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FIRE SCENE LAYER SEARCH

By D. F. Peak, C.F.I.

Are your fire scenes being layer searched and examined correctly? A layer search is the systematic search through the fire debris by sifting or using equipment that enables the investigator to examine the smallest bits of debris to read burn patterns or find items that may provide information about the fire. Layer searching is dirty work and many times is accomplished on one's hands and knees. The layer search tells a story and provides information about fire travel, specific burn patterns, fuel loads, contents, area of origin, and fire cause.

As the individual assigning the case you should review your expert's photographs and reports to see if the fire scenes are being systematically layer searched, reconstructed, and documented. When assigning a case, look at your fire scene to determine what is needed. A careful analysis can determine if the entire scene needs to be layer searched and reconstructed or if layer searching a single room can accomplish the goal.

Too many times follow-up investigations find that the scene was not layer searched or reconstructed to determine the area of origin, the potential ignition sources, burn patterns showing fire travel, placement of furniture or contents, and evidence that may have been reduced to ashes or melted blobs of plastic or metal.

The purpose of a layer search and reconstruction is to recreate the fire scene as

nearly as possible to the state it existed prior to the fire. NFPA 921 states "**such fire scene**

reconstruction allows the investigator to see the fire patterns on exposed surfaces and make a more accurate origin analysis. A further benefit is the probability that complete exposure of the fire scene will enable other persons to better visualize the fire patterns."

Thorough scene examinations will reveal the remains of contents in and around the fire area, and may reveal potential ignition sources or fuels that may have otherwise been overlooked.

Another important fact to consider in the layer search is the available fuels found in the debris. Are there remains or products that can enhance fire spread that are natural to the structure such as polyurethane foam insulation, or soundboard applied to walls instead of drywall. Many times a layer search and proper reconstruction with burn patterns and interviews will be the only way fire travel and flame spread can be determined.

Good layer searches take time and effort and therefore are many times not completed. Proper layer searches and reconstruction will produce cleaned floors, reconstructed contents, and piles of fire debris that have been removed and examined. These procedures should be photographed and documented before, during, and after the completion. Photographs should also be taken of specific pertinent findings as they are uncovered. The time may make the initial investigation cost more, but it will pay dividends by providing the answers that would

have been unexplained later when the case is involved in liability, subrogation litigations, or criminal prosecution.

WHY DID MY NEIGHBORS HOUSE CATCH FIRE?

Jeffrey L. Sellon, P.E., C.F.E.I.

The cold weather this winter combined with little snow cover resulted in a number of unusual fires.

The cold weather froze more underground water pipes than normal. Some people tried to thaw the pipes with electric welders.

Typically, welders were connected between the water pipe in a house and its underground water shut-off at the curb. Current from the welder was then circulated through the pipe. After a few hours, the neighbor's house caught fire.

Current from welders doesn't always stay in the appropriate water pipe. If the resistance in the neighbor's water pipe and associated grounding connections was less, more current flowed into the neighbor's house through its water pipes.

If the welder finished and left before the fire was discovered, the cause of the fire was a real puzzler!

Although this is a well-known problem, welders are still used to thaw pipes. Some cities prohibit the use of welders to thaw pipes. Other cities permit the use of welders.

When current from a welder causes such a fire, one clue is that the insulation on some of the ground wires may be melted. Full circuit lengths of wiring in a house may be melted or burned while other circuits remain undamaged.

Check the circuits to all the appliances that were connected to the metal water piping system in the house, such as an electric water

heater or dishwasher. The insulation of such circuits may be damaged because the ground wire overheated from welder current that flowed from the water pipe connection through the appliance's electrical ground.

FIRE GASES

by Robert Holmberg, C.F.I., C.F.E.I.

Senior Investigator

A fire recently occurred involving wool products and this made me think it might be of interest to review some information about fire gases. Did you know some of the common fire gases encountered at a fire scene are carbon monoxide, CO, carbon dioxide (CO²), oxides of nitrogen, including nitric oxide (NO), and nitrogen dioxide (NO²), hydrogen cyanide (HCN), hydrogen chloride (HCl), and phosgene gas?

Routes of entry into the body include absorption through the skin, eyes, inhalation, ingestion, and absorption through the soles of your shoes.

Some things to keep in mind:

Carbon monoxide gas is odorless and colorless and it combines with your blood's hemoglobin 200 times more readily than oxygen. A 1% concentration of carbon monoxide in a room will cause a 50% level of carboxyhemoglobin in the bloodstream in 2 ½ to 7 minutes. A 5% level of carbon monoxide in a room will cause this in 30 to 90 seconds.

