UV For Arson Investigations

All fires are routinely investigated to determine the cause and point of origin for statistical reporting purposes. Fires involving loss of life, substantial property damage or believed to be of incendiary origin require a more thorough investigation.

A major fire investigation might involve the police, fire investigators at the local and state level, several insurance companies, any number of attorneys, and consultants hired by the attorneys and insurance companies. It goes without saying that each of these entities will have their own agenda.

It would be nice to assume that anyone investigating a fire involving loss of life or significant property damage has been trained in accordance with NFPA 1033, *Standard for Professional Requirements for Fire Investigators*, and certified as a fire investigator by the state fire marshal's office, the National Association of Fire Investigators or the International Association of Arson Investigators. Failing training in accordance with NFPA 1033, we might hope that our hypothetical fire investigator is familiar with:

1. http://www.ncjrs.gov/pdffiles1/nij/181584.pdf
2. http://www.interfire.org/res_file/aec_20ig.asp
3. http://www.interfire.org/res_file/fseab_uo.asp
4. http://www.interfire.org/res_file/kirk_ars.asp
5. http://www.interfire.org/res_file/atflabfd.asp
6. http://www.interfire.org/res_file/srchseiz.asp
7. http://www.interfire.org/res_file/docscleg.asp
8. http://www.tcforensic.com.au/docs/article1.html
9. http://www.tcforensic.com.au/docs/article12.htm
10. NFPA 921 - Guide for Fire and Explosion Investigations
11. Kirks Fire Investigation 7th Edition - Dr. John DeHaan
12. Forensic Fire Scene Reconstruction - Icove and DeHaan
13. Pocket Guide and Pour Pattern PDF @ arsonguide.com

The 1994 Firehouse Magazine extract advocating UV as means to detect accelerants is typical of what you might find in older texts and on the

Internet, much of which dates to the film era before portable sniffers of both the battery-operated and tail-wagging varieties became readily available.

The articles by Australian fire investigator Tony Cafe, numbers 8 and 9 on page one, are short and to the point. Mr. Cafe uses a Canon Digital Rebel SLR camera. He does not use ultraviolet because many substances found in the home or in a place of business fluoresce, including materials used in the furnishings and the structure itself.

All of photos in the Accelerant Pour Pattern PDF to be found at http://www.arsonguide.com were taken by Bob Corry at http://www.scene-investigator.com using ordinary flash photography. Mr. Corry's comments regarding ultraviolet echo those of Mr. Cafe and Dr. Graham.

The most useful information that I've found from the digital era is a PowerPoint entitled *The Limitations and Advantages of Ultraviolet Light Sources in the Detection of Ignitable Liquids at Fire Scenes* presented by Sarah Kunkel at the 2006 annual meeting of the Mid-Atlantic Association of Forensic Scientists.

In 2006, Ms. Kunkel was enrolled in the forensic science program at Marshall University in West Virginia. Dr. J. Graham Rankin, Professor of Forensic Chemistry at Marshall, cautions that ***UV fluorescence is not definitive*** and suggests that UV fluorescence might best be used to select sampling sites when a canine is not available.

Dr. Rankin is one of the authorities who reviewed Kirks Fire Investigation 7th edition edited by Dr. John DeHaan. Dr. Rankin was kind enough to verify that Dr. DeHaan does not mention UV fluorescence in what some consider the most authoritative text on fire investigations.

The gist of Ms. Kunkel's PowerPoint, which is no longer available on the Internet, was to the effect that ultraviolet can be used to detect the fluorescent dyes found in certain petrochemical products such as gasoline and diesel fuel.

I take mild exception to Ms. Kunkel's conclusion that fluorescence was caused by dye additives in gasoline and diesel fuel. While Ms. Kunkel might easily have acquired dyed fuel from pumps used to supply untaxed

gas to schools, government agencies and farm vehicles, dyed fuels are not commonly sold at retail to the motoring public.

Ms. Kunkel use a UVSL-26P light source manufactured by UVP Inc. The UVSL-26P appears to be a bench light rather than something designed for the rigors of the arson investigations in the field. It is commonly sold through gem and mineral supply houses. The price at this writing is $343.00 at polmanminerals.com.

Ms. Kunkel picked what might be the least expensive battery operated lamp with switch-selectable outputs centered at 254 nm or 365 nm, or both 254 and 365 nm simultaneously.

Google hydrocarbon fluorescence. Google fluorescent minerals. You will find articles to the effect that hydrocarbons and fluorescent minerals are brightest in the UVC portion of the spectrum centered at 254 nanometers with UVA centered at 365 nanometers relegated to second place.

