

INVESTIGATING FATAL EXPLOSIONS



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“The circumstances surrounding a fire or explosion are very important to the Medical Examiner’s Office. The origin and cause determinations made by the Fire/Explosive Investigator help the Forensic Pathologist in establishing the cause and manner of death. Only through cooperation and coordination of all involved agencies can a thorough, competent, and scientific investigation be performed.”

Fire and Explosion Investigation Principles

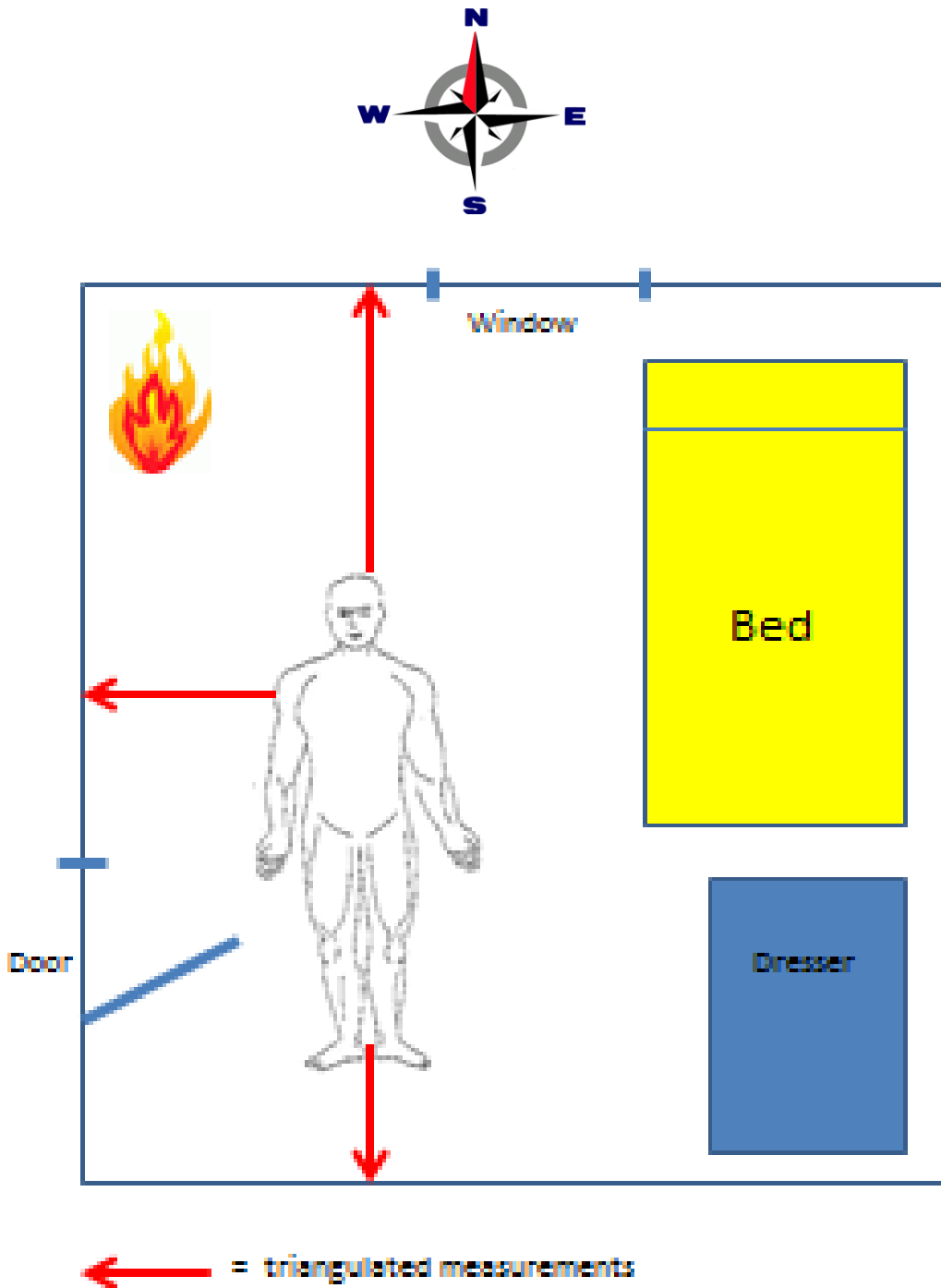
Fire/Explosion Investigators must understand that when there is a death in the context of fire or explosion, there will be two concurrent and active investigations. These two investigations consist of an origin and cause fire/explosion investigation and a death investigation.

