

# Fire Basics

Forensic Science

Watch this video!

- <http://tinyurl.com/hwl879v>

# Fire Investigation Terms

- **Fire** - Produced when a substance undergoes rapid oxidation involving heat and light.
- **Fire Triangle** – Shows the three elements needed to produce and sustain a fire.

# Fire Investigation Terms

- **Flash Point** – The lowest temperature to which a substance must be heated in order for the substance to give off vapors which will burn when exposed to a flame or ignition source.
- **Point of Origin** – The location where the fire started.



# Add to notes....

- Multiple points of origin: could mean objects fell from the ceiling thus causing another point of origin OR it could mean arson.

# Fire Investigation Terms

- **Burn patterns** – Noticeable patterns created by the fire as it burns.



- **Accelerants** – Substances, such as gasoline, paint thinner, and alcohol, that accelerate the burning process.



# Fire Investigation Terms

- **Arson** – A fire started deliberately.

**\$5,000 AWARD FUND**

It has been determined that this fire is

**ARSON**

If you have information regarding this fire, please call

**800-452-7888**

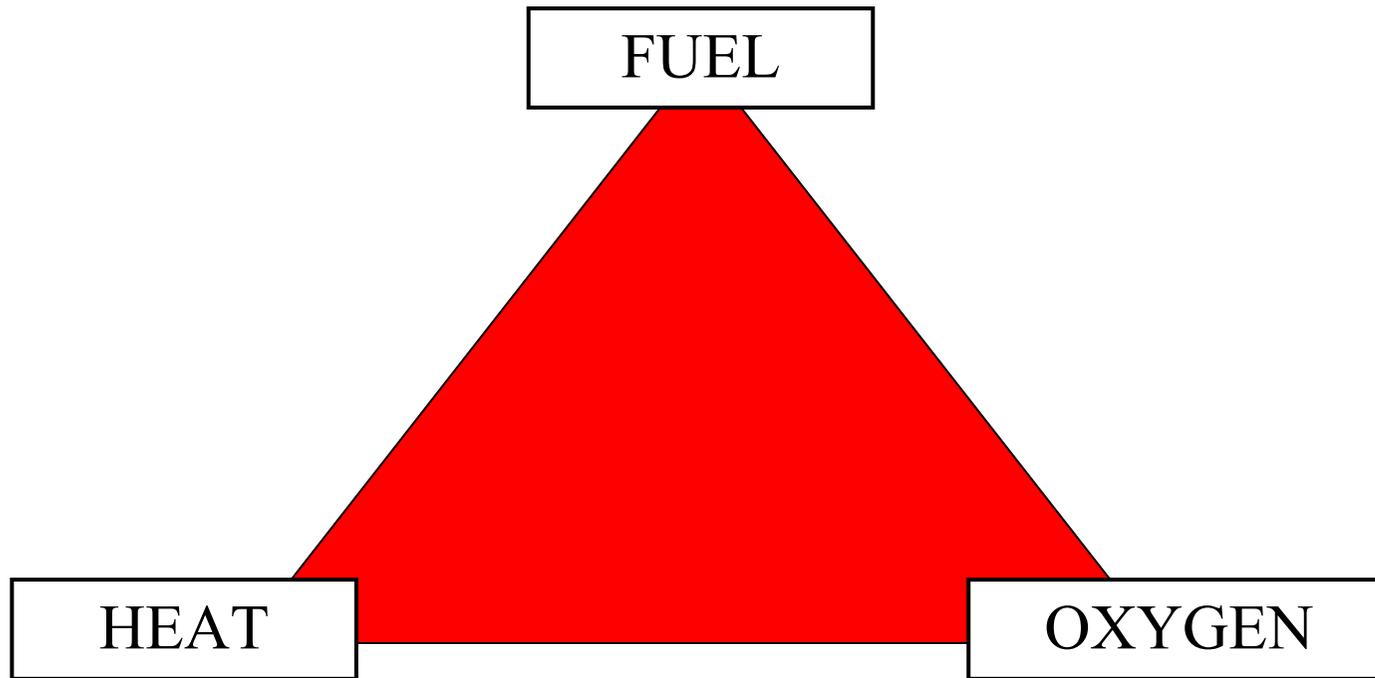
**NW INSURANCE COUNCIL**

**OREGON COUNCIL AGAINST ARSON**

**INTERNATIONAL ASSOCIATION of ARSON INVESTIGATORS INC. IAAI OREGON CHAPTER 31**

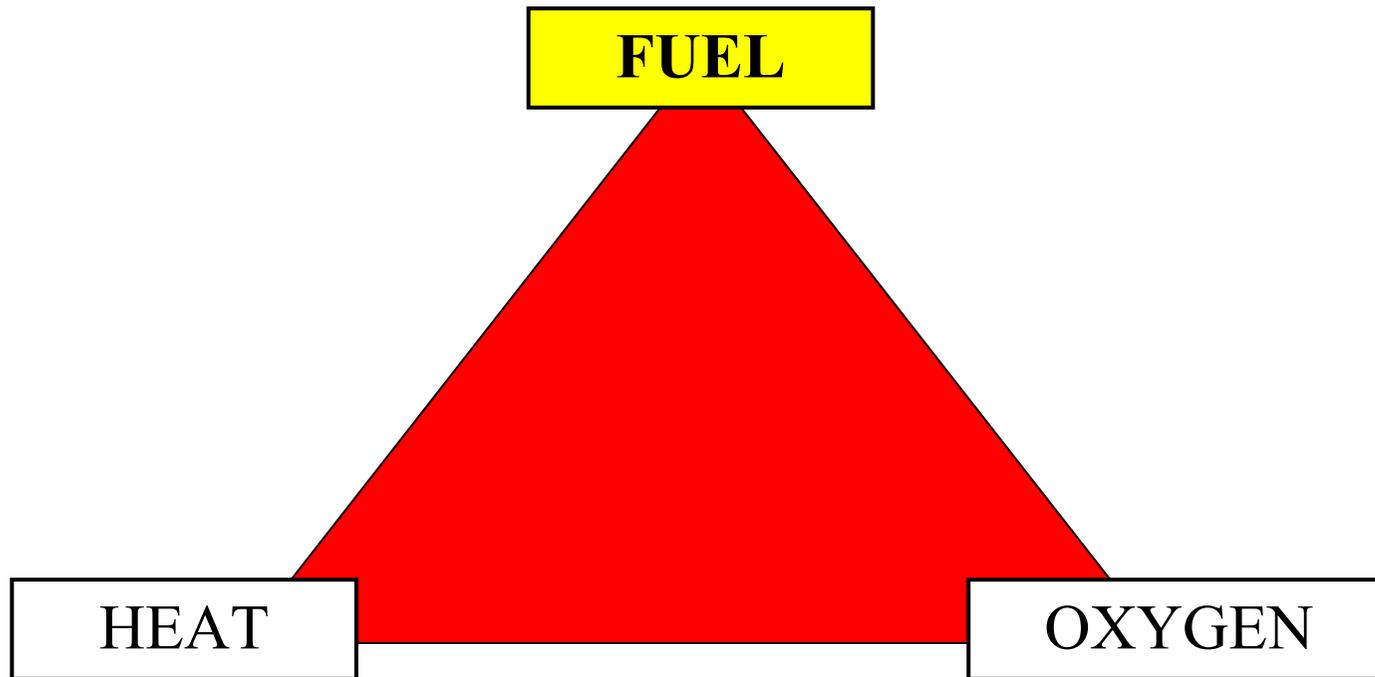
# Fuel + Oxygen + Heat = Fire

The **FIRE TRIANGLE** represents the **three** elements needed for fire to occur: heat, fuel, and oxygen.