Concentrations of 100 ppm (.01%) usually cause no symptoms. 200 ppm (.02%) may cause a mild headache. 400 ppm (.04%) headache after 1 to 2 hours. 800 ppm (.08%) headache after 45 minutes, nausea, collapse and unconsciousness after 2 hours. 1000 ppm (.1%) dangerous, unconsciousness after 1 hour. 1600 ppm (.16%) headache, dizziness,

nausea after 20 minutes. 12800 ppm (1.28%) immediate unconsciousness, danger of death in 1 to 3 minutes.

Carbon dioxide gas, CO², is nonflammable, odorless, and colorless. A 5% concentration in the air can cause a marked increase in respirations, along with headaches, dizziness, sweating and mental excitement. A 10% to 12% concentration can cause death within a few minutes from paralysis of the brain's systems.

Hydrogen cyanide gas is colorless and has an almond odor. It will cause gasping respirations, muscle spasms, increased heart rate, and often sudden collapse. 135 ppm is fatal in 30 seconds, 270 ppm can be almost immediately fatal. This is the same compound used in a gas chamber! A gas mask will not help you because this compound is also absorbed through the skin!

Materials that give off hydrogen cyanide gas when burned are wool, nylon, polyurethane foam, rubber, and paper. Hydrogen cyanide has been shown to be found in significant concentrations in automobile fires because of large amounts of plastic in their makeup.

LOTS OF EXPERIENCE

Phoenix has a combined total of 120 years of fire investigation experience between its five full-time fire investigators. Combined, they have investigated more than 4,000 fires. Phoenix can usually place an experienced fire investigator on

JARGON

by Tom McAdam, C.F.E.I.
Investigations Manager

Since many fire investigators are retired from

the fire service, a firehouse term or two may occasionally slip into their reports. A lot of firehouse terms are not suitable for this family publication, but here's a guide to some that you might run across. This can also be handy in deciphering fire department reports.

Accelerant--something used to start, spread, or increase the intensity of a fire. Often an ignitable liquid, but can be ordinary combustibles or anything that will burn.

"A" side, "B" side, etc.--Designations given to the sides of a building during firefighting operations. The front is usually the "A" side, and the other sides are given letter designations moving clockwise around the building.

BLEVE--Boiling Liquid Expanding Vapor Explosion. Occurs when a liquid is heated above its boiling point in a closed container. Because it's under pressure, it does not boil and turn to vapor. When the container ruptures the pressure is released and the liquid immediately goes into the gaseous state. If it is a flammable liquid and the vapor ignites, a violent explosion and fireball result.

Defensive mode--Used to describe fire attack from outside the building; generally employed when the risk to firefighters is far greater than any advantage of an interior attack. Usually involves the use of multiple large caliber hose streams.

Exposure--Adjacent buildings, structures, vehicles, etc., that are or could be threatened by a fire. Often referred to by the side they face, i.e. exposure "A," exposure "B," etc. (A key element of the defensive mode is protecting the exposures.)

First due--The first fire truck that's supposed to arrive at the scene, usually from the closest station. If the first due rig is out of position (on another call, training, inspecting, etc.), it may not be the first to arrive.

Incident commander (IC)—The person in overall charge of a fire scene during firefighting operations. Is usually, but not always, the highest ranking officer on the scene.

Master stream—large caliber fire streams of 500 to 1000 gallons a minute. Generally mounted on fire trucks or aerial ladders, used in defensive operations.

Overhaul—checking for hot spots after the fire is out. Involves moving debris, poking holes in walls and ceilings to look for fire extension, and/or removing some materials to the exterior. Can be destructive in nature, but necessary to prevent rekindles.

Surround and drown—see “defensive mode.”

SELLON’S RULES OF THUMB

by Jeffrey L. Sellon, P.E., C.F.E.I.

Although rules of thumb can get a person in trouble because there are many variables, such rules can also be helpful memory joggers.

1. In air, it takes 70,000 volts for electricity to arc 1 inch.
So 15,000 volts will arc approximately $\frac{1}{4}$ inch.
And 120 volts just about won't arc through air at all.
2. Through air it takes 350 volts for an electrical arc to maintain itself. Lower voltage arcs self-extinguish.
3. Arcs, however, can be sustained at 120 volts through a carbonized path.
4. An alternating current arc through a carbon path must be at least 20 to 30 volts for the arc to exist. The arc is extinguished as the voltage goes to zero. It then re-ignites when the voltage reaches 20 to 30 volts again.
5. A spark is a hot particle. An arc is a luminous discharge across a gap. So a spark plug is really an arc plug.
6. An arc can be 5,000 degrees F.

