



Texas State Technical College

Harlingen

FIRE PREVENTION

Understanding Its Causes

THE FIRE TRIANGLE

For a fire to start three conditions must be met at the same time:





THE FIRE TRIANGLE

◆ Fuels: Materials that burn. The higher the temperature the easier and quicker they burn.

Common Fuels Include:

- Solvents such as acetone, alcohols, and toluene
- Gases such as acetylene and propane
- Solids such as wood and paper



THE FIRE TRIANGLE

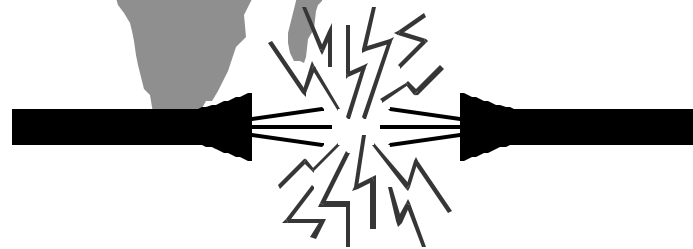
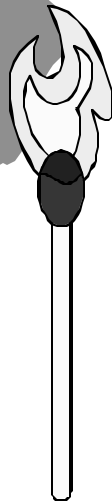
- ◆ Oxidizers: Oxygen or other substances capable of releasing oxygen to a potential fire.

Common oxidizers include acids, especially nitric and perchloric acids; chlorine dioxide; and other oxidizing agents such as potassium permanganate and potassium chlorate.

THE FIRE TRIANGLE

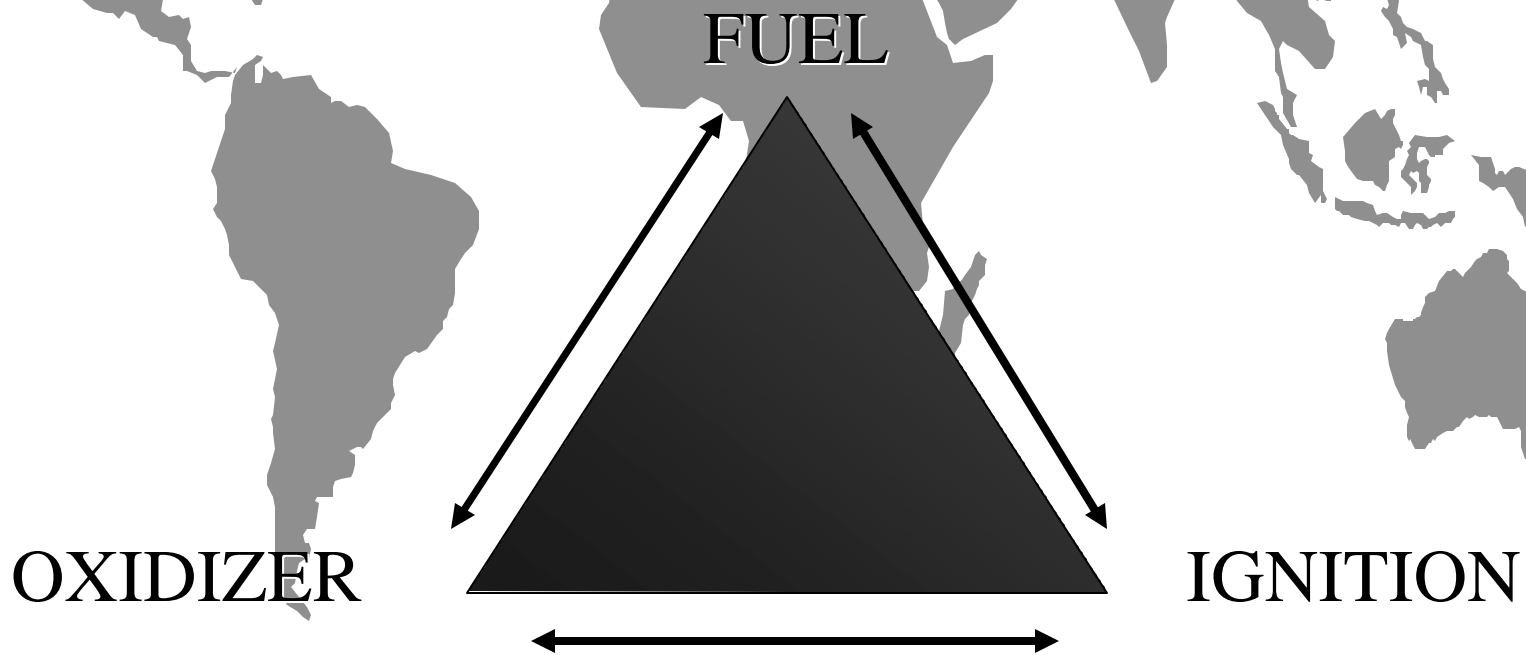
◆ Source of Ignition

An ignition source can be a spark, static electricity, arcs from faulty electrical equipment, a lit cigarette, or even a hot light bulb.