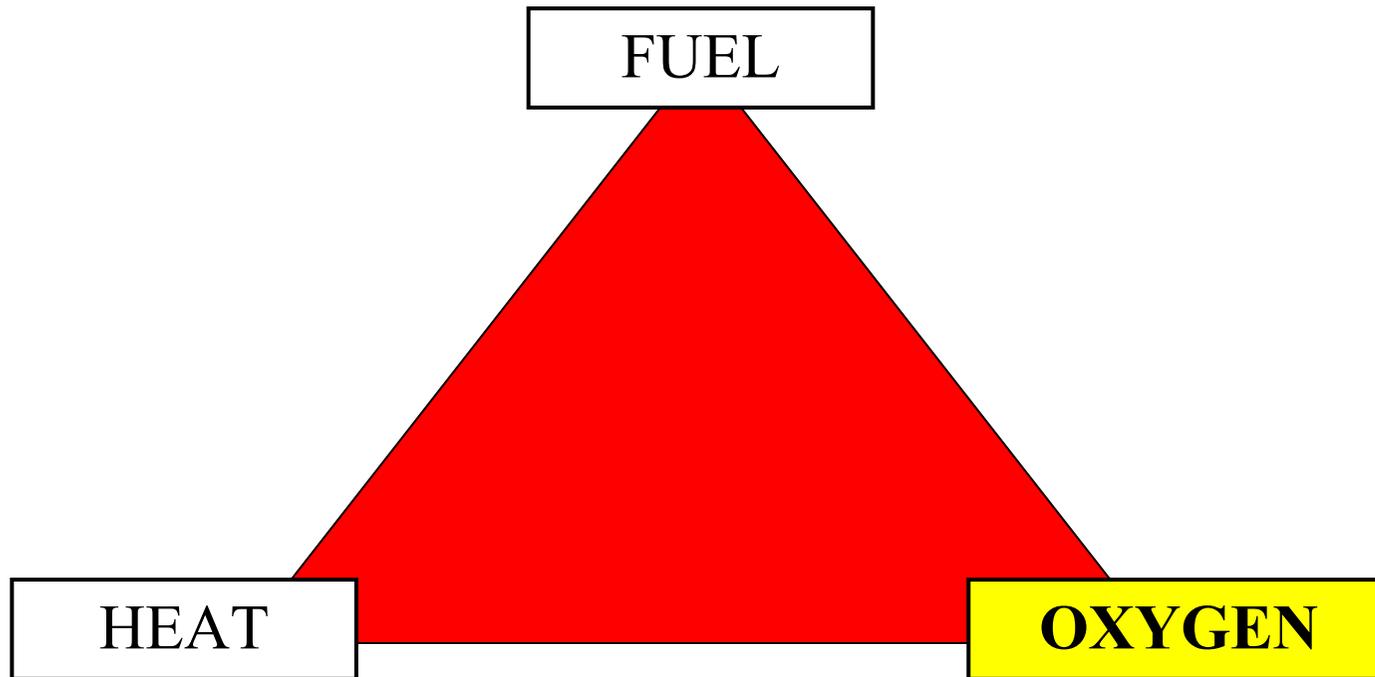


**Fuel** can be any **combustible material** in **any state of matter** - solid, liquid, or gas. Most solids and liquids become a **vapor or gas** before they will burn.

Examples:  
CLOTHING  
FURNITURE  
CURTAINS  
FLAMMABLE LIQUIDS



The air we breathe is about **21% oxygen**. Fire requires an atmosphere with at least **16% oxygen**.



# Remember: Fuel + Oxygen + Heat = Fire

**Heat** is the energy necessary to **increase the temperature of the fuel** to a point where sufficient vapors are given off for **ignition** to occur.

