

# Glossary of Fire Terms

By

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## ACCELERANT

In chemistry, a catalyst (a compound that may speed up a chemical process). In fire investigation, the term is used to describe liquids and compounds utilized by arsonists in the setting of fires, such as alcohol, gasoline, charcoal lighter fluid, and paint thinner.

## ACETYLENE

A colorless hydrocarbon gas, C<sub>2</sub> and H<sub>2</sub>, that is produced by the action of water upon certain carbon compounds and used principally in welding and cutting operations.

## ALERT

The action the canine makes to indicate to the handler that an accelerant has been located.

## ALERT POINT

The point where a canine indicates that an accelerant is located.

## ALLIGATORING

Describes visual patterns showing the degree of the carbonizing process of wood when exposed to flame or sufficient heat. This results in structural deterioration of the wood, characterized by cracks and ridges resembling the back of an alligator.

## AMPERAGE

The strength of a current measured in amps.

## AMPERE (AMP)

A unit of rate of flow of electricity. Flow of electricity depends upon the pressure in volts and resistance, identified as impedance, in alternating current circuits.

## ANNEAL

Removal of tension from spring steel through the application of heat. An example would be coil springs that have collapsed within themselves and will not spring back after being exposed to heat and fire.

## ARC/ARCING

Either intentionally (by a switch), or accidentally (because of a loosened terminal), heating that results from high resistance when an electric current is interrupted. The degree of heat or intensity of the arc depends upon the amount of current in the circuit. Electric arcs can ignite combustibles because of sparks being thrown in the general vicinity of the fault, whereas fault type heating alone, in an overloaded conductor, may result in the ignition of insulation and of combustibles in the immediate proximity of the conductor. Either of the above conditions can result without opening the circuit breaker or other circuit safety device.

## AREA OF ORIGIN

The term used by fire investigators to describe the general area where a fire started. It is not limited to the specific point of origin. The term may describe an entire building in a multibuilding fire or a room in a structure.

## ARSON

To willfully and maliciously burn or cause to be burned, or aid, counsel or procure the burning of any structure, forest land or property. Does not include a person burning own property unless there is intent to defraud or there is injury to another person or damage to another person's property.

## AUTO-IGNITION TEMPERATURE

The minimum temperature to which material must be heated to initiate or create self sustained combustion, independent of any outside heat source. The term is also used in the discussion of spontaneous heating resulting from physical, chemical, and biological reactions.

## BEADING

A condition found on electrical wiring when arcing has occurred. The electrical wire ends appear beaded or formed into a series of melted round balls.

## BRITISH THERMAL UNIT (BTU)

The amount of heat necessary to raise the temperature of one pound of water one degree Fahrenheit (F), measured at 60 degrees F. One BTU equals 252 calories. It is important to recognize the difference between heat and temperature. Heat is quantity of measurement whereas temperature is the measure of intensity. Specific heat or thermal capacity of a substance is the number of BTUs required to raise the temperature of one pound of the substance one degree F or the number of calories to raise one gram of the substance through one degree Centigrade.

## BURNING POINT

The temperature which a substance must attain before it will ignite on the application of an ignition source or a flame. Pre-heated materials ignite more quickly when a flame is introduced because it may have already reached the burning point.

## BURN PATTERN

Used in defining and illustrating the progress of a fire by means of visible charring, decomposition, and displacement. It may be used to define carbonization from luminous and non-luminous combustion, spontaneous ignition process, and pyrolysis. It may be used in describing major fire progress or limited progress inside walls or isolated areas and spaces. When used by experts, they should be required to define the concept behind its use.

## BUSS FUSE

Device used for over current protection. May also be called plug fuse.

## CALORIE

The amount of heat required to raise the temperature of one gram of water one degree Centigrade, measured at 15 degrees C. One BTU equals 252 calories. As heat can be converted to energy, it may be said that one BTU equals 1.055 joules; one BTU per minute equals 0.0236 horse power.

## CARBON

A nonmetallic chemical element found in many inorganic and all organic compounds. Diamonds and graphite are pure carbon, and carbon is also present in substances such as coal, coke, charcoal, soot and smoke. Wood and some fabrics commonly deteriorate to carbon and charcoal in the process of decomposition and are subject to spontaneous heating in piles.

## CARBON BLACK

This may be formed by the incomplete combustion of natural gas and a liquid hydrocarbon or by a liquid hydrocarbon alone. It occludes oxygen and slow smoldering combustion may easily result if stored without proper cooling and ventilation. After thorough cooling and airing, carbon black will not heat spontaneously although heating may result from mixture with oxidizable oils. Dust explosion hazards may exist where carbon black is processed or stored.

## CARBON DIOXIDE

Gas which may be a product of combustion.

## CARBON MONOXIDE

Gas which may be a product of combustion.

## CAUSE

As used in fire investigation, identifying and describing the igniting agent or heat source of a particular fire. For example, some causes could be; "match ignited and thrown into combustibles.", "friction from electric motor belt from thrown bearings.", and "incendiary origin Molotov cocktail ignited and thrown into window of dwelling which then ignited draperies and carpet."

## CENTIGRADE

One Centigrade degree is 1/100 the difference between the temperature of the freezing and boiling points of water at one atmosphere of pressure. 0 is the freezing point and 100 is the boiling point of water.

## CHARCOAL

A black form of carbon produced by partial burning of oxidizing wood or other organic matter and compounds. Under certain conditions, charcoal reacts with air to heat spontaneously and ignites into self sustained flaming combustion. The more finely the charcoal is divided, the greater the hazard of combustion. Spontaneous heating may result from lack of sufficient cooling; lack of ventilation; becoming wet, then drying without ventilation; friction; being finely divided without ventilation; or leaving the residue in a chemically unstable condition.

## CHARRED

Used to define carbonization from luminous and non-luminous combustion, spontaneous ignition process or pyrolysis.

## CINDER

A hot, but not flaming, piece of partly burned material.

## CIRCUIT BREAKER

A type of electrical overcurrent device. There are circuit breakers and oil circuit breakers; adjustable and nonadjustable; and instantaneous and delay, with thermal tripping mechanisms. (REF: National Electrical Code) Overcurrent protection devices include thermal cutouts which are not intended to open short circuits or grounds, but may be used to protect motors and heavy branch circuits from overload, and plug fuses which are produced in several types including the onetime and the time delay (Type S), which is designed to discourage tampering or bridging. Overcurrent devices also include thermal cutouts which are not intended to open short circuits, but may be utilized to protect motors and motor branch circuits from overload. Others include various types and classes of cartridge fuses which may be equipped with drop out links, onetime fuses, super lag renewable, as well as dual element fuses of the blade and ferrule type. (REF: National Electrical Code)

## CIRCUMSTANTIAL EVIDENCE

Proof of circumstances surrounding the transaction; proof of certain facts and circumstances in a given case from which a jury may infer other connected facts which usually and reasonably follow according to the common experience of mankind.

## CITY GAS

This gas may be natural, manufactured, or liquified petroleum gas, or mixtures of any of these. Natural gas seems to be in most common use today and consists mainly of methane, a small amount of ethane, possibly some propane, butane, small amounts of carbon dioxide, and varying amounts of nitrogen. In compound the result is a lighter than air mixture at the meter.

