ULTRA-VIOLET PRODUCTS

Application Bulletin

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USE OF ULTRAVIOLET LIGHT IN ARSON DETECTION

Ultraviolet light is a simple, reliable, cost effective method of arson detection that is too frequently over-looked in arson investigation. UV light not only assists in rapidly locating accelerant residues, it also assists in locating the point of origin of the fire. The color which accelerants glow is affected by heat exposure--the longer an accelerant is exposed to heat (i.e. the origin), the more differentiated its fluorescence color will be from other less exposed areas. Evidence of accelerants is almost always invisible to the naked eye after they have been absorbed in a fire. However, the areas tarnished by accelerants are easily discernible under UV light.

Volatile hydrocarbons such as gasoline, kerosene and other petroleum fractions, benzene, acetone, grease, lard, vegetable oils, paints, etc fluoresce when exposed to UV. In addition, UV light can be helpful in locating fragments incendiary devices since explosive wrappings are frequently fluorescent. The use of UV light enables the investigator to accurately identify locations where samples should be collected for further laboratory analysis. Samples collected in cans and plastic evidence bags can then be heated in warm water to form condensation. Latent accelerant residue may then be brought to the surface and seen under UV light.

In order to successfully use UV light at a fire scene, ambient light must be reduced to a minimum. This can be done by covering windows and other exposed areas with an opaque sheeting such as black plastic. If that is not possible, a portable cabinet such as UVP's CC-10P allows you to put samples inside, turn on an attachable, portable UV light and view the specimen through UV protective lenses.

It is important to 1) put collected samples in a properly sealed air-tight container, and 2) properly label the evidence (date, where found, and the mark of the investigator), before dispatching and storing (under lock and key in the "property room") via the recommended procedure.

UV Light in Comparison to "Sniffers"

UV lamps and sniffers are tools in arson detection, each of which aids the investigator. While it is not recommended that one of these tools be used in place of the other, there are advantages that UV light lends to an investigation:

1. Use of UV light is not contingent upon wind conditions.

2. The sniffer does not detect specific infected areas, but rather indicates a general area of saturation, making pour pattern sampling difficult.

3. The sniffer is effective only two to three days after saturation, while UV lamps have been proven to effectively fluoresce samples up to two months after an incident.

4. After a hot lengthy fire, the odors of accelerants are usually gone.

5. A sniffer will often pick up false positives, such as human saliva as a positive identification of an accelerant.

What is Ultraviolet Light?

Ultraviolet light is the band of wavelengths (electromagnetic radiation) between visible light and x-rays. It differs from visible light only that its wavelengths are too short to be seen by the human eye. Ultraviolet light is typically divided into three ranges:

- **UV-A** (longwave) which is 315nm and above,
- **UV-B** (mid-range) which is 280nm-315nm, and
- **UV-C** (shortwave) which is 280nm and below.

The chief source of natural UV light is the sun. In fact, 9% of all energy emitted by the sun is ultraviolet, most of which is in the region of 300nm to 400nm.

How Does UV Light Work?

Fluorescence in many materials is caused by some impurity, frequently referred to as "activators", or "activating agents". All matter is made of atoms. All atoms are made of electrons which orbit around a nucleus. In the case of many accelerants, if these electrons are exposed to UV light, they absorb energy, move violently, and jump outward from their normal orbit. As they leave their orbit, another electron is pulled down from its orbit to maintain the electrical balance. This movement produces energy and it is this energy which is seen as fluorescence. Fluorescence occurs only while the material is being activated by ultraviolet light.

Phosphorescence occurs when a material retains and releases, in the form of visible light, some of the energy it receives during the period of activation called fluorescence, after the activating UV source has been removed. This released radiation following the period of activation may persist for periods from a quarter of a second to a matter of many hours. The light given off during phosphorescence is quite dim compared to fluorescence.

How to Get Started

Since accelerants respond to both shortwave and longwave UV, a portable, AC/DC lamp that is both shortwave and longwave lamp such as UVP's UVSL-26P is ideal. Fully charged, it will operate continuously off the internal lead acid battery on the field for up to five hours. It can also operate off a wall outlet for laboratory use. For those who prefer to leave a six watt lamp in a vehicle for emergency use, the UVGL-48 is an excellent choice. It operates on two 6-volt lantern batteries.

When photographing/documenting fluorescence from an arson scene, use a one lux video camera (first choice) or a 35mm camera equipped with high speed color film.

Some sort of opaque covering, such as black plastic, will be needed to darken the room or area being searched. When reducing ambient light is not possible, a portable UV cabinet such as the UVP CC-10P will be needed to view samples for fluorescence.

When working with shortwave UV, use protective eye-wear such as UVP's Blak-Ray® Goggles or Blak-Ray Spectacles.

Other Uses of UV Light in Forensics

UV can be of great assistance in bomb investigation. Many ingredients of explosives fluoresce, such as anfo, nitrates, sulfur, fuel oil, paraffins, and P.E.T.N. Metal fragments with traces of these residues can frequently be found with the use of UV light as well as molotov cocktail type containers.