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Supplementary Technical Notes for Ignitable Liquids

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1. Introduction

These guidance notes are intended to be used to supplement the production of an MG22 (SFR) form, such that the forensic result can be reported in the most clear and succinct way. The relevant version and section(s) of these supplementary notes should be quoted within the MG22 document produced by the person creating the report.

1.1 Definitions and Abbreviations

Abbr.	Meaning
GC	Gas Chromatography
HPD	Heavy Petroleum Distillates
LPD	Light Petroleum Distillates
MS	Mass Spectrometry
SFR	Streamlined Forensic Reporting
Definitions	
Can	indicates a possibility or a capability
May	indicates a permission
Shall	indicates a requirement
Should	indicates a recommendation

2 Overview

- 2.1.1 Some fires are ignited deliberately following the application of an ignitable liquid to materials or surfaces. When the vapours from such liquids are ignited, the heat generated may cause any combustible materials in close proximity to become ignited and burn at an accelerated rate; consequently, the ignitable liquid may be referred to as a fire accelerant.
- 2.1.2 If ignitable liquids are poured, spilled or splashed onto a surface, their residues may subsequently be detected. The persistence of these residues will depend on a number of factors including: the amount of liquid originally present; the volatility of the liquid; and the environmental conditions.

3 Ignitable Liquids

- 3.1 Ignitable liquids tend to be classified according to their characteristic range of constituent chemicals and the various classes are normally distinguishable through analysis. For example, typically encountered ignitable liquids refined from crude oil include: Light Petroleum Distillates (LPDs), such as cigarette lighter fluids; Medium Petroleum Distillates (MPDs), such as white spirit and some turpentine substitutes; Heavy Petroleum Distillates (HPDs), such as diesel fuel, some barbeque lighting fluids and heating oils; and a range of other fuels and solvents, including petrol. Other ignitable liquids are encountered as single chemicals, for example, ethanol and acetone. It is often not possible to distinguish between ignitable liquid residues from the same class or product, for example different brands of petrol or diesel.
- 3.2 Volatile ignitable liquids, such as petrol, produce vapour that can be readily ignited by an electric arc, a spark or a naked flame (such as from a lit match or lighter); once ignited, these liquids often produce intense, energetic flames. At normal room temperatures, the vapour from less volatile ignitable liquids, such as white spirit, kerosene and diesel fuel (petroleum distillates), is ignitable by a naked flame only if the liquid is first absorbed onto a material that can act as a wick, such as when soaked into an absorbent material (e.g., fabric, carpet, cardboard).

4 Analysis

- 4.1 In the laboratory, suspected volatile ignitable liquids are routinely analysed by means of a technique known as gas chromatography (GC). This technique effectively separates the numerous chemicals of varying volatility within the liquid or residue. Having been separated from each other these chemicals may be individually identified by a technique known as mass spectrometry (MS). The combined technique, known as GC-MS, provides a sensitive and highly discriminating means of identifying ignitable liquids.
- 4.2 It is usual practice, when undertaking the examination of an item to determine if an ignitable liquid residue is present, to heat the object within its sealed exhibit bag for a period of time. A sample is then taken from the air (headspace) within the bag, and this is submitted for GC-MS analysis. When the item is required for other forensic techniques, such as DNA or fingerprints, samples can be taken at reduced or ambient temperatures, which can be less effective.

- 4.3 Following analysis, common ignitable liquids can be identified from their characteristic range of hydrocarbon compounds and by comparison with reference samples and library data. The analytical techniques routinely employed are not quantitative and therefore any comments made about relative amounts of the chemicals detected are subjective.
- 4.4 The analytical technique is extremely sensitive and small amounts of volatile chemicals in regular use within the laboratory environment, or residual vapour from items heavily contaminated with ignitable liquids, can be detected when items are analysed. However, good laboratory practice, including the processing of blank samples and the regular monitoring the laboratory environment(s), alongside other quality assurance samples and measures, are undertaken to demonstrate that significant levels of relevant volatile chemicals are not present in the laboratory environment.

5 Control Packaging

- 5.1 Any item suspected of containing residues from a volatile ignitable liquid must be sealed into suitable airtight packaging, such as within nylon and polythene bags, as soon as is practicably possible. The purpose of this is to: prevent evaporative loss of any ignitable liquid vapours; to prevent the item from becoming contaminated at some later time from any external source of ignitable liquid; and to facilitate sampling of the headspace itself. Nylon packaging, however, is susceptible to performance loss and may begin to lose its efficiency over prolonged periods of time.
- 5.2 Packaging can become contaminated with low or trace levels of ignitable liquid residues, either during manufacture or in storage, if exposed to an external source of ignitable liquid. In order to explore whether a result could be due to contamination, control packaging can be taken from the same ‘batch’ as those used to package the exhibits and analysed.

6 Reference Documents

Document Name	Document Number	Responsible Department
MG22A	SFR MG22A	FCN Science Directorate
MG22B	SFR MG22B	FCN Science Directorate
MG22C	SFR MG22C	FCN Science Directorate
MG22D	SFR MG22D	FCN Science Directorate
SFR Annex	SFR2 Annex	FCN Science Directorate
Case Management Risk Form	SFR Case Management Risk Form	FCN Science Directorate
National Guidance for Streamlined Forensic Reporting	FCN-MGT-GUI-0003	FCN Science Directorate