## COMBUSTIBLE LIQUIDS

Liquids with a flash point at or above 200 Degrees Fahrenheit are sometimes referred to as combustible liquids. When a combustible liquid is heated to or above its flash point, it may have some of the hazards of a flammable liquid. (See Flammable Liquids)

## COMBUSTIBLE SOLIDS

Those solids found in greatest abundance in properties which constitute the greatest bulk of property destroyed by fire. These include all materials which will ignite and burn or undergo substantial chemical change when subjected to heat or flame. The chemical makeup of most ordinary combustible solids is carbon, hydrogen, and oxygen with lesser percentages of nitrogen and other elements. Cellulose is the main component of wood by weight; paper is almost pure cellulose. Cotton consists of 90 percent cellulose. Animal fibers consist of protein molecules containing high percentages of nitrogen as well as carbon, hydrogen, and oxygen.

## COMPETENCY OF A WITNESS

A person is competent to testify if he has sufficient understanding to receive, remember, and narrate impressions and is sensible to and understands the obligation of another. Competency also entails an adequate ability to observe, mental capacity, and other relevant factors.

## CONDUCTION

The process by which heat is communicated from one body to another by direct contact or through an intervening solid liquid or heat conducting medium. Some examples are; a steam pipe in contact with wood; a chimney flue in contact with attic or ceiling framing; a chimney flue in contact with attic or ceiling framing; a pair of pliers in contact with electrical conductors that are grounded through an electrode. The amount of heat transferred depends upon the heat conductivity of the materials and the area of thickness of the conducting mass. The rate of transfer is in direct proportion to the temperature differential between the points of entrance and departure.

## CONSUME

To destroy as by fire. To waste or burn away.

## CONTRACT

An agreement by which a person undertakes to do or not to do a particular thing. Within the meaning of the federal contract clause of the Federal Constitution, the term includes not only contracts as the word is ordinarily understood, but all instruments, ordinances, and measures which embody the inherent qualities or purposes of contracts and carry reciprocal obligations of good faith. (REF: Ballentine's definition of contracts.)

## CONTRACT MALA IN SE

This term includes all contracts of an immoral nature, iniquitous in themselves, and those opposed to sound public policy. Where both parties are in peridilcto (in equal fault), neither as a general rule, will be accorded relief in a court of law.

## CONTRACT OF INSURANCE

An agreement by which one party in a consideration promises to pay money or its equivalent, or do some act of values to the as-sured upon the destruction or injury of something in which the other party has an interest.

## CONVECTION

The process by which heat is moved by air differences, usually in a rising or circular pattern. For example, in the case of air circulation in a room, heat from a stove will move laterally if there is an obstruction to vertical movement such as a ceiling and vertically if there is an obstruction to horizontal movement such as a wall.

## CONVERSION OF CENTIGRADE TO FAHRENHEIT

The formula for converting Centigrade to Fahrenheit is:  $F = 9/5C + 32$ .

Example: convert 10C to F

$$F = 9/5C + 32$$

$$F = 9/5(10) + 32$$

$$F = 18 + 32 = 50 F$$

The formula for converting Fahrenheit to Centigrade is:  $C = 9/5F - 32$ .

## CORPUS DELICTI

The body of the crime, assuming that the specific crime charged has actually been committed by someone. The corpus delicti is made up of two elements; first that a certain result has been produced (i.e. a man has died or a building has been burned); and second, that someone is criminally responsible. (REF: Ballentine on corpus delicti and 7R.C.L.774) The corpus delicti specifically implies the body of the offense, or the substance of the crime.

In an arson case, the corpus delicti consists of two elements; first, that the fire occurred (the burning or fire must at least extend to a charring of the wood or fabric to satisfy the legal requirements of burning); and second, that a fire resulted from the willful and intentional ignition by a criminal agency. The first must be shown by affirmative evidence. The second may be shown by direct or circumstantial evidence. For example, if flammable liquids were present in the library of a dwelling and ignited by a trailer extending from the door, the corpus delicti may be established by providing the occurrence of fire and second, eliminating all reasonable, accidental sources of ignition such as electrical, mechanical, smoking, lightning, etc.

## CRIME

Under interpretations in our system, crime is a wrong of public character because it possesses elements of evil which effect the public as a whole and not merely the person whose rights of person or property have been invaded. The term includes felonies and misdemeanors. Crime is also defined as an act committed or omitted in violation of a public law either forbidding or commanding it.

## CRIMINAL CHARGE

A charge, strictly speaking, exists only when a formal written complaint has been made and a prosecution initiated against the accused. In the eye of the law, a person is charged with crime only when he is called upon in a legal proceeding to answer to such a charge.

## CRIMINAL CONSPIRACY

A combination of two or more persons attempting to accomplish, by some concerted action, some criminal or unlawful purpose, or to accomplish some purpose not in itself criminal, by criminal or unlawful means.

## CRIMINAL INFORMATION

A formal declaration of the charge or offense against a person, made by the prosecuting or district attorney, and filed in the court in which the person is to be tried.

## CRIMINAL INTENT

That evil state of a person's mind, accompanying an unlawful act, in the absence of which no crime is committed. In some crimes, the law requires specific intent such as in some statutes making it a felony to file a proof of loss with the intent to defraud an insurance company. In other crimes, the intent may be general as long as the act is willful and intentional, such as the willful and malicious act of setting fire to a railroad bridge. In certain crimes, the intent may be implied from the obvious willfulness of the act in which case malice may be inferred. It is important for the investigator to distinguish clearly between intent and motive. Motive is the reason, real or fancied, that a person had for committing an act. Intent, express or implied, is required under the law. Proof of motive is not a requirement under the law.

## CRIMINAL OFFENSE

As used in statutes permitting the introduction of evidence of commission of a criminal offense to affect the credibility of a witness, the term is generally held to include both felonies and misdemeanors, but not to include violation of a municipal ordinance.

## CRIMINAL PROCEEDING

The prosecution of a person charged with a criminal offense. The subsequent contemplation of the conviction and the punishment for the offense of the person so prosecuted. A proceeding against a juvenile offender is generally not a criminal proceeding.

## CRIMINAL PROSECUTION

A prosecution in a court of justice, in the name of the sovereignty of the jurisdiction involved, against one or more individuals accused of a crime. Although instituted by an individual, a criminal prosecution is not in any sense an action between the person instituting it and the prisoner.

## CRIMINAL STATUTE

A statute which describes an act or the omission of an act as a criminal offense. A statute authorizing punishment for contempt is a criminal statute. Statutes in this category may be either felonies or misdemeanors.

