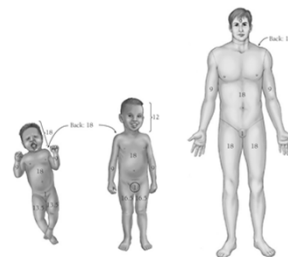
Physical Evidence

- Both apparent and microscopic
- Often located in areas beyond body
 - Clothing
 - Furnishings
 - Potential ignition sources

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Medical Evidence (Burns) (1 of 2)

- Assess degree of burn
 - First, second, third, fourth
- Assess body area
 - "Rule of nines"



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Medical Evidence (Burns) (2 of 2)

- Documentation
 - Make sketches or take photos before treatment or healing
- Mechanism of burn injury
 - Burns may not be distinguishable in appearance

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Medical Evidence (Inhalation)

- Testing determines levels of fire byproducts
 - Actions of injured individuals
 - Environment to which victim was exposed
- Hospital tests should analyze:
 - Level of COHb
 - HCN concentrations
 - Alcohol
 - Drugs

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Access to Medical Evidence

- Laws may limit investigator's access to medical records
 - May require patient consent or court order
- Records may reveal:
 - Impairments that complicated detection of or escape from the fire
 - Deaths that occurred before the fire

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Mechanism of Inhalation Injuries (1 of 2)

- Elimination of CO
 - Administering O₂ affects speed of CO elimination
 - Useful to know when interpreting COHb levels
- Explosion-related injuries
 - Location and distribution of injuries may indicate location and activity of victim

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Mechanism of Inhalation Injuries (2 of 2)

- Explosion-related injuries (cont'd)
 - Injuries are classified into four groups
 - Blast pressure injuries
 - Shrapnel injuries
 - Thermal injuries
 - Seismic injuries

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Summary (1 of 6)

- Every fire or explosion involving serious injury should receive a full investigation.
- The investigation is in two parts, one for the origin and cause of the fire or explosion and the other for the cause and manner of death.

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Summary (2 of 6)

- All victims of a fire or explosion should receive a full autopsy to determine the cause of the death.

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Summary (3 of 6)

- The investigator faces a number of fundamental issues with regard to the investigation, including victim identification, cause of death, manner of death, victim activity, and postmortem changes.

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Summary (4 of 6)

- There are many products from the combustion process that can affect the victim of a fire or explosion. Breathing these products or direct skin contact can cause a variety of effects on the body.

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Summary (5 of 6)

- Tests and documentation during the postmortem examination provide the investigator with valuable information to aid in identifying the victim as well as establishing the cause and manner of death.

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Summary (6 of 6)

- The location and distribution of explosion injuries may indicate location and activity of the victim at the time of the explosion and may help to establish the location, orientation, energy, and function of the exploding mechanism or device.