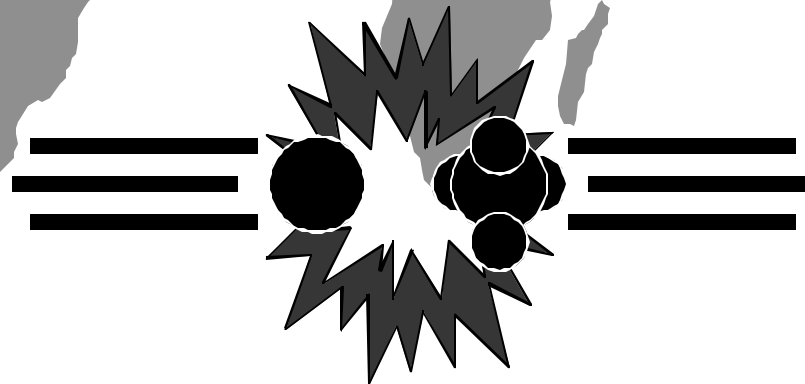
THE FIRE TRIANGLE

Fire prevention consists of making sure that these three legs of the fire triangle never meet.



FIRE PROPAGATION

Recent studies indicate that the spread or propagation of a fire is also dependent on a fourth factor: the chemical chain reactions that can occur as a result of heat produced by the fire.





FLAMMABLE CONDITIONS

A fire will not always start when the legs of the fire triangle meet, unless all three elements are present in the required amounts.

For example: Vapors from a flammable liquid must be mixed with a certain amount of air in order to ignite and propagate a flame.

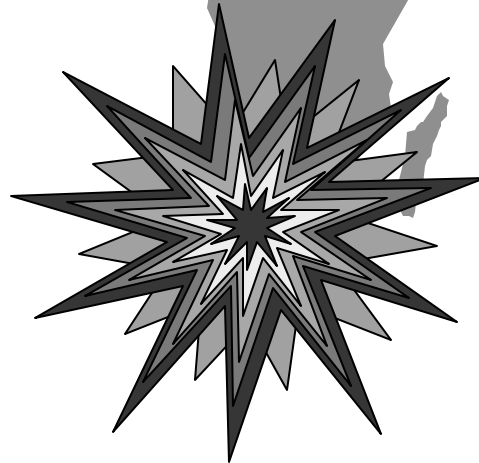


FLAMMABLE RANGE

- ◆ Lower Flammable Limit: The lowest concentration at which a fuel/air mixture will burn. Below this there is too little fuel (the mixture is too lean).
- ◆ Upper Flammable Limit: The highest concentration at which a fuel/air mixture will burn. Above this there is not enough oxygen (the mixture is too rich).

FLASH POINT

The lowest temperature at which sufficient vapors form above the liquid to produce an ignitable mixture with air.





FLAMMABILITY RANGE

The Department of Transportation classifies liquids for transportation regulation purposes.

Flammables: All liquids with a flash point below 100 degrees Fahrenheit

Combustibles: All liquids with a flash point above 100 degrees Fahrenheit

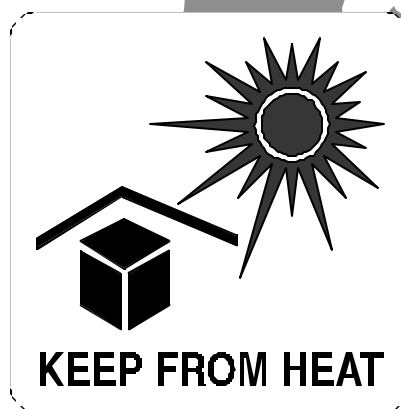
FLAMMABLE GASES & SOLIDS



- ◆ Gas cylinders such as acetylene welding gas need to be properly stored and used.
- ◆ Solids such as paper, wood, and cloth need to be treated as potential fuels. Rags or paper soaked with flammable liquids need to be properly handled and disposed of.
- ◆ Metals that burn (pyrophorics) are especially dangerous.

STORAGE & HANDLING

Since it is impossible to eliminate oxygen from the fire triangle, fire prevention depends on trying to eliminate sources of ignition and restricting the amount of flammable and combustible liquids.