## CURRENT, ELECTRIC

Electrical current is of two kinds; direct (DC) and alternating (AC). Direct current is a continuous flow in the same direction, as in batteries; alternating current creates a flow which is periodically re-verses and creates a system of waves. The number of cycles is the number of waves per second. As a rule, alternating current circuits are in single or three phases. Single phase is carried by a two wire circuit although a third or neutral wire is often used which does not alter the principle. In a three phase, three wire, balanced (delta) circuit, the current flow in each conductor leads or lags the current in the other two conductors and the algebraic sum of the three is zero. Any of the two wires of a three phase circuit



is much greater than that required to operate it once it is in motion or at normal speed. The common voltages are 120/208 and 277/480. (REF: National Electrical Codes) The flow of electric current creates magnetic force and a change in magnetic field surrounding a system of wires. This produces an electric voltage which, in turn, creates current flow. These facts are the basis of the generator and the electric motor. Voltage is produced in the windings of the motors and generators. In a motor, voltage created by the rotor is known as back electromotive force. To some extent this restricts the flow of current through the motor. The current required to start a motor is much greater than that required to operate it once it is in motion or at normal speed.

#### CURTAIN BOARDS

A non-combustible barrier suspended to bank heat along a ceiling in order to enhance the effectiveness of a sprinkler or extinguishing system.

#### CRYOGENICS

This is the science of dealing with the behavior of materials at temperatures close to absolute zero. It is utilized in the handling of gases such as argon, oxygen, hydrogen, and nitrogen, for purposes of liquidification, transport, and storage.

(REF:NFPA Cryogenic Properties of Gases)

#### DEBRIS

The ruins or rubble which results from the burning of materials.

#### DECOMPOSITION EXPLOSION

Certain compounds are capable of decomposing almost instantaneously. Examples are commercial explosives, ammonium nitrate, and carbon disulfide. In addition, certain other endothermic compounds are subject to explosion under certain conditions. Explosive decomposition is usually accompanied by the release of large quantities of hot gases and in general, it is correct to say that the speed of release of the gases is proportionate to the violence of the explosion. Explosions and detonations may result in the formation of pressures attaining several hundred pounds per square inch. A pressure wave may spread in all directions at velocities from a few thousand to more than twenty five thousand feet per second and which, in turn, can cause damage to buildings and fixed objects. Some authorities classify explosions as low order (explosions of gunpowder and similar explosives) and high order (in groups of dynamite, nitro compounds, etc.)

#### DECOMPOSITION, HEAT OF

Heat of decomposition is the heat released by the decomposition of endothermic compounds, i.e. those requiring the addition of heat for their formation.

## DETONATORS

The term commonly used to describe the device employed in initiating the decomposition of explosive compounds such as dynamite and blasting gelatin. Detonators generally require two types of explosives; one being sensitive to heat or fire, such as the safety fuses, which will explode a second more powerful charge that detonates or boosts to the principal explosive. Lead azide is commonly used as the first detonator because of its high sensitivity. The detonators are usually designed to attach to the safety fuse or another remote triggering device and are contained inside a tubular copper or aluminum case, with an attachment suitable for crimping. Detonators are commonly designed for electrical activation.

## DIFFUSE EXPLOSION

The instant decomposition of combustible gases in appropriate mixture with air. In a limited space, this phenomenon may displace walls, bulkheads, and fixed objects. The combustion produces a great amount of sudden heat with expansion dependent upon volume. This is not a high velocity type explosion but is heat producing and capable of displacement damage as well as continuing fire.

## DIRECT EVIDENCE

Evidence given by witnesses who testify directly concerning their own knowledge of the main facts to be proven. Eye witnesses are a good example; "A" takes the witness stand and testifies that he saw "B" toss a burning object through the window of the dwelling and that immediately thereafter flames burst from the window and "B" ran from the scene.

## DISTILLATION

As used in fire investigation a laboratory process utilized in the recovery and analysis of accelerants. In simple distillation, the evidence specimen is heated to vaporize the residue and the vapors are condensed to reform as a liquid. In the process of steam distillation, the residue recovered from the scene is flooded with water and heated to the boiling point. Steam and vapors are introduced into the process and the condensed results are then separated. The accelerant, if any, is then identified. Vacuum distillation is a process in which any accelerant present in the suspected specimen is removed by simultaneous application of suction and heat.

## DUST EXPLOSION

The rapid order combustion of finely divided particles of combustible solids in an atmospheric oxygen environment when an igniting source is present. The fine particles or dust may be from coal, plastics, grain, explosive powders, wood cotton, industrial waste, or light metal. The phenomenon may be accompanied by considerable heat but is not considered in the high explosive order although low order explosive damage and displacement may result.

## DYNAMITE

A high explosive, principally consisting of nitroglycerin absorbed in inert solid materials to reduce sensitivity to shock. Straight dynamite is essentially nitroglycerin absorbed in a combustible absorbent such as wood pulp and extra oxidizing materials such as sodium nitrate with a small amount of calcium carbonate or zinc oxide. Ammonia dynamite consists of ammonium nitrate with nitroglycerin, in smaller percentage, and may also include sulfur and cereal products along with a neutralizing zinc oxide. Gelatin dynamite broadly covers a variety of compounds with the common factor consisting of the substitution of smokeless nitrocellulose powder for relatively inactive wood pulp. The compounds are gelatinous and plastic in mass and are sometimes called blasting gelatin. It is generally considered more potent than ordinary dynamite. Dynamites are considered far more stable to shock than nitroglycerin although the dynamite compounds will explode on overheating and exposure to heavy shock, such as impact by a bullet. The dynamites become unstable in conditions of improper storage, aging, and crystallization. Disposal should be restricted to explosives experts.

## ELECTRICITY

In the context of flowing through conductors, electricity is composed of identical particles called electrons that are much lighter than atoms. Electrons weigh only  $\frac{1}{1837}$  as much as an atom of the lightest chemical element, hydrogen. (In this context, electricity may be described as "an electric current; a stream of moving electrons, setting up a magnetic field of force through which it produces kinetic energy")

## EVIDENCE

That which makes clear or verifies the truth of the very fact or point in issue, whether from the defense or the prosecution. Those rules of law whereby we determine what testimony is to be admitted, what is rejected in each case, and what weight is to be given to the testimony so admitted.

## EXPERIMENTAL EVIDENCE

This is proof of a fact or theory in the form of an experiment made during the course of the trial and in the presence of the jury and usually in the courtroom. The admission of such evidence is entirely within the discretion of the court and neither party can demand it as a matter of right.

## EXPERT OPINION EVIDENCE

The testimony of an expert in which he is permitted to state his opinion on a question of science, skill, or trade. Thus the opinions of medical men are regularly admitted as to the cause of disease, death, consequences of wounds, sanity, and state of mind. Numerous other professional's testimony is similarly considered. In many Federal and State jurisdictions, witnesses who qualify to the satisfaction of the Court to be especially skilled in the chemistry and behavior of fire are permitted to form and express opinions to the jury as to origin and cause of the fire. They are never permitted to testify as to who set the fire; that is the exclusive province of the jury. The jury may believe or disregard the opinions or conclusions of an expert witness or weigh his credibility in the same manner they can weigh

the testimony of any other witness. In some jurisdictions, courts only allow an expert fire witness to testify as to his findings; for example, that he found evidence of a bomb, accelerant, or separate and distinct points of origin. Courts in those jurisdictions that are more conservative about the admission of expert testimony will not permit the expert to state his conclusion of opinion as to cause. They hold that this area is the excessive province of the jury or the triers of fact.

