TECHNICAL BULLETIN

SUBJECT	Beware Ignitable Liquids in Unexpected Places
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Introduction

Most fire examiners are aware that ignitable liquids are found in many commercial products. Examples of such products are listed in our Interpretive Guidance document, which is a useful resource for evaluating whether a potential product at a fire scene may contribute to a positive fire debris analysis result. This Technical Bulletin introduces the fire examiner to several unusual items which may also contain an ignitable liquid.

Case study: the ignitable dolphin

Our laboratory recently received a peculiar sample consisting of a plastic bottle opener, pictured below. The bottle opener was a souvenir item, shaped like a dolphin, with a bottle opener built into its tail fin and a magnet attached to it. The body of the dolphin was hollow and filled with small seashells and sand, suspended in a liquid. The client had attended a fire scene and found the bottle opener on the kitchen floor in front of the fridge. The item had an oily substance coating it, which smelled like a petroleum product. The client collected a sample to test the item for the presence of ignitable liquid residues.

The bottle opener had broken, causing the liquid inside to leak out. A sample of the liquid was analysed and was classified as a petroleum distillate – an ignitable liquid. The composition of this sample was similar to that of some industrial solvents and

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lamp oils. This result helped explain the petroleum-like odour that the client encountered when they touched the fluid which was leaking from the bottle opener.

Consider the number of kitchen fires you attend where the kitchen has flashed over, and little is left of the appliances and cabinetry. A bottle opener such as the one above could have been stuck to the fridge or stored in one of the kitchen cupboards. If this type of bottle opener was broken during the fire, it would have spilled its contents everywhere. If you obtained a sample of debris contaminated by this liquid and obtained a positive laboratory result, would you determine the fire to be deliberately lit?

Next time you examine a fire scene, consider asking the owner of the property whether any unusual decorative or souvenir items were present, and determine whether any of these may have been filled with a potentially ignitable liquid.

Hand sanitisers and hand cleaning products

The COVID-19 pandemic has resulted in a worldwide spike in the sale of sanitising products, the most common of which is liquid hand sanitiser. Liquid hand sanitiser is present in almost every commercial and industrial premises in Australia as a result of directives by health authorities during the pandemic. When was the last time you attended a fire at a commercial or industrial facility? Did you take a sample from the same location in which they stored or used their hand sanitiser products? If so, you may wish to consider the information below.

Alcohol is known to be an effective antiseptic, and most sanitiser formulations are based on ethanol (ethyl alcohol) or propan-2-ol (isopropyl alcohol). Sanitisers are more effective with higher concentrations of alcohol, and most liquid hand sanitisers contain at least 60% alcohol (by weight). Therefore, be cautious about sampling in areas where hand sanitising products are known to be present. Positive results for ethanol or isopropyl alcohol (classified as oxygenated solvents) in these areas may be totally benign. Conversely, their presence is suspicious in areas where no hand sanitising products are used. Methanol is not used in sanitiser formulations due to its toxicity, but it is highly flammable and may be used as an accelerant. Therefore, sample results indicating the presence of methanol should be considered forensically significant.

Consider another common cleaning product: workshop/industrial hand cleaners. These liquids are typically highly viscous as they contain microplastics which act as grit to exfoliate the skin during washing and physically remove contaminants. A test of one such product in our laboratory, pictured at left, showed that it contained a miscellaneous ignitable liquid mixture, consisting of a petroleum distillate (medium range) and an oxygenated solvent (consisting of terpineol). Text on the product label indicated that it contained multiple petroleum-based components, including C8-10 alkane/cycloalkane/aromatic hydrocarbons and pine oil.

The presence of petroleum products in cleaning solutions is not unusual. They actually assist the cleaning process by dissolving other petroleum-based liquids stuck to your skin. However, be wary if you use these products during your scene examination or evidence collection duties as they represent a potential contamination risk.

What about other hand cleaning products which do not specify any hazardous ingredients or flammable compounds on their packaging? For example, the product below specifies “No Petroleum Solvents!” on the front of the bottle.

Unfortunately, these kinds of products can still complicate the analysis process. The product above contains a terpene compound, limonene, in small amounts. Limonene (flash point 48°C) is a component of products which use citrus oil (or derivatives thereof) as the active ingredient. Citrus oil-based liquids are commonly used as environmentally friendly cleaning solvents and degreasers. Limonene is also available as a single-component product (typically marketed as an industrial solvent or cleaning liquid, such as the product pictured at right). As limonene is a flammable compound, its presence may be reported as a miscellaneous ignitable liquid in laboratory test results. Therefore, be sure to verify the nature of any chemicals used in your area of origin, even if they are not petroleum-based.

Note that limonene is also a common background compound produced naturally by some timber substrates, as well as being a pyrolysis product created during the combustion of some materials (particularly rubber). A skilled fire debris analysis laboratory will be able to assess the significance of compounds such as limonene in a test sample and report on them accordingly.

Aerosol products

Products packaged in aerosol cans contain two main components: a propellant and a liquid product. The propellant may take the form of a compressed or liquefied gas, depending on the design of the aerosol system. Propellants are not typically an issue in terms of fire debris analysis as they are expelled from the aerosol container as gases and will not persist for a significant amount of time. The liquid product, on the other hand, may be a petroleum-based liquid. These ignitable liquids are

used as solvents or vehicles to carry the product's active ingredient as it is expelled from the aerosol container.

Insecticides are a common example of a commercial product which is manufactured in this way. The active ingredient (the insecticide) may consist of only one or two chemical compounds. These compounds must be dissolved in a compatible solvent in order to regulate their concentration as well as aid in deployment. The product pictured at left was analysed by our laboratory and found to contain an isoparaffinic product – an ignitable liquid. Due to the large number and variety of products which are available in aerosol forms, there is a similarly large number and variety of ignitable liquids which are used as aerosol solvents. Aerosol products can contain aromatic products, isoparaffinic products, petroleum distillates, cycloalkane products, oxygenated solvents, and miscellaneous ignitable liquid mixtures.

The primary issue to consider when examining a fire scene where aerosol containers are present is the potential for contamination. Pressurised containers can explode, spreading their contents all over the fire scene. Fire examiners must be cognizant of the location of any aerosol products and should evaluate whether there is a realistic chance that the areas they wish to sample from have been contaminated. If possible, a comparison sample of the aerosol product in its original packaging should be submitted to the laboratory for analysis.

There are exceptions to the above rules of thumb. For example, products marketed as "compressed air" or freeze spray contain only propellant. In aerosols where the product is itself a petroleum-based liquid, an additional solvent is not necessary, and the packaging will stipulate what type of ignitable liquid the product is composed of.

Conclusion

Fire examiners must be aware that ignitable liquids can be found not only in commercial liquid products, but also in household items such as trinkets, souvenirs, decorative or display items, and other miscellaneous knick-knacks. Liquid products such as hand sanitisers and cleaners can also contain petroleum products, as can pressurised aerosol products.

With ignitable liquids potentially present in so many items at a fire scene, thorough inquiries to determine the contents present in the area of origin, as well as collection and analysis of relevant comparison samples, is vitally important.