STORAGE & HANDLING

- ◆ Eliminate sources of ignition
- ◆ Choose the least hazardous materials possible
- ◆ Reduce the amounts stored to a minimum
- ◆ Use safe storage procedures and containers
- ◆ Ensure containers are properly labeled



CONTAINER LABELING

Flammable liquids should have a label such as this:

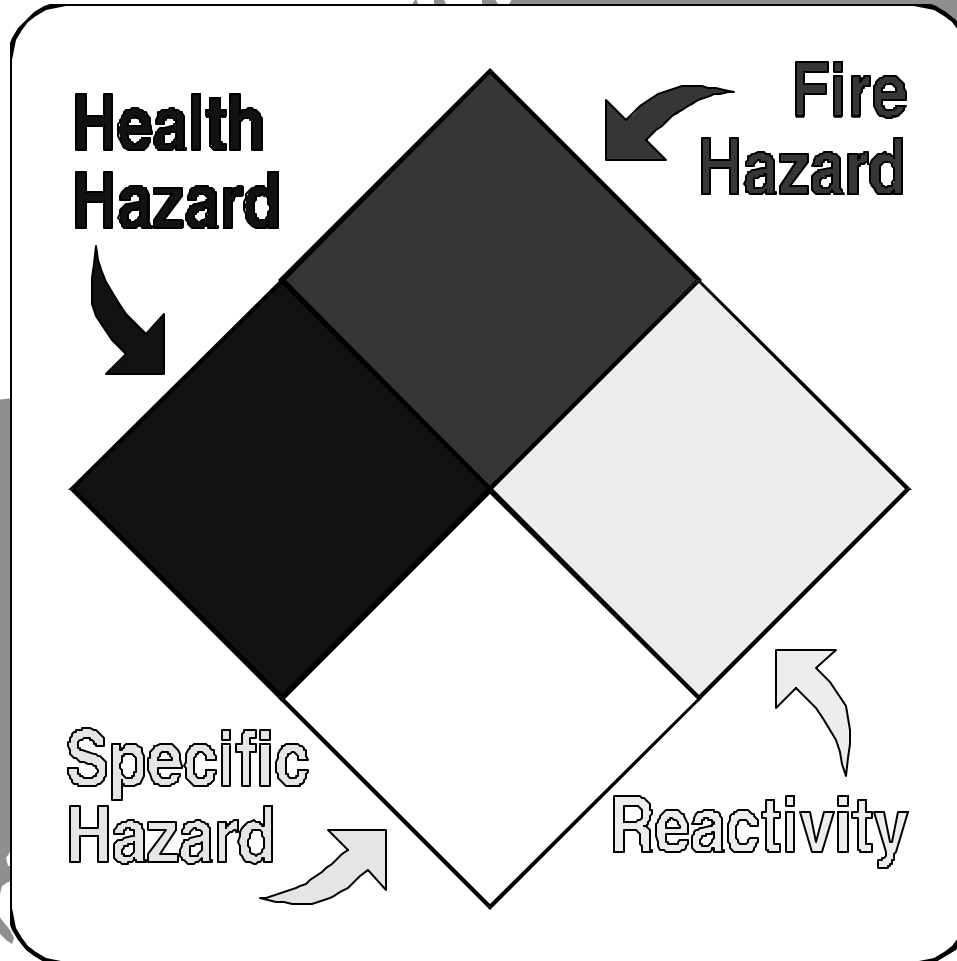
DANGER

FLAMMABLE

*KEEP AWAY FROM HEAT, SPARKS &
OPEN FLAMES*

KEEP CLOSED WHEN NOT IN USE

NFPA LABELING SYSTEM



MATERIAL SAFETY DATA SHEETS (MSDS)



- ◆ Information regarding fire prevention and fire extinguishing
- ◆ Safe storage and handling procedures
- ◆ Spill clean-up procedures
- ◆ Proper labeling
- ◆ Use to compare products for hazards such as flash point and flammability range



STORAGE AMOUNTS

Local and state fire codes limit the amounts of flammable and combustible liquids that can be stored in various locations.

*CHECK WITH YOUR LOCAL FIRE
DEPARTMENT*



STORAGE AREAS

- ◆ Best location to store *large* amounts of flammable and combustible liquids is a separate outside building.
- ◆ If this is not possible, then a suitable flammable storage cabinet or inside storage room should be built.