#### EXPERT WITNESS

An expert witness is one who has acquired such special knowledge of the subject matter about which he is to testify, either by study with recognized authorities on the subject or by practical experience, so that he can give the jury assistance and guidance in solving a problem of which their good judgment and average knowledge is inadequate.

#### EXPLOSION

An explosion is an instantaneous decomposition of a solid or liquid substance, extending throughout the entire mass and accompanied by considerable disengagement of heat. The substance is partly or wholly converted into gaseous decomposition products.

#### EXPLOSIVE LIMITS (Flammable limits)

In the contact of gases and vapors which form flammable mixtures with atmospheric oxygen (oxygen and nitrogen), and pure oxygen there is a minimum concentration of vapor in air or oxygen below which flame propagation does not occur on contact with an ignition source. There is also a maximum proportion of vapor or gas in air above which flame or explosion will not occur. These boundary line mixtures of vapor or gas with air are known as the lower and upper flammable or explosive limits and are usually expressed in terms of percentage by volume. Generally, it may be said that if a mixture is below the lower flammable, or explosive limit, it leans toward exploding or burning; above the upper flammable or explosive limit, the mixture is too rich to burn or explode. (For example, in pumping liquids such as hydrocarbon fuels from storage tanks, it is a common safety practice to replace the volume with inert gases, thereby eliminating the possibility of the introduction of an explosive mixture in the oxygen gas vapor spectrum. An inert gas will neither flame nor explode).

#### EXAMPLES OF EXPLOSIVE LIMITS

(In percent by volume of vapor-air mixtures)

Substance	Low Limit	Upper Limit
Acetone	2.15%	13.0%
Allyl Chloride	3.11%	11.1%
Butyl Alcohol	2.4%	8.0%
Gasoline	1.4%	7.6%
Hydrogen	4.0%	75.0%

## EXPLOSIVES

Solid or liquid explosives represent gases or vapors condensed into the smallest possible compass. The substance used in the blasting or explosive arts are generally termed explosives or blasting materials. Their detonation results in a sudden and enormous expansion of gases and vapors which are liberated from the previous condition of chemical combination. In addition to the commonly known and special industrial explosives, certain fertilizers and chemical industrial compounds are unstable and require special handling in packaging, transportation and storage and will explode violently under conditions of mishandling or misuse. These compounds are described in various industrial and public safety manuals. Some of the more common blasting explosives are ammonite, blasting powder, chlorate powder, carbonite, explosive gelatine, guhur dynamite, gelatine dynamite, wetterdynamite, nitroglycerin, and nitrocellulose.

## FAHRENHEIT TEMPERATURE

A temperature scale which sets the boiling point of water at 212 degrees and the freezing point at 32 degrees above the zero point on the scale.

## FELONY

As a general rule, all crime punishable by death or imprisonment in the state prison are felonies; all others are misdemeanors.

## FIRE (Combustion)

As used in the discussion of combustion, fire is the process whereby substances, or individual constituents of the same, combine with oxygen accompanied by the liberation of heat. Three factors are necessary to the process in general sense; the body or supporting factor (oxygen). The substance to be consumed (such as wood, coal, etc.) and the disseminating factor (heat).

## FIRE GASES

Fire gases generally refer to the gaseous products of combustion. Most combustibles contain carbons which, when burned form carbon dioxide when the oxygen supply is good and carbon monoxide when the air supply is poor. Other gaseous products of combustion may include hydrogen sulfide, ammonia, sulfur dioxide, hydrogen cyanide, nitric oxide, phosgene, and hydrogen chloride. The products of gases depend mainly upon the chemical composition of the fuel as well as ventilation and combustion temperatures during the process.

## FIRE LOAD

The fire load of a space or occupancy is the expected amount of combustible materials in the area or space under consideration. It can generally be expressed in the terms of the weight of the total combustibles per square foot of the occupancy in relation to their heat producing capability in the calories or BTUs. Most fuels, such as wood fibers petroleum products, books, papers and furniture may

be rated in BTUs per pound and the fire load thereby generally computed. However, construction in or ventilation of the space may produce substantial variables. Predictions can only be general. American and British laboratories have produced standard time temperature curves for various classes of occupancies based upon calculated fire loads which may be utilized for references.

#### FIRE PARTITION

A partition serving to restrict spread of fire but not related as a fire wall.

#### FIRE POINT

The lowest point in temperature at which a flammable liquid in an open container will produce vapors in continuing combustion. The fire point is usually a few degrees above the flash point except in certain unstable compounds.

#### FIRE RESISTANCE

Uniform building codes define fire resistance as a relative term used with a numerical rating or modifying adjective to indicate the extent to which building materials, structures, or other materials resist the effect of fire; for example, resistance of two hours as measured on the standard time temperature curve.

#### FIRE SUPPRESSION

Those activities (usually performed by fire department personnel) required to extinguish a fire. Those activities may include the application of water on the burning material, venting of a structure or removal of debris.

#### FIRE TRIANGLE

A term used in some fire training courses to illustrate the need for the three factors essential for fire; fuel, heat and oxygen. Basically, combustion depends upon the substance to be consumed, oxygen (the supporter of combustion), and the disseminating factor which is heat. The disseminating factor may result from physical, chemical, or biological reactions.

#### FIRE WALL

Broadly defined as a wall erected to prevent the spread of fire. Effective, approved walls must have sufficient fire resistance to withstand the effects of the most severe fire that can be expected in the building and must provide a complete barrier, along with any openings suitably protected.

#### FLAME

It is generally conceded that burning materials, when supported by sufficient oxygen, produce luminosity called flame. It is generally accepted that flame is a distinct product of combustion. The sufficiency of the flame and its extension depends upon the fuel, availability of oxygen, and quality of fuel or fuel load. The color of the flame may vary with the type of fuel and also with conditions of draft;

it may also vary with degree of temperature. For example, a natural gas flame, under poor conditions of draft and ventilation, may appear lazy and yellow or orange; under appropriate and well adjusted ventilation effects, it may appear blue.

#### FLAMESPREAD

Once ignition occurs, it is the propagation or movement of flame from layer to layer and/or across surface exposures without regard to the source. There are a number of accepted methods of testing materials and surfaces for flame spread and scaling possible rate of spread under fire conditions.

#### FLAMMABLE

Generally used in fire investigation and code standard to describe combustible material that ignites readily and burns intensely with rapid flame spread. The term is used in a general sense without a clear definition of ignition temperature, surface burning rate, or other defined guidelines. The term is preferred over inflammable in order to avoid possible confusion due to the prefix "in" which suggest the negative, such as in the term non-flammable.

#### FLAMMABLE LIQUIDS

Fire protection authorities, including the National Fire Protection Association, have established an arbitrary division between liquids and gases which is defined in NFPA #30 of the Flammable Liquids Code. Liquids are those having a vapor pressure not exceeding 40 psi absolute at 100F approximately 25 psi gauge pressure. Flammable liquids are those having closed cup flash point below 200F. and are divided into three classes in the Flammable Liquids Code. Combustible liquids are those with a flash point at or above 200F. When a combustible liquid is heated to or above its flash point, it may have some of the hazards produced by flammable liquids.

