Effects of Fire on Fingerprint Evidence

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At any major crime scene investigation, one can expect to see a police crime scene technician searching for latent fingerprints. Cases such as rape, murder, robbery, burglary and forgeries are commonly investigated by using fingerprint examinations.

Fingerprints have been used for the purpose of criminal identification for years because of their individual characteristics which do not change. These characteristics form before birth and can remain identifiable throughout one's life and after death. Upon our hands and feet we have friction skin. Friction skin is comprised of ridges that have sweat pores which constantly exude perspiration. Aside from the natural fluids exuding from the friction skin, the ridges may also become contaminated with other mediums (paint, blood). When an object is touched, the perspiration or other matter upon the raised ridges may transfer to the item. The outline of these ridges leaves what is referred to as a latent fingerprint impression.

Arson presents itself as one of the most expensive crimes in terms of dollar loss. The crime of arson however, seems to attract a lesser degree of attention when it comes to examining a scene for fingerprints. This is likely due to the destructive forces which are present at fire scenes: intense heat and excessive black soot. The investigator may not entertain the possibility of a scene fingerprint examination because of the destructive nature of fire.

The techniques used to develop and visualize fingerprints are varied. An age-old fingerprint development technique involves the use of burning camphor. The burning camphor crystals yields a fine black smoke. When this smoke is allowed to cover a nonporous article it adheres to fingerprint ridge detail. If an item is overdeveloped (too much smoke/soot applied) the item can be rinsed under water, clearing the excess soot from the background. The controls (amount of heat and soot) that are available for this fingerprint development technique are left to the discretion of the technician. Conversely, at a fire scene, there are not controls. Temperatures can reach into the thousands of degrees, and the soot and smoke may be thick, coarse and oily. Those circumstances not withstanding, an arson scene may still yield fingerprint evidence. The concept in the camphor processing technique can be applied to a fire scene even though the heat may have been excessive and the soot oily or coarse. The rinsing technique for an overdeveloped camphor processed print can be applied to evidence recovered at an arson scene.

As a fire investigator working an arson scene, putting the case together usually means assembling circumstantial evidence. Classifying a fire as an "arson" may be proven by eliminating electrical and natural causes of fire, thus concluding human involvement. To proceed with a criminal investigation into an incendiary fire, it is necessary to identify the suspect. This would be done by establishing motive and opportunity. Interviews, surveillance, financial backgrounds, modus operandi and other investigative procedures might be used. Fingerprint evidence can bring more weight to the circumstantial evidence available, or even change this to direct evidence case. In many fire investigations proving that an arson was committed is not nearly as difficult as proving that a particular person committed the arson or was involved in with the scene.

As part of this research project [1], four separate incendiary fires were set at the fire academy burn building in Montour Falls, New York. A kerosene gasoline mixture was used in each fire. Ordinary household items were placed in each scene. Flammable liquid containers were also placed in these settings, such as those which may be left behind by an arsonist. Fires were set and allowed to burn. The fires resulted in the kind of intense heat and thick black smoke that would be encountered in the field. The fires were extinguished through ordinary suppression efforts, and examined.

Items were examined for fingerprints. None of the items showed any obvious fingerprint impressions. The items were then processed using the cold water rinsing technique, being processed and then re-examined. The process of rinsing and re-examination continued with each stage being photographed and documented. It was found that items which were closest to the point of origin bore no identifiable fingerprints. Items which were at least a few feet from the point of origin were more likely to retain fingerprint ridge detail, but did not always yield fingerprints. The most notable results were on a metal light fixture which was directly over the point of origin in one fire. Several excellent quality fingerprints were developed by the cold water rinsing technique. Once this item was allowed to dry, fingerprint lifting tape was used which resulted in the removal of even more residues from the object, leaving a better contrast between the surface and the fingerprint. The fingerprints appeared as black on a gray surface. The fixture and fingerprints were photographed before processing and at each stage of the development process. The fingerprints on this particular metal fixture were found to be fixed upon the surface. Aggressively rubbing the fingerprints had no effect on their appearance whatsoever.

Another notable result was found in rooms adjacent to the point of origin. Items in these nearby rooms which received extensive heat and smoke, but little or no flame, yielded identifiable fingerprints when the cold water rinsing technique was utilized.

The findings from this research indicates that nonporous objects that were

within or very close to the point of origin tended not to retain any identifiable fingerprint evidence. Items which were a few feet from the point of origin, receiving smoke and soot prior to flame, retained prints more often. It appears that layers of soot upon an object tend to protect the residues of the latent prints, thus developing the print and in some instances "baking" the print into the surface. The processes that occur in a fire scene mimic the camphor processing technique which employs the same concepts in that heat and pigment are applied to a nonporous object, with the soot adhering to the perspiration or other contaminants of a latent fingerprint. Items which were placed into the fire scene were handled by the writer prior to the fire, such as would be done by an arsonist. It is also noted that although identifiable fingerprints were retrieved from these "arson" scenes, several other control items did not result in the recovery of fingerprints.

Items in and around the point of origin should be considered for latent fingerprint evidence. Spending time during the initial scene investigation looking for fingerprints may alleviate months of investigation as evidence is sought to identify a suspect in the crime. ■

[1] Conducted at the New York State Department of State Office of Fire Prevention & Control Academy of Fire Science Montour Falls, New York. The grant for this project provided by Factory Mutual Engineering Boston, Massachusetts.

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