This is contrary to claims that wavelengths as high as 450 nm are suitable for arson investigations. I could not tease a glimmer of fluorescence from gasoline purchased at any of the five gas stations in Woodland Park, Colorado, using 365, 395 nm and 450 nm lights.

However, I was using relatively inexpensive lights of the type that might be purchased by a student or a fire investigator spending his own hard-earned cash. An engineer working for http://www.fosterfreeman.com/ tells me that the brighter your light, the more you'll see. It takes a certain amount of energy to excite UV fluorescence.

UV Light Technology at http://www.uv-light.co.uk sells a 35 watt HID light covering the UVA portion of the spectrum from 295 to 415 nm with peak output between 350 and 385 nm.

Labino at http://www.labino.com markets a 35 watt HID light. Their UVA filter covering the 319 - 400 nm portion of the spectrum is suggested for fire investigations. The price is $7,500 from Arrowhead Forensics, Labino's US distributor.

Xenide at http:/www.aelight.com sells their 25 watt AEX-25 HID light for a reasonable $455.00. An explosion proof version can be had for twenty dollars more. The last time I spoke with technical support, you could order slip-on filters covering the 254, 365, 405, 450, 560, 620, 850, and 960 nanometer wavelengths.

AE Light does not market filters or goggles. You will need clear goggles rated by the manufacturer to protect against UVA, UVB and UBC plus red, orange and yellow goggles and red, orange and yellow barrier filters for photographing your discoveries, if any.

You can't generalize based on published specifications. You've actually got to test lights which might be of interest under operational conditions, as recommended in the various SWG guidelines at http://www.theiai.org.

Be careful. Powerful ultraviolet lamps, especially those in the UVC portion of the spectrum (254 nm), can damage your eyes and your skin when used without protective goggles and clothing. Labino markets clear goggles said to provide complete protection down to 254 nanometers.

UVC centered on 254 nm can sterilize medical instruments. It will kill DNA. Do not charge forth blindly through the fog on the assumption that ultraviolet is non-destructive and can therefore be used with impunity before biological evidence has been collected.

UVA is usually considered harmless but certain medications can render people sensitive to light in the 315 - 400 nm portion of the spectrum.

Look for protective eyewear that complies with ANSI Z87.1 - 2010 or Military Standard 622 for side protection and impact resistance. You can download a catalog from http://www.uvex.us that lists the level of protection against UVA, UVB and UVC afforded by various safety glasses in the UVEX product line.

I buy Tiffen and Hoya filters from photo equipment vendors such as Adorama and B&H Photo-Video. I buy red, yellow and orange goggles from any of the forensic supply houses. I would not purchase UV goggles from any vendor that does not explicitly state that their goggles will provide 99.9% or better protection from UVC centered at 254 nanometers.

At any rate, thanks to Ms. Sarah Kunkel, there is persuasive if not conclusive evidence suggesting that ultraviolet light at wavelengths between 254 and 365 nanometers can be used to detect at least some accelerants at least some of the time.

Since false positives are common and the presence of a flammable liquid cannot be proven without laboratory analysis, the obvious reasons for using ultraviolet would be to photograph pour patterns that cannot be photographed with ambient light or electronic flash and to screen for hydrocarbons that could not be detected by chemical or canine sniffers.

Internet research indicates that UVC centered at 254 nm has more energy per photon than longer wavelengths. This explains why so many lights marketed to geologists and fluorescent mineral collectors are either specific to 254 nm or combine 254 with 365 nm lamps in one housing.

A good assortment, AC and battery powered (to include Ms. Kunkel's UVSL-26P lamp), can be found at http://www.polmanminerals.com, some at prices less than the price for similar lights advertised by forensic dealers.

I found a 365 nm light at http://www.blacklightsusa.com for $39.95. A similar light from a forensic dealer lists for $120.

If the price of a high end forensic light or an advanced SLR camera strikes you as unreasonable, remember that every firefighter on the scene of a major fire is very likely standing in $5,000 worth of turnout gear.

Any consultant with PhD or PE after his name is going to ask for and get $2,000 per day plus expenses. Consultants are often hired by the prosecution and the defense on any fire involving loss of life or significant property damage. Many arson trials are decided by expert witness testimony.

Caveat: UV fluorescence can only be seen and photographed in near-total darkness and, at least where blood spatter and semen are concerned, the stains must be totally dry. If using UV to detect pour patterns at an arson scene is of interest, call around until you find a fire department that is using UV fluorescence with satisfactory results.