#### FLAMMABLE (EXPLOSIVE) RANGE

This is the range of combustible vapor or so called gas air mixture between the lower and upper limits commonly described as the flammable or explosive range. Flammable or explosive ranges of percent of vapors in air vary widely. For example the explosive range of Gasoline is 1.4% (lower) and 7.6% (upper) limit; Hydrogen gas is 4.0% (lower) and 75% (upper); Ethyl Alcohol is 4.3% (lower) and 19% (upper).

#### FLASHOVER

Initial progress of a fire may be slow or fast depending upon the characteristics of initial ignition and basic fuel. Important factors are the nature of the fuel or fabric, its surface, finish, environment, and available oxygen. If the fire continues, it may eventually reach a stage where all exposed combustible surfaces simultaneously burst into flame. This is what is generally known as flashover and is significant in the communication of fire from space to space, even in supposedly separated areas. Flashover is a common phenomenon a product of fuel load, combustible surfaces, temperature, and available oxygen. The results of flashover may be mistaken by inexperienced fire investigators as separate and distinct

areas of origin; this sometimes creates the mistaken illusion that a fire was incendiary when, in fact, it was not.

#### FLASH POINT

The flash point is the lowest temperature at which a substance gives off vapor sufficient to form an ignitable mixture with the air near the surface of the substance. In respect to its use in the terms of vapors and flammable liquids, the term ignitable mixture is used in the context of flammable range. When ignited between the upper and lower limits, it is capable of flame propagation away from the source of ignition. Combustion may not be continuous at the flash point, depending upon fuel, extent, and environment. As indicated above, the term flash point most commonly applies to flammable liquids although there are many solids that may slowly deteriorate, sublime, or become chemically active at normal ambient temperatures. Many others will react in slightly higher temperatures or when exposed to direct rays of the sun, producing vapors which will flash while the substance retains its basically solid state.

#### FRAUD

Conduct which operates prejudicially on the rights of others and is so intended; a deception practiced to induce another to part with something of value, or surrender some legal right and which accomplishes a desired end. As commonly used, the word implies deceit, deception, artifice and trickery.

#### FUEL BREAK

An artificially created or natural separation between buildings and improvements and forest or flammable vegetation, or through wild lands to enable fire crews to combat and control advancing fire. The construction, permitted cover, and widths depend upon code and official discretion in relation to the risks involved, terrain, and adjacent natural vegetation.

#### FUSIBLE LINK

Metal parts designed to separate at desired temperatures to release or otherwise activate self closing fire doors or openings. Fire doors, for example, may be made self closing by a system of weights suspended by wires, or pulleys restrained by fusible link or other fixed temperature release or heat responsive device.

#### GALVANISM

Electric current in energy resulting from a chemical reaction.

#### GAS

Gas is an aeriform fluid of matter lacking independent shape or volume, which tends to expand indefinitely. The properties of gases, and their behavior, can only be explained by assuming that they are composed of extremely minute particles in constant motion the higher the temperature, the more violent the motion. For fire protection purposes, gases are generally divided into two broad categories;



flammable and nonflammable. The hazards of flammable gases are generally similar to flammable liquids and there is really no sharp line of demarcation between gases and liquids in respect to fire hazard; further any actual gas, at a sufficiently low temperature and high pressure, becomes a liquid and any flammable liquid at a sufficiently elevated temperature becomes a gas.

#### GAS CHROMATOGRAPH

An instrument used by forensic experts to identify accelerants in fire debris. A specimen is analyzed and graphed. The graphs produced by this instrument are compared to accepted standard graphs of known accelerants and the specimen can then be identified. This instrument cannot detect accelerants in minute amounts and should not be considered conclusive evidence of the presence or absence of an accelerant.

#### GASOMETER

An instrument designed to measure gas, such as an explosion meter.

#### GRAM

The basic unit of mass in the metric system.

#### GRAVITY

In physics, gravity is used in terms of weight in resistance to terrestrial gravitation. The rate of acceleration of gravity is approximately 32 feet per second. It is also used in terms of the weight of liquids and oils.

#### HALOGENS

The members of this group are chemically active and have similar chemical compositions. Some halogens include bromine, chlorine, fluorine, and iodine. They differ from each other only in the degree of activity. They are noncombustible but will support combustion of certain compounds. Turpentine, phosphorus, and some finely divided metals will ignite spontaneously in the presence of halogens. Halogen fumes are poisonous, corrosive, and extremely irritating to eyes and throat.

#### HARDWOOD

Hardwoods such as oak, ash, mahogany, and gum are commonly used in finishing and veneers, and also in certain key construction members. Coniferous woods such as pine, cypress, and some of the cedars are softwoods used in framing. There is very little difference between hard and soft woods in reaction to fire except in some redwoods.

#### HEAT

As related to combustion, heat may be manifested in the form of rapid oxidation, with the evolution under certain circumstances, of flame, smoke and light. A knowledge of the conditions that determine whether rapid oxidation of a substance with evolution of light will occur is essential to the principles of

fire control and investigation. All substances are made up of atoms or groups of atoms (molecules). Each atom consists of units of energy in the form of electrons, protons, and neutrons in continuous motion ultimately expressing individual composition in the form of energy. Energy can be expressed in the form of heat. Chemical reactions are endothermic or exothermic. Exothermic reactions are those which produce products with less total energy than the reacting substance whereupon the energy has been released in the form of heat. Endothermic reactions produce products with more total energy than the reacting substances whereupon energy in the form of heat has been absorbed. Oxidation reactions involved in fires are exothermic in the sense that one of the products of the reaction is heat. While, by far, the most common oxidizing material is the oxygen of the atmosphere (one fifth oxygen and four fifths nitrogen), certain chemicals, such as sodium nitrate and potassium chlorate, can also readily release oxygen under favorable conditions thereby supplying the flame environment or even creating an explosive environment. Certain pyroxylin plastics contain sufficient oxygen combined in their molecules to produce combustion without an outside source; zirconium dust may be ignited with carbon dioxide. Other explosive and industrial compounds, as earlier stated, will produce oxidizing conditions sufficient for graduated or instantaneous decomposition accompanied by the disengagement of heat.

#### HEAT EXPLOSION

A term used by some firemen and investigators which they interpret synonymously with flashover. There is considerable doubt about the accurate usage of such a term since it has been utilized to categorize widely different situations of fire behavior under the same classification.

#### HEAT OF COMBUSTION

The amount of heat released during the process of complete oxidation, generally referred to as calorific value. Heat of combustion depends upon the arrangement and numbers of atoms in molecules. Calorific values are commonly expressed in BTUs per pound or in 1 gram calories per gram. (Sawdust produces approximately 8,490 BTUs per lb; cotton about 7,000 BTUs per lb.; while cottonseed oil produces approximately 17,200 BTUs per lb; and crude oil approximately 18,000 BTUs per lb)

#### HUMIDITY

The amount or degree of moisture in the air. Relative humidity is the amount of moisture in the air as compared to the amount that the air could contain at the same temperature. While relative humidity has only a moderate effect on a structure fire once ignition occurs, it is a factor in the moisture content of wood and vegetable materials as well as fabrics.

