

## Effects of Fire on Fingerprint Evidence

By Mark A. Spawn

*The author served as the Chief of Police for the City of Fulton, New York. Research for this paper was conducted when Chief Spawn served as an Investigator in the Criminal Investigations Division at the Fulton Police Department. He is a New York State Fire Investigator II, Latent Fingerprint Examiner, State Fire Instructor, and has testified as an expert witness in criminal identification. He collaborated in the development of the state's Fire Scene Evidence curriculum which includes a section on fingerprints at the fire scene. In 2008, Spawn was appointed by the Governor to serve on the New York State Arson Board.*



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### FINGERPRINT SCIENCE

Fingerprints have been used for the purpose of criminal identification for years because of their unique, individual characteristics. These characteristics form before birth and can remain identifiable throughout one's life and even after death.

Upon our hands and feet we have *friction ridge skin*. This skin contains sweat pores that constantly exude perspiration. Aside from the natural oils, salts, proteins and water exuded through the skin, these ridges may also become contaminated with other mediums such as paint and blood. When an object is touched, the perspiration or other matter on the raised ridges may transfer to the object. The outline of these ridges leave a fingerprint impression.

The search for fingerprint impressions are a routine part of most major criminal investigations. Cases such as murder, robbery, burglary and forgery are commonly investigated by fingerprint examination. Because of the permanent characteristics of our fingerprints, and because they can provide direct proof of a person's contact with an object, they can be an exceptional piece of physical evidence when connected to a crime scene. After all, a successful criminal prosecution requires that sufficient evidence be established beyond a reasonable doubt that a particular person participated in the commission of a crime. Fingerprints, an objective piece of forensic evidence, can help to establish this proof.

### ARSON

Arson presents itself as one of our nation's most costly crimes. Arson, however, seems to attract a lesser degree of attention when it comes to fingerprint evidence. This is likely due to the formidable forces that are present at fire scenes: intense heat, tremendous

damage, and excessive black soot. The investigator may not entertain the possibility of a scene examination for fingerprints because of the destructive nature of fire.

## **FINGERPRINT PROCESSING**

The techniques used to develop and visualize fingerprints are varied. An old fingerprint development technique involves the use of camphor. The burning of camphor crystals yields a fine black smoke. When this smoke is allowed to envelop a non-porous 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 and leaving the developed outline of a fingerprint. The technician controls the amount of heat and soot that are applied for this fingerprint development technique. Conversely, at a fire scene, there are no controls - temperatures can reach into the thousands of degrees, and the soot and smoke may be thick, coarse and oily. Those circumstances notwithstanding, a fire scene may still yield fingerprint evidence. The rinsing technique for an overdeveloped camphor-processed print can be applied to a fire scene even though the heat may have been excessive and the soot oily or coarse.

## **FINGERPRINTS AT THE FIRE 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 it is necessary to identify the suspect. Without a witness, this would be done by establishing motive and opportunity. Interviews, surveillance, financial background, modus operandi and other investigative procedures might be used. Fingerprint evidence can bring more weight to the circumstantial evidence available, or even change a circumstantial case to a direct evidence case. In most 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 with the scene. Fingerprints can change that. For instance, if the fingerprints of a particular subject are identified on an object at the arson scene, the investigator can conclude that the subject had physical contact with the item. If that object happens to be an instrument of the arson, a gasoline can for example, then the subject must

provide a valid explanation for the contact. Depending on the other facts present in the investigation, such an identification can provide an extremely valuable interview tool, and perhaps aid in eliciting a confession. Of course, there is also the possibility that the subject will provide a valid explanation as to why his or her fingerprints are on an item. A thorough investigation can confirm or refute such an assertion.

## RESEARCH PROJECT

As part of this research project, four separate incendiary fires were set at the burn building at the New York State Academy of Fire Science in Montour Falls, New York. A kerosene-gasoline mixture was used in each fire. Ordinary household items were placed within each scene. Typical gasoline containers were also placed in these settings, such as those which may be left behind by an arsonist. Other items were also placed in the scenes and all were handled by the author prior to the fire to provide undeveloped, latent fingerprints on the items. 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. The items were recovered and examined for fingerprints. Initially, none of the items showed any obvious, visible fingerprint impressions. They were then processed using the cold water rinsing technique, and then reexamined. The process of rinsing and reexamination continued, with each stage being photographed and documented.

## FINDINGS

It was found that items which were closest to the point of origin bore no identifiable fingerprints. In many instances, damage to the substrate was so significant that the preservation of any trace evidence was not probable. 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 result in identifiable fingerprints. The most notable results were of a metal light fixture which was directly over the point of origin in one fire. Several excellent quality fingerprints were developed by using 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 the gray surface (pictured at left). The



Metallic light fixture recovered from test fire scene. Item was completely covered in soot and located above point of origin. Fingerprints shown became etched into the metal, making them permanent.

(Photo: M. Spawn)

fixture and fingerprints were photographed before processing and at each stage of the development process. The most significant finding was that fingerprints on this particular metal fixture were found to be fixed upon the surface. Aggressively rubbing the fingerprints had no affect 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 used.

The findings from this research indicates that generally, non-porous objects that were within or very close to the point of origin tended not to retain any identifiable fingerprints. 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 tends 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 non-porous object, with the soot adhering to the perspiration or other components of a latent fingerprint.

## **SUMMARY**

Investigators should always consider the potential for fingerprint evidence at the fire scene. By carefully inspecting items that may have been handled by a suspect, this investment of time could alleviate months of follow-up investigation by providing an earlier identification of the suspect. A timely identification can also help in recovering other evidence before it deteriorates or can be concealed.

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