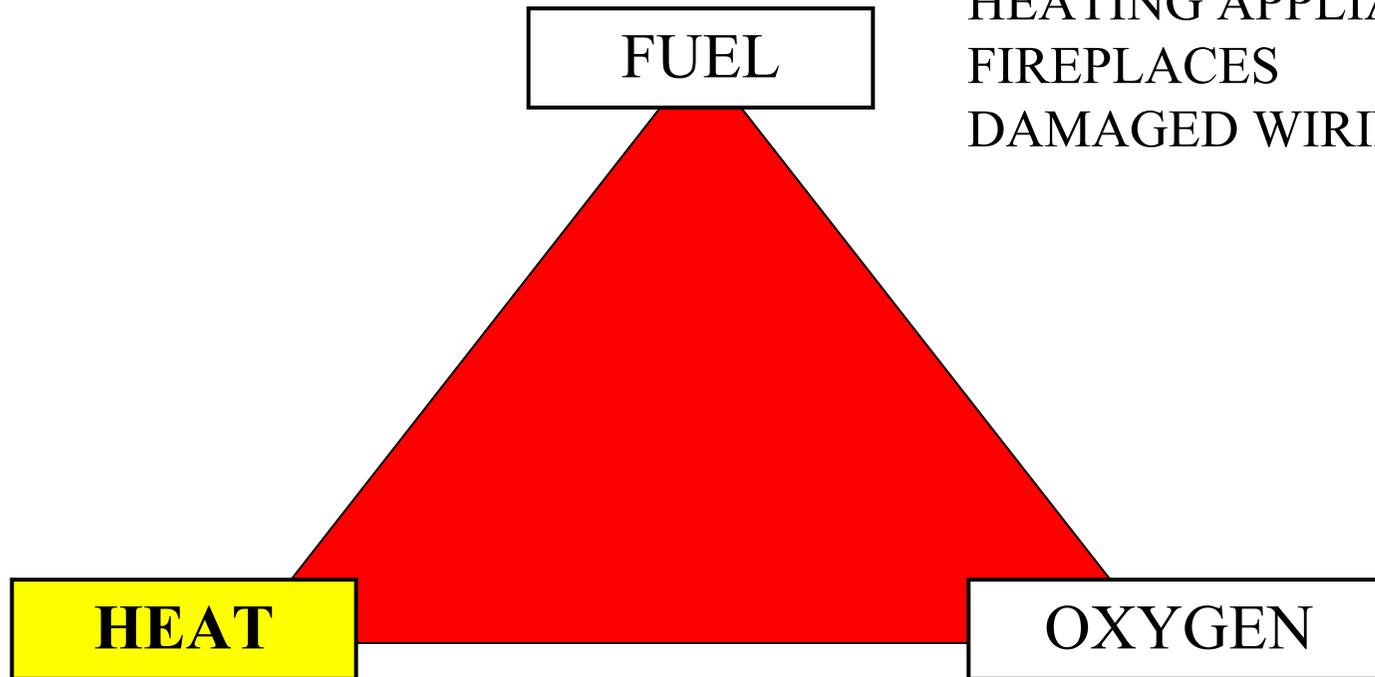
Examples:

STOVES

HEATING APPLIANCES

FIREPLACES

DAMAGED WIRING



# Fire Clues

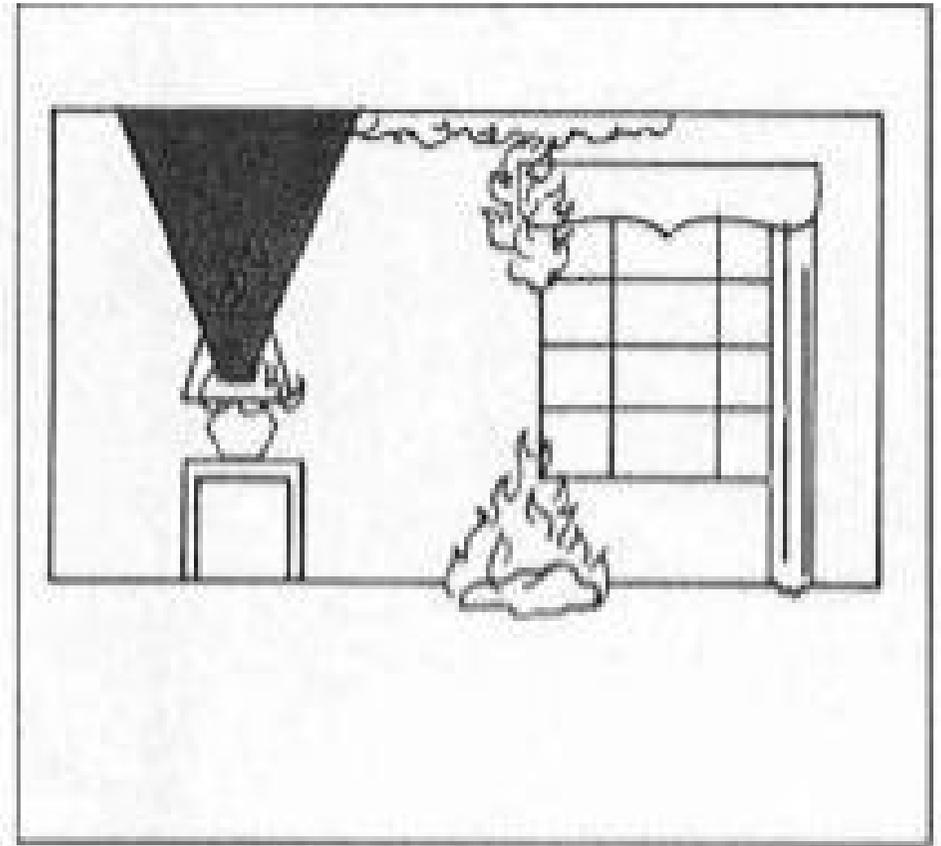
- **Point of Origin** – Burn patterns and other damage can help determine the point of origin, or the location where the fire started.