#### HYDROCARBON

Any compound containing only hydrogen and carbon; benzene and methane are examples of hydrocarbons.

## IGNITION

The heating of a compound or substance to the point of continuing combustion or chemical change.

## IGNITION, SPONTANEOUS

In general terms, this is the process wherein substances or compounds ignite as a result of an increase in temperature of the substance or compound without an independent outside ignition source and without drawing heat from its surroundings. It is sometimes called spontaneous combustion by laymen although it may occur over a long term period such as in unventilated, piled, green hay or other vegetable products; coal dust; charcoal; and oil paint rags. The rate of heat generation, air supply, and insulation properties of the suspect fuel and surrounding environment have definite relevance to whether or not spontaneous heating will occur. In most vegetable compounds, the process may be slow; on the other hand, with unstable or rapidly oxidizing compounds, heat generation may be rapid and even explosive. The process may be luminous or nonluminous. It may occur with or without smoke.

## IGNITION TEMPERATURE

Ignition temperature is generally defined as that point of minimum temperature to which a solid, liquid, or gaseous substance must be heated to initiate or cause self continuing combustion, independent of the heating or igniting source. Experience and tests have shown that ignition temperatures may vary with change in conditions and environment and listed ignition temperatures should be considered as only approximations. For example, ignition temperatures of flammable liquids and vapors may vary depending upon vapor or air gas mixture, size and shape of the contained environment, and other chemical and physical factors. This is why there is some variation in reported ignition temperatures by different laboratories. The ignition temperature of combustible solids may be reasonably influenced by the rate of airflow, rate of heating, surface conditions, and size of the particular solid.

## IMPEDANCE

In reference to alternating electric current, the apparent resistance corresponding to the true resistance in direct current; a combination of inductive reactance and resistance is referred to as impedance. The symbol  $Z$  and the quantity is measured in ohms. There are two methods of determining the impedance of a circuit that is made of both inductive reactance and resistance. These are the vector or impedance triangle method and the computation method. (Load and resistance have relevance to fire cause.)

## INCENDIARY

In fire investigation, describes a fire set by human hands. This fire is usually started by applying some type of flame producing device (match or lighter) to flammable materials. The flame producing device is usually removed after igniting the materials. Fire investigators may determine a fire to be incendiary after all accidental causes have been eliminated.

## INERT

The term indicates a physically neutral or inactive substance such as nitrogen, helium, and other gases which present no fire hazard and can neutralize atmospheres which would otherwise be explosive. For example, inerting systems are used to pump inert gases into contained explosive atmospheres as when oil tanks are pumped out during discharge of tanker cargoes. Inerting systems may also be utilized to extinguish fires.

## INSURANCE

A contract whereby one undertakes to indemnify another against loss, damage, or liability arising from an unknown or contingent event.

## INSURANCE ADJUSTER

An agent of an insurance company whose general duty it is to adjust and report losses to the principal officers of the insurance company. Under relatively recent usage, adjusters may be direct employees of the insurance carrier or agents by retainer or special assignment. Insurance adjusters may also be retained directly by the insured to represent the interest of the insured in his negotiation with the insurance carrier.

## INSURANCE AGENT

One who negotiates policies of insurance for a commission paid to him by the insurance company.

## INSURANCE BROKER

One who acts as a middleman between the insured and the insurer and who solicits insurance from the public under no employment from any special company, but having secured an order, places the insurance with a company selected by him. A broker is the agent for the insured, though at the same time, for some purposes, he may be the agent for the insurance carrier. Any acts and representations within the scope of his authority as such agent are binding on the insured.

## INSURANCE CARRIER (Insurance Company)

Within the general context, a company engaged in the business of making contracts by which it agrees to indemnify the other parties (the insured or designated) from a loss or damage which they may suffer from a specified peril.

## INSURANCE CONTRACT

A contract whereby one person undertakes to indemnify another against loss, damage, or liability arising from an unknown or contingent event.

## INSURANCE MONEY

Money recoverable on a policy of insurance by the insured against the insurance company which issued the policy.

## INSURANCE POLICY

An agreement by which one person, for a consideration, promises to pay money, an equivalent, or do some act of value to another upon the destruction or injury of something by specified peril.

## INSURE

To contract to indemnify a person against loss from stated perils; to enter into a contract of insurance as insurer.

## INSURED

When used as a noun in fire policies, it is the person whose property and legal representatives is insured, but it should not be extended to include any other persons, such as the mortgagee of the property.

## INSURER

A person who by contract of insurance, agrees, to indemnify another person, called the insured, against loss from certain specified perils.

## INTENT

In the legal sense, intent is distinct from motive and may be defined as a deliberate act to effect a certain result. Motive is the reason which leads the mind to desire that result. In a trial for arson, the prosecution must show that the act of setting the fire was intentional as opposed to accidental.

## INVESTIGATIVE LEAD

The continuing inquiry resulting from basic information. For example, stated facts must be verified by a disinterested third party before the information can be accepted as fact. The investigative leads are indispensable in factual investigation. The pursuit of investigative leads is all too often neglected.

## KINDLING

Some fire authorities classify the ordinary fire fuels into three categories; tinder, kindling, and bulk fuel. Tinder is described as material ignitable by a common domestic match and will continue to burn. Kindling is defined as material that will ignite and burn if associated with sufficient tinder but in which a match will not produce a continuing fire. Bulk fuel includes the heavy timbers.

## KINETIC

Movement resulting from motion.

## KINETICS

The science that deals with the motion of masses in relation to the forces acting on them (as in explosions).

## KINETIC THEORY

The theory that the minute particles of all matter are in constant motion and that the temperature of a substance is dependent upon the velocity of this motion. Increased motion is accompanied by increased temperature. According to the kinetic theory of gases, elasticity, diffusion, pressure and other physical properties of gasses are due to the rapid motion (in straight lines) of the molecules; to their impact against each other and the walls of the container; to weak cohesive forces between the molecules, etc.

## LATENT HEAT

In general, the additional heat required to change the state of a solid to liquid at its melting point or from liquid to gas at its boiling point after the temperature of the substance has reached either of these points.

## LATENT HEAT OF VAPORIZATION

Latent heat of vaporization is the heat which is absorbed when one gram of liquid is transformed into vapor at the boiling point under one atmosphere of pressure. It is expressed in calories per gram or BTUs per pound.

## MALICE

In legal sense, a condition of the mind which shows a heart devoid of social duty and fatally bent on mischief, the existence of which is inferred from the acts committed or words spoken. Malice means an intentionally wrongful act without just cause or excuse, or as the result of ill will; it does not necessarily signify ill will toward a particular individual. Hence the law implies malice where one deliberately injures another in an unlawful manner.