1. The Fire/Explosion Investigator and Medical Examiner should examine and process the body together
2. Approach every fire/explosion scene as a potential crime scene and approach every fire/explosion associated fatality as a potential homicide, until proven otherwise
3. Evidence can be collected contrary to destructive nature of fire and explosions
4. All fire/explosion fatalities should be autopsied (exceptions are rare)
5. Always keep an open mind and “do not try to fit square pegs into round holes”
6. Continually assess the scene findings with findings on or in the body

Basics of Fatal Fire/Explosion Scene Processing

1. Obtain history of property (ownership, insurance, etc.)
2. Scene assessment and documentation (photography and diagrams)
3. Examine scene for evidence (gas cans, weapons, etc.)
4. Locate decedent and begin processing of body to extract for ME
5. Photograph body and immediate scene
6. Note any evidence on or near body
7. Consider collecting evidence on or near body early
8. Examine all aspects of body and in relations to scene:
 - Location of the body (bedroom, near an exit)
 - Position of the body (chair, hiding)
 - Clothing on the body (pajama's, work clothes, shoes)
 - Burn patterns on the clothes
 - Burn patterns on the body
 - Items found around the body (keys, telephone, flashlight, fire extinguisher, weapons)
 - Blast damage (pressure, impact, and shrapnel).
9. Extract body and send to ME office for autopsy
10. Begin origin and cause fire/explosion investigation

Fatality Scene Documentation Example



1. Measure body from 3 known or fixed points
2. Utilize scene landmarks for measurements
3. Measure from head, feet, and shoulders of decedent
4. Measure overall dimensions of room/area

Victim Identification

The first priority of the Medical Examiner in any fire or explosion fatality is to identify the victim. This can sometimes be a very difficult process, depending on the degree of trauma imposed on the body by fire or the explosion. Methods used to identify bodies by Medical Examiners include:

Direct Visual or Photographic Identification

- a. Only used ***IF*** decedent is visually recognizable!
- b. Photograph of decedent shown to NOK
- c. NOK shown/views decedent at scene

Scientific Methods:

- d. Fingerprints
- e. Dental records
- f. DNA (nuclear and mitochondrial)
- g. Medical radiographs

Circumstantial Methods:

- h. Clothing and personal effects
- i. Tattoos, scars, unique anatomical features
- j. Surgical history of decedent
- k. Anthropology
- l. Circumstances placing decedent at or near scene

Alternative Methods:

- m. Prosthetic / artificial devices (implants)
- n. Dentures
- o. Cardiac pacemakers or defibrillators

With each of the aforementioned methods of identification, there are limitations.

Cause and Manner of Death

Smoke and soot inhalation (CO poisoning) is the most common cause of death among fire victims, followed by thermal (burn) injuries, subsequent infections if there was a time of survivability, and then blunt force trauma from structural collapse or explosion.

For victims of explosions, blunt and/or penetrating trauma are the most common causes of death.

Most burns occur on the body due to direct contact with flames. The severity of the burn relates directly to the intensity of the fire and the duration of exposure of the body to the fire. It is possible to have a body reduced to ashes (cremation) if a fire has burned for a very long period of time and at low temperatures, or for a short period of time with extremely high flame temperatures.

Five Manners of Death

Natural
Accident
Suicide
Homicide
Undetermined

Certificate of Death

Legally documents death of an individual
Confirms identity of decedent
Allows for settlement of estates
Statistical value

Certificate of Death †

Name : The Wicked Witch of the East
Residence : The Land of Oz

I HEREBY CERTIFY that I attended deceased from
May 6th 1938 to May 6th 1938.
I last saw her alive on May 6th 1938.
Death is said to have occurred on date stated below at 12:30 A. M.
Date of Death May 6th 1938
Month Day Year
Signature W.S. Bauwister M. D.
Address Munchkin City

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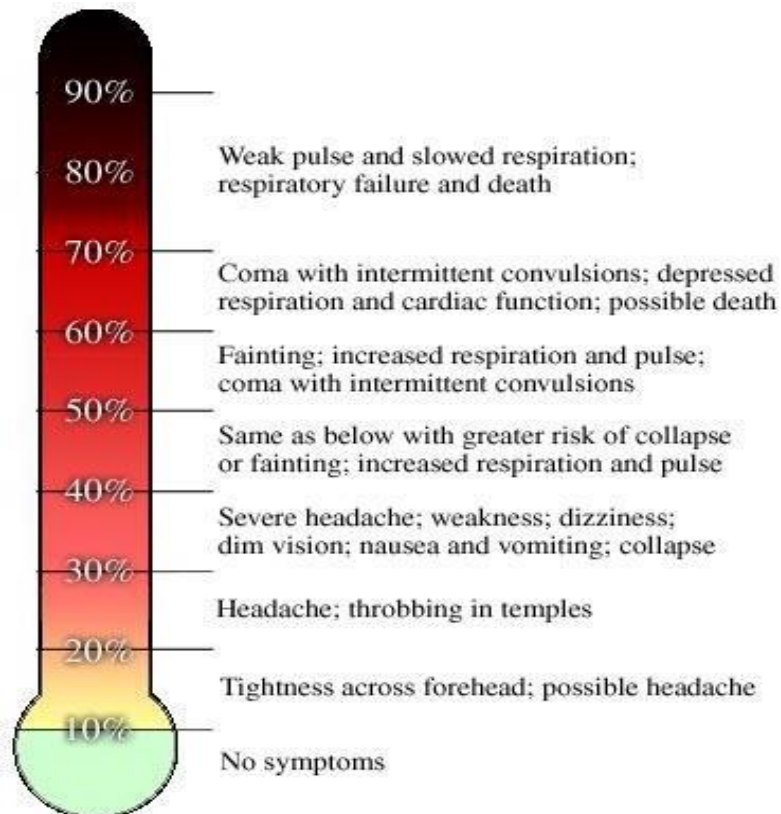
Carbon Monoxide (Carboxyhemoglobin) Levels