- **Char Patterns** – Created by very hot fires that burn very quickly and move fast along its path, so that there can be sharp lines between what is burned and what isn't.
  - A char pattern on a door would help an investigator determine which side of the door the fire was on.
  - A char pattern on the floor would help investigators determine the use of an accelerant and its path.



- **V-Patterns** - Fire burns up, in a V-shaped pattern, so a fire that starts at an outlet against a wall leaves a char pattern that points to the origin.
  - A very narrow V-shape might indicate a fire that was hotter than normal, such as one helped along by an accelerant.
  - A wide V-shape might indicate a fire that was slow burning.
  - A U-shape could indicate that there was a "pool of origin" rather than a point of origin, such as might be caused by, say, a puddle of gasoline.



Fire will burn upward and outward until it reaches the ceiling and then will travel horizontally. The progression of the fire can ignite flammable materials away from the point of origin, which can drop and will continue to burn. The material that has dropped to the floor level and has continued to burn will also cause a "V" pattern and sometimes investigators mistakenly interpret this phenomenon as a separate and unconnected origin of the fire.

- **Heat Shadows** - Occur when heavy furniture shields part of a wall; can help determine the origin point.



- **Glass** - Glass fragments, windows, and light bulbs can provide clues to a fire.
  - Light bulbs tend to melt toward the heat source, so the "direction of melt" can indicate the direction of the fire.
  - The shattered or cracked glass of the windows can provide indications as to how a fire burned.
  - A dark soot layer on the glass could indicate a slow, smoldering fire.
  - Clear glass with an abnormal pattern of cracking could imply a very hot fire, possibly due to an accelerant.



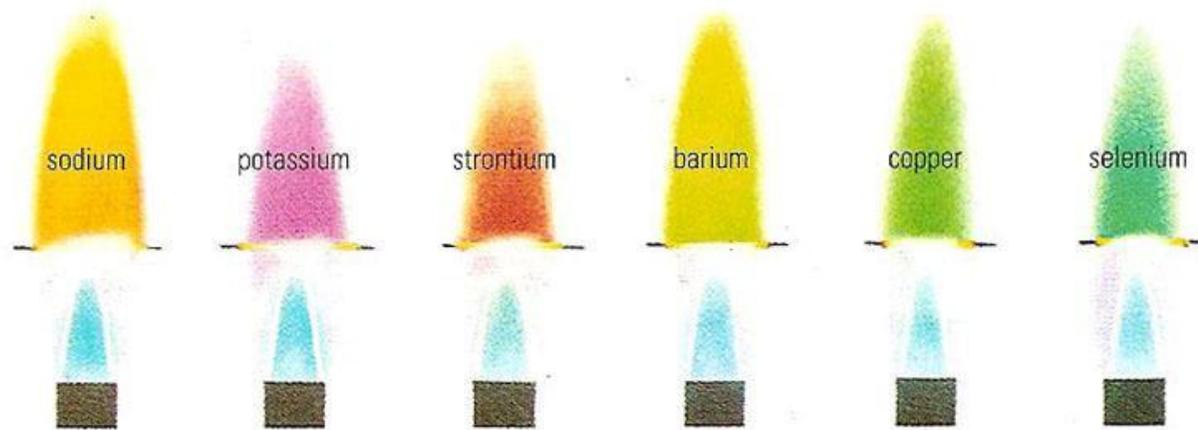
**Chimney Effect** - Since fire burns upwards, there can be a "chimney effect" where the fire ignites at a point, the superheated gases rise upward and form a fireball, which continues straight up to burn a hole in the ceiling. If the roof is not entirely burnt, and the fire investigator finds such a hole, the origin of the fire could be directly underneath.