## MELTING (failing) POINTS

The following are approximate melting points in degrees Fahrenheit. (REF: NFPA)

Aluminum	150-1500
Brass	575-1800
Copper	1981 (average)
Glass	400-1600
Iron (pure)	2795
Iron (gray cast)	2246
Iron (white cast)	2102
Iron (wrought)	2750
Iron (cast)	2000-3800
Steel	2350-2675
Tin	425-475
Zinc	750-775

Unprotected steel columns fail in 15 minutes in fire tests. Unprotected cast iron columns fail in 30 minutes. Three inch plan floor or four inch laminated floors fail in 45 minutes.

## MISDEMEANOR

Any crime which is neither punishable by death nor by imprisonment in a state prison.

## MOTIVE

In criminal law, motive is that which leads or tempts the mind to indulge in a criminal act. It is not necessary to establish motive for a conviction, though it explains the actions of the parties or connects the defendant with the offense charged.

## NEGLIGENCE

Failure to take the care to be expected from a reasonably prudent person.

## NONWAIVER AGREEMENT

An agreement between an insurer and insured that the investigation activities of the insurer in connection with the claim shall not waive or invalidate any of the provisions of the insurance contract or any of the rights of either of the parties.

## OHM, OHM'S LAW

An ohm is the unit of electric resistance. The relationship between volts, amps, and ohms is stated as follows:

$I$  equals current in amps

$E$  equals electromotive force in volts

$R$  equals resistance in ohms

$I=E/R$   $R=E/I$   $E=IR$

## ODOMETER

An instrument for measurement of radio or electronic wavelength.

## OXIDATION

Generally, the union of a substance with oxygen: the process of increasing the positive valence or decreasing the negative valence of an element or ion; the process by which electrons are removed from atoms or ions.

## OXIDE

A binary compound of oxygen and some other element.

## OXIDES

Oxides of metals and nonmetals react with water to form alkalines and acids respectively; this reaction may occur violently with sodium oxide. Calcium oxide, more commonly identified as quicklime, also reacts with water accompanied by the evolution of sufficient heat to ignite combustible materials such as cloth, paper, and wood.

## OXYGEN

A colorless, odorless, tasteless, gaseous chemical element that is the most abundant of all elements. It occurs free in our atmosphere of which it forms one fifth, in volume, along with nitrogen. Oxygen is very active and is able to combine with most other elements. It is essential to the life and growth processes, as well as to combustion.



In an atmosphere of pure oxygen, combustion is more intense than in an environment of atmospheric oxygen which is approximately only one fifth pure oxygen and four fifths nitrogen. Oxygen may be manufactured by liquefying air and separating the oxygen from the nitrogen by a process based on their differences in boiling points called fractionating; oxygen may also be produced by the electrolytic decomposition of water separating it into its constituents; hydrogen and oxygen. Hydrogen gas is lighter than air, extremely explosive, and with a fairly wide explosive range. Liquid oxygen is used widely in industry. Liquid oxygen, reduced to the liquid state under extremely low temperatures and container stored, weighs about 71 lbs. per square foot and, at atmospheric pressure, its temperature is 297 degrees F. Carbonaceous material, mixed with liquid oxygen, is used as an explosive.

#### OZONE

An allotropic form of oxygen usually resulting from or formed by electrical discharge in the air; also used as an oxidizing, bleaching, or deodorizing agent in the purification of water.

#### OZONIC

A solution of ethylic ether, hydrogen peroxide, and alcohol.

#### PATTERNS OF SPREAD

The term used by fire investigators to describe the remaining physical evidence of the progress of the fire from origin to control. A great deal of fire terminology is utilized by investigators to explain these patterns such as depth of char, smoke staining and V-Patterns. There is no known scientific authentication and no evidence that any one combination of the terms or methods is precise in any given fire. Because of fire load, weather conditions, fire suppression activities and other various conditions, patterns of spread are unique to each fire.

#### PILOT LIGHT

In general, a gas fueled burner, utilized to rekindle a principal burner (main burner) and commonly used in domestic and industrial gas fueled appliances. The more modern devices are utilized and regulated with automatic safety controls.

#### PLASTICS

Plastics may be generally described as compounds consisting of small molecules known as monomers that link together into long chains to form polymers and copolymers. In respect to their reaction to fire, plastics may generally be classified as either thermoplastic compounds which soften when heated or thermosetting plastics, once set, cannot be re-softened. Plastics reaction to heat and fire as well as toxicity of their combustion products show considerable variation.

#### PLUG FUSES

Devices used for overcurrent protection. There are several types including the ordinary one-time type, the time delay type and the S type which does not have to be time delay. The S type may be designed

so that the 16 to 30 amp classification cannot be used in fuse holders of the two initially described. Plug fuses are sometimes called buss fuses.

#### POINT OF ORIGIN

In the context of fire investigation, point of origin means the precise location where the initial ignition of the substance took place; usually, the location of the heat source is indicated. Point of origin is more specific than area of origin.

#### PRESSURE, EXPLOSIVE

Explosions may be characterized by energy release apparent in effect but not cause. Depending upon their causes, explosions are of four principal kinds; energy release generated by rapid oxidation of gasoline vapor; release of energy generated by rapid decomposition such as in a dynamite explosion; release of energy caused by excessive pressure such as in a boiler explosion; and energy release created by nuclear fission or fusion, such as a hydrogen bomb explosion. A practical method of differentiating between fire and explosion is that an explosion develops forces which may cause violent displacement of structures or other objects, and indicates the presence of pressures developed by the explosion of vapors and other materials.

#### PRODUCTS OF COMBUSTION

The term is usually used in the context of physical and visible results of a fire in the form of combustion gases, flame and smoke. Most combustible materials contain carbon, which burns to form carbon dioxide when the air supply is ample. When the air supply is limited, carbon monoxide may be apparent. Some of the other gases may be formed when the materials burn and these may include ammonia, hydrogen cyanide, hydrogen chloride, nitric acid, phosgene, hydrogen sulphide, sulfur dioxide, and other gases, depending upon the subject of combustion and temperature rise in the combustibles.

#### PYROLYSIS

Generally defined, pyrolysis is physical and chemical decomposition by heat. Since the organic nature and structure of commonly combustible fuels vary, the process varies. When heated, organic compounds, such as wood, are subject to complex deterioration to simpler compounds which progressively may become more volatile and therefore more flammable than the previous structure. The heating need not occur in the form of apparent flaming combustion; it may be accomplished by exposure to steam pipes, electrical heat producing sources, or inert gases. Pyrolysis has occurred in wood framing in sealed walls where adjacent heat producing steam pipes have gradually carbonized (pyrolyzed) the wood framing over the years. The process will ultimately produce flaming combustion. At the other end of the time spectrum, the phenomenon may occur in a relatively short period of time.

## PYROPHORIC MATERIALS

These are compounds that may ignite spontaneously. They may be called pyrophor and include materials such as titanium; hafnium, uranium; and thorium as well as phosphorated hydrogen; ethyl, methyl, and propyl compounds; and potassium sulfide.

## RADIATION

As used in fire investigation, radiation is one of the three methods or media by which heat is transferred. The three methods being conduction, convection, and radiation. Radiation is the heat transfer, from one body to another, by heat rays, through intervening space, in much the same manner as light is transferred by light rays. Two examples are heat from the sun and heat from an electric heater adjacent to a wall. Radiated heat passes freely through a vacuum and through gases, like light, heat is reflected from glass or another bright surface.