Sources: NFPA 921; Electrical Hazards and Accidents, Greenwald; Electrical Hazards and Accidents, Geddes; Square D Company

THINGS TO KNOW ABOUT SPONTANEOUS COMBUSTION

By: Robert S. Gertson, C.F.E.I.

Spontaneous combustion (also called spontaneous ignition) is the process by which a material spontaneously heats and ignites. In order for the material to spontaneously heat, the material must increase in temperature without drawing heat from its surroundings. Three conditions required for something to spontaneously heat are the rate of heat generated, the air supply, and the insulation properties of the immediate surroundings.

The process of spontaneous heating can range from a few hours to several days, depending on the material and its surroundings. The amount of air flow determines the rate of heating of the material. If the air flow does not remove heat faster than it's generated, then the temperature will increase.

An oxidation reaction occurs when the material and air join together, but not so much air that the heat created is carried away. This can be explained by a material subject to spontaneous combustion placed either in an open garbage can, hung on a clothes line, or tightly bundled together. Each of these factors determines the amount of oxygen that will flow through the material.

The material in the garbage can will have the greatest chance of heating because it will most likely be spread out or loose, allowing air to flow freely through the material. If a material is hung on a clothes line, the amount of air will be greater than the amount of heat being generated, which will cool the material and decrease its temperature. If a material is tightly bundled together access for air to flow is limited until the

material opens or loosens up to allow air to flow freely and provide enough oxygen in the material.

Precautions should be used when using materials subject to spontaneous heating. Some materials should be kept in a cool and dry place. Spills or leaks with liquid products should be monitored so soaking of nearby cloth fabric doesn't happen. Some materials need to be placed under water; on the other hand some need to be free of moisture. Some products need to be kept inside metal containers. Materials range widely in their use and storage, so the material's procedures for proper use and clean up need to be acknowledged.

The following are the materials subject to spontaneous heating, ranging from the highest tendencies to the lowest tendencies. Examples of materials which have a high tendency to spontaneous heat are; alfalfa meal, charcoal, cod liver oil, colors in oil, fish meal, fish oil, fish scrap, linseed oil, oiled clothing, oiled fabrics, oiled rags, oiled silk, peanuts - "red skin", tung nut meals, and varnished fabrics.

Examples of materials that range between high and low are; burlap bags, castor oil, coal, cocoa bean shell, cocoanut oil, corn-mean feed, corn oil, cottonseed oil, dried grains with oil content, various feeds, fertilizers, foam rubber in consumer products, grain, hay, hides, iron pyrites, istle, jute, lamp black, lanolin, lard oil, lime, linseed, manure, menhaden oil, metal powders, metal turnings, mineral wood, oleic acid, oleo oil, olive oil, paint containing drying oil, paint scrapings, peanuts-shelled, perilla oil, pine oil, powdered eggs, powdered milk, rags, red oil, roofing felts and papers, sawdust, scrap film(nitrate), scrap leather, scrap rubber or buffings, sisal, soybean oil, tankage, tung oil, wallboard, waste paper, whale oil, and wood wastes.

Examples of materials that have a low tendency to spontaneous heat are; cottonseed, mustard

oil, palm oil, peanut oil, and turpentine.

As one can see, there are numerous materials that are subject to spontaneous heating. The information on each of these materials can be found in the Fire Protection Handbook, Eighteenth Edition, Section A-13/A-16.

PHOENIX OPENS NEW LAB

On April 15, 2002, Phoenix Laboratories and Engineering Services opened for business. With a laboratory adjacent to the Phoenix Investigations office in Englewood and experienced engineers on staff, Phoenix can provide rapid turn around on laboratory examinations of items involved in fires, water losses, lightning claims, and other losses. When used in conjunction with Phoenix Investigations, Inc., for loss investigations, clients get a seamless transition from scene and field work to laboratory activities, with close coordination to ensure a quality investigation and engineering analysis.

A competitive fee structure makes Phoenix Laboratories and Engineering Services a prudent choice when answers are needed to guide decisions on subrogation or claim denial. On cases that Phoenix Investigations is not already involved in, Phoenix Laboratories and Engineering Services can be retained independently of Phoenix Investigations, so conflicts of interest are not an issue.

An open house is being planned in the near future to acquaint our clients with the capabilities of the laboratory and personnel. If you would like an individual tour, contact Jeffrey Sellon, Don Peak, or Tom McAdam at 303-762-8487.



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