General “Rules of Thumb”

Smokers can have baseline blood CO of up to 10%

Must take decedent’s medical history into account when interpreting CO results. The below tables are estimates. Death may occur at levels below or higher than the values

Concentration	Symptoms
35 ppm (0.0035%)	Headache and dizziness within six to eight hours of constant exposure
100 ppm (0.01%)	Slight headache in two to three hours
200 ppm (0.02%)	Slight headache within two to three hours; loss of judgment
400 ppm (0.04%)	Frontal headache within one to two hours
800 ppm (0.08%)	Dizziness, nausea, and convulsions within 45 min; insensible within 2 hours
1,600 ppm (0.16%)	Headache, tachycardia , dizziness, and nausea within 20 min; death in less than 2 hours
3,200 ppm (0.32%)	Headache, dizziness and nausea in five to ten minutes. Death within 30 minutes.
6,400 ppm (0.64%)	Headache and dizziness in one to two minutes. Convulsions, respiratory arrest, and death
12,800 ppm (1.28%)	Unconsciousness after 2-3 breaths. Death in less than three minutes.



Burn Classifications

- First Degree (superficial):** Least severe. Epidermis is involved. Looks like a “sunburn.” Area involved is red, swollen, and painful to touch.
- Second Degree (partial thickness):** Consists of all aspects of 1st degree burns plus blistering. Scars can develop.
- Third Degree (full thickness):** Consists of all aspects of 2nd degree burns plus the burn is through the dermis of the skin. No pain can be felt near center of burn, but pain can exist near periphery. Scarring will develop.
- Fourth Degree:** Most severe burn or “charring.” Skin, underlying soft tissue, and bone can be lost. Whole body parts may even be consumed.

“Artifacts” Caused by Heat and Fire Impinging on Body

- Soot changes external appearance of body
- Hair loss changes external appearance of body
- Body weight is decreased
- Height of body can decrease
- Muscle groups contract (pugilistic pose or “boxer’s pose”)
- Hair color may change
- Skull may burst open from steam effects (“exploding skull phenomenon”)
- Blood collections on brain may “mimic” antemortem injuries
- Skin splitting from heat may appear to be antemortem trauma or therapeutic incisions

Blast Injuries

- Primary: Injuries from the primary or shock wave (hollow organs)
- Secondary: Injuries from shrapnel or other objects blown into patient
- Tertiary: Injuries sustained when patient is thrown into an object
- Quaternary: Injuries sustained from post-blast activity (i.e. fire, building collapse)
- Quinary: Injuries from post-blast environmental contaminants (CBRN)

Forensic Autopsy Conducted on a Fire/Explosion Fatality Include:

- A scene investigation and preliminary body exam
- A review of the decedent's medical and social history
- Establishing a positive identification for the decedent
- Full body radiographs
- Collection of evidence (i.e. clothing from body for ignitable liquid analysis or explosive residues)
- External examination of the body including clothing and personal effects
- Internal examination of the body, including all organs
- Toxicology studies (alcohol and drugs)
- Blood or tissue carbon monoxide levels (cyanide levels if appropriate)
- Microbiology (if needed)
- Sexual assault exam (if needed)
- A written report explaining cause and manner of death by Medical Examiner

A Forensic Autopsy Can Help Answer the Following Questions:

- Who is the decedent?
- Was the decedent alive or dead at the time of the fire?
- What is the decedent's cause and manner of death?
- Was the decedent under the influence of drugs or alcohol at time of fire?
- Does the decedent have any pre-existing medical conditions which may have contributed to the decedent's death or prevented his/her escape from the fire/explosion?
- Was there any trauma about the body that was not fire-related?
- Is there any evidence of bullets or knife tips in the body?
- Is there any restraint apparatus found on the body (i.e. gags, nooses)?
- What is the distribution of burn patterns on the body (torture)?

- Where was the decedent at the time of the fire/explosion and why?

Assistance and Consultation

(24/7 and 365 days per year)

Iowa Office of the State Medical Examiner

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Contact your local dispatch center to contact the SFM Duty Officer on-call

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