FLAMMABLE STORAGE CABINETS

- ◆ Built to meet OSHA and NFPA standards
- ◆ Labeled in large letters:

FLAMMABLE-- KEEP FIRE AWAY

- ◆ Maximum of 120 gallons of Class I, II, and III A liquids (60 gallons of Classes I and II)
- ◆ Maximum of three cabinets may be located in a given fire area

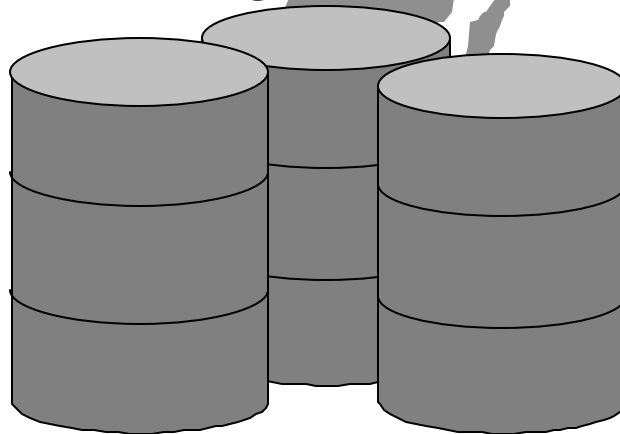


STORAGE CONTAINERS

- ◆ Quantities of flammable liquids exceeding one pint should be stored in approved portable safety cans
- ◆ In instructional laboratories the largest container size for flammable liquids is one gallon (or a two gallon safety can)

STORAGE DRUMS

- ◆ 55 gallon drums should only be stored in a separate storage area away from heat and sunlight.
- ◆ The maximum size of drum that should be stored indoors is 5 gallons.



INSIDE STORAGE ROOMS



- ◆ Requirements found in NFPA 30 (Flammable & Combustible Liquids Code)
- ◆ Fire resistance rating of 2 hours for walls, floor, and ceiling
- ◆ Class B fire doors
- ◆ Automatic fire protection systems
- ◆ Mechanical ventilation depending on the amount stored
- ◆ Class I-Division 2 electrical wiring and fixtures



DISPENSING

- ◆ When dispensing from drums, use approved transfer pumps or drum faucets.
- ◆ When pouring flammable liquids from a drum to a metal container, ground the drum and bond the metal container to the drum to prevent the build-up of any static charge.



SPIILLS AND LEAKS

- ◆ Spills must be quickly and safely cleaned up to prevent flammable vapors from igniting
- ◆ A large quantity of absorbent material should be kept on hand
- ◆ Treat spill clean-up materials as flammable and dispose of separately from the regular trash, preferably in a separate plastic bag
- ◆ Large spills of flammable liquids (more than one quart) need special cleanup procedures



FIRE FIGHTING

Four Basic Types of Fires

- ◆ Class A -- Common Solids
- ◆ Class B -- Flammable Liquids
- ◆ Class C -- Electrical Equipment
- ◆ Class D -- Burning Metals



FIRE EXTINGUISHERS

- ◆ Class A Types -- Water based for areas containing ordinary combustibles
- ◆ Class ABC Multipurpose Dry Chemical -- Displaces oxygen and smothers the flame
- ◆ Class ABC Halon 1211 -- Inhibits chain reactions of a fire
- ◆ Class BC -- Carbon Dioxide displaces air and cuts off the oxygen supply.



Automatic Sprinkler Systems

- ◆ Water -- Sprays a mist when activated by the heat of a fire
- ◆ Halon -- Sprays a halogenated chemical onto the fire. Halons decompose to toxic gases when heated. Use must be carefully planned.

PROCEDURES FOR FIRE FIGHTING



- ◆ OSHA regulations allow for three situations:
 - Total evacuation in case of fire alarm
 - Partial evacuation with some employees allowed to use fire extinguishers
 - All employees allowed to use fire extinguishers
- ◆ OSHA specifies training requirements if any employees are allowed to use fire extinguishers

USING FIRE EXTINGUISHERS



- ◆ If you think you can handle the fire, sound the fire alarm to set the emergency plan in operation
- ◆ Grab the closest fire extinguisher that conforms to the type of fire
- ◆ Activate the fire extinguisher and follow the directions for use
- ◆ If at any time you feel overwhelmed, or the extinguisher charge runs out, leave the area and wait for the professional fire fighters



INTEGRITY OF EQUIPMENT

- ◆ Fire fighting equipment must be well maintained and checked periodically for pressure and integrity
- ◆ Fire extinguishers must be placed prominently according to OSHA regulations
- ◆ Fire suppression equipment, such as sprinkler systems, must also meet the appropriate OSHA standard

REMEMBER !

**Fire Prevention Is
Everyone's
Responsibility**