## SABOTAGE

The damaging of property or hindering of production in an underhanded effort to defeat or harm persons or property.

## SEARCH PATTERN

The method used by the Accelerant Detection Canine Team to cover a complete area when searching for accelerants.

## SELF-INCRIMINATION

The giving of testimony as a witness against one's will. The United States Constitution provides the Fifth Amendment guaranteeing that no one shall be compelled to testify against himself in the Federal courts and nearly every state has embodied the same provisions in their respective constitutions. The guarantee extends to self incrimination situations during interviews by peace officers and certain governmental representatives.

## SMOKE

The vaporous matter resulting from some forms of combustion and made visible by minute particles of carbon suspended in the vapor. In chemistry, suspension of solid particles in gas. Under the usual conditions of insufficient oxygen for complete combustion, there may also be present methane, methanol, formaldehyde, and formic and acetic acids. The combination of the combustible, rate of heating, oxygen concentration at or near the combustible surface, along with temperatures, usually determines the composition of fire gases and the resulting smoke, if any. The color of the smoke may vary with the composition of the combustibles and by ventilation or application of water. Smoke particles may cool to the extent where water vapor, acids, and residues of the combustibles involved may be identified if recovered from areas such as windows or other surfaces. It is, of course, well established that moisture laden particles, if inhaled, may carry highly poisonous or irritating compounds

into the respiratory tract and eyes. If allowed to accumulate in a building, hot unburned products of combustion will ignite explosively when a supply of oxygen is suddenly made available. (See Flashover) Some firemen and investigators call this phenomenon a smoke explosion. This is one of the prime reasons why firemen vent fires, usually by opening windows, doors, or by cutting holes in the roof.

#### SMOKE STAINING

Smoke particles will adhere to unburned surfaces such as walls and windows within a burned structure. Smoke staining assists the investigator in determining whether the fire spread was rapid or slow and whether accelerants were burned.

#### SPECIFIC GRAVITY

The ratio of the weight or mass of the given volume of a substance to that of an equal volume of another substance used as a standard. (Water for liquids and solids, air or hydrogen for gases) The specific gravity of gasoline and other petroleum products, for example is commonly measured in Degrees API (American Petroleum Institute.)

#### SPECIFIC HEAT

The ratio of the amount of heat required to raise the temperature of a unit mass of a substance one degree to the amount of heat required to raise the temperature of the same mass of water one degree; the number of calories required to raise the temperature of one gram of a given substance one degree Centigrade.

#### STATIC ELECTRICITY

Designed as stationary electrical charges or discharges in the atmosphere; frictional electricity such as produced in movement of bodies or fabrics on surfaces. It is relevant to fire investigation in that electrical charges, without proper bonding or grounding, may introduce a spark or arc into an explosive or combustible environment. Some examples are improperly bonded or grounded fuel lines, tanks, and pumping facilities.

#### SUBROGATION

As used in civil actions, the substitution of one for another so that the new party succeeds to the former's rights or legal claims. It is frequently referred to as the doctrine of substitution. It is a device commonly used in insurance litigation, adopted or invented by equity to compel the ultimate discharge of a debt or obligation. It is the mechanism by which the equity of one man (or party) is worked through the rights of another. The right of an insurer on payment of a loss to be subrogated pro tanto to any right of action which the insured may have had against any third person whose wrongful act or neglect caused the loss insured against by the insurer is one example.

## TEMPERATURE

The degree of hotness or coldness of any substance or body, usually measured in terms of Kelvin or Rankine temperature.

## THERMOSTAT

Thermostats are widely used, fixed temperature heat detectors used in signaling systems. Probably the most common type is the bimetallic type which utilizes two metals with different expansion coefficients resulting in movement of the strip and closing or opening of the contacts regulated to the temperature function.

## TORT

An injury or wrong committed either with or without force, to a person or person's property. Such injury may arise out of nonfeasance, malfeasance, or misfeasance.

## TRAILER

A term used to describe the means utilized to extend an ignition point from a location outside an occupancy into the space where the plant or booster may be located. Trailers often connect various "plants" or "sets" inside a space to insure complete involvement within a short period of time. Flammable liquids such as kerosene and charcoal lighter fluid have been frequently used. Gasoline is seldom used as a trailer because of the rapid evaporation characteristics that makes its use unpredictable. Various types of window cord, rope and newspaper have been commonly used, saturated in kerosene or other medium flashpoint fuels and distributed through the premises. Blasting cord has been used, particularly where explosions are desired.

## TRANSFORMER

Generally, an apparatus or device for transforming or converting the voltage of an electric current. There are two types; a step down transformer which changes high voltage to lower voltage; and a step up transformer which changes lower voltage to higher voltage. Transformers vary in size and capacity from the liquid and mechanically cooled types found in substations and primary facilities right on down to the smaller units in primary service entrances and secondary areas.

## VAPOR DENSITY

Vapor density is the relative density of a gas or vapor (minus air) as compared to air. A figure of less than 1 indicates that a vapor is lighter than air; a figure greater than 1 indicates that the vapor is heavier than air. The vapor density of a compound equals the molecular weight of the compound divided by 29. In the formula, 29 is the composite of the molecular weight of air.

## VAPOR PRESSURE

The pressure of a confined vapor that has accumulated above its liquid. It is determined by the nature of the liquid and the temperature. Vapor pressure figures for many substances may be found in chemical handbooks; vapor pressures of petroleum products are usually determined by the Reid method as recommended by the American Society for Testing Materials. ASTM Standard D 323

## VENTING

Firemen usually vent fires by opening doors or windows or cutting holes in the roof. The reason for this is to allow gases and hot unburned products of combustion to escape. If this is not done, smoke explosions or flashover may occur.

## VOIR DIRE

To speak the truth. An oath is so called when it is administered to a prospective juror or a witness as a preliminary step to examining his qualifications as a juror or witness.

## VOLATILE

Those that may be readily vaporized. The hazards depend upon their flash point and explosive range. Examples of volatile liquids are acetone, allyl alcohol, ethyl alcohol, gasoline, and kerosene.

## VOLT (V)

Volt is a unit of electrical pressure, the force which causes electricity to flow through a conductor. Voltage is not necessarily a measure of fire hazard. For example, 1.5 volts through a very fine wire can cause that wire to become red hot. The heat of the wire, if in contact with combustibles, will result in fire.

## WATT

The watt is a unit of electrical power. A current of one ampere flowing under pressure of one volt equals one watt. For example, a 100 watt light bulb rated at 110v takes a current of 0.9 amp and has a resistance of 130 ohms. It is the demand for power when using items such as a light bulb, heaters, stoves, and motors that places the load on the conductors. If the demand is more than the size or capacity the conductors can carry (are rated for), heating of the conductors will follow. A fire may follow the heating or arcing growing out of the overload since circuit safety devices, such as fuses or circuit breakers may not open the circuit before ignition of combustibles occurs.