- **Color of smoke** – Determine what type material was burning



**Color of flames** – Indicates at what temperature the fire was burning.



# Accident or Arson?

- **Accidental Nature**

- Heating System
- Electrical appliances
- Lightning
- Children playing with matches
- Smoking

- **Non-Accident**

- Odors – Gas, kerosene, or other accelerants
- Furnishing – Removal of personal objects and valuables
- Clothing – Check debris for buttons, zippers, etc
- Locked windows, blocked doors
- Two or more points of origin
- Look for inverted v-patterns (can be a sign that an accelerant was used)
- Floors charred – Can indicate use of an accelerant
- Trailers that lead the fire from one place to another



Image: Havana Rural Fire Department

# Fire Investigation Basics

- Work from the least damaged areas to the most heavily damaged areas.
- Document with notes, photographs, and videos.
- Collect evidence (accelerant samples, fire items, and other crime scene evidence.)
- Interview witnesses
- Determine the point of origin.
- Determine the heat source(s).
- Hypothesize the reasons for the fire.

## Havana – Laurel Street Practice Burn Photographs

What clues might a fire investigator gain from this photograph?



## Practice Burn Photographs



A fire started in the kitchen area does not take long before it is a ball of flame reaching quickly to the ceiling.

Fires can easily double in size every 60 seconds, meaning there is little time to extinguish a fire before escape should be your primary goal if trapped.



Fire fighters look on as the fire spreads across a room.



The house is nearly completely consumed.

# Arson Facts in America

According to the FBI Crime Index, juvenile and adult arson cause an annual average of 560,000 fires, 750 deaths, 3,700 injuries, and \$1.5 billion in property loss. 55% of all arson arrests in the US are children under 18.

## What are Common Motives for Arson?

- **Crime concealment:** To conceal another crime such as murder, burglary, or vehicle.
- **Revenge or spite:** To get back at someone for a perceived injustice.
- **Monetary Gain:** Arson-for-Profit fires are set to burn a building, vehicle, or some other object in order to gain profit from the fire. The profit may come in several forms; from insurance coverage on the property, or from putting a competitor out of business.
- **Malicious Vandalism:** Fire set to someone's property, just to destroy it. Malicious vandalism fires account for the largest percentage of arson fires. These fires are frequently set by juveniles.
- **Mentally Disturbed:** Some persons have been found to have an irresistible impulse to set fires.

# Juvenile Firesetting

Fires set by juveniles are usually the result of a child or teenager experimenting with fire with a lack of understanding of the consequences. Others fires may be started by troubled children as a “cry for help” or as acts of vandalism.

The facts ...

In Rochester, New York, a two year old, playing with matches, started a fire that took his life and the lives of five family members.

In Roanoke, Virginia, a seven year old boy set fire to a chair in an abandoned building, the fire spread to an adjacent house and trapped an elderly woman.

In Passaic, New Jersey, a firefighter was killed and hundreds of people lost their homes in a fire started by a group of teenage boys.

These tragic events are not isolated incidents. In a typical year, in the U. S., 300 people are killed and \$190 million in property is destroyed in fires set by children. Children themselves are usually the victims of these fires accounting for 85 of every 100 lives lost.

# North Carolina Law says ...

- If the dwelling burned was occupied at the time of the burning, the offense is arson in the first degree and is punishable as a Class D felony.
  - Punishment: 40 years and/or fine
- If the dwelling burned was unoccupied at the time of the burning, the offense is arson in the second degree and is punishable as a Class G felony
  - Punishment: 15 years and/or fine

# What can you do to help prevent arson or arson damage?

Report suspicious persons and activities that may result in arson.

If you have a friend or classmates that has set fires in the past or plans to set a fire, tell an adult – parent, teacher, counselor, police officer, or a fireman.

Start or participate in a community watch program with your parents.

Install and properly maintain fire alarms in your home and encourage friends and relatives to do the same. Your family should also have a fire escape plan for your home.

