Supplementary Technical Notes for Fibres SFR

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Grey shaded sections will denote changes from previous version

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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 Forensic Service Provider.

1.1 Definitions and Abbreviations

Abbr.	Meaning
Fibre Lifts, Tape lifts, Tapings	Tapes used to recover fibres
FPF	Fibre-plastic Fusion
FTIR	Fourier Transform Infrared Spectroscopy - instrumental chemical analysis
MSP	Microspectrophotometry– instrumental colour analysis
SFR	Streamlined Forensic Reporting
UVMSP	Ultraviolet Region MSP
Definitions	
Can	indicates a possibility or a capability
DNA-17	A DNA test that targets 17 areas of DNA plus a gender marker
May	indicates a permission
Shall	indicates a requirement
Should	indicates a recommendation

2 Fibres

When an item such as a garment, comes into contact with another surface (such as car seats, POE surfaces, other individuals or weapons) there is the potential for fibres to be transferred from the garment's fabric to that recipient surface. The number of fibres transferred will depend upon the nature of the fabrics in question, on the type and duration of the contact and on the nature of the recipient surface. Some garments are made of fabrics that are unsuitable for consideration as a source of transferred fibres. For example, garments may shed their constituent fibres, but these fibres may be commonly occurring and therefore of low evidential value (e.g. white cotton; colourless fibres lack a key feature of comparison, namely colour, and therefore are generally of little evidential value in cases such as this). Other garments may be made of fabrics that do not tend to shed their constituent fibres. In some instances, whilst the fabrics involved may not shed their constituent fibres, damage to the surface of a garment may be significant enough to result in fibres or tufts of fibres being shed from the area of damage and thus render a garment suitable as a source of fibres for transfer. The most suitable sources of transferred fibres are those fabrics that readily shed distinctive fibres onto the surfaces with which they come into contact.

3 Fibre-Plastic Fusion (FPF)

In a collision, contact traces may be exchanged between the interior surfaces made of thermoplastics and the clothing of the occupants. According to the direction of an impact the occupants will be catapulted onto parts of the interior equipment of the vehicle. As a result, pieces of garments are frequently rubbed under high pressure against surfaces of thermoplastic components and the kinetic energy of the bodies is transformed into frictional heat which causes local melting of the thermoplastic material. During these contacts, which will last only a split second, textile fibres of the rubbing garment are transferred into the softened plastic and are fixed in the immediately re-solidifying material. By comparison with the clothing of all occupants the transferred fibres can be assigned to a distinct garment. Therefore, these fibre-plastic fusions (FPFs) are a kind of snapshot, showing the examiner which garment was in which place at the very moment of the impact. In addition, FPFs in most cases show threads of smeared plastic which indicate the direction of the impact that produced them. Hence the outcome of a fibre-plastic fusion examination may not only be the seating arrangement of the occupants of an automobile in the moment of the impact, FPFs may also help to determine the trajectories of the vehicle's occupants during the accident.

The corresponding trace to the FPFs on the interior plastic surfaces in a car are plastic coating marks on the clothing (garments, shoes) of the occupants. These traces are formed somewhat less frequently – usually in high-speed impacts – by transfer of softened thermoplastic material from the interior of the car to the clothing. They are rather valuable particularly if garments showing a low sheddability are involved (e.g. leather, filament yarn fabric) or if two occupants of a car are wearing garments made of indistinguishable fibres (e.g. blue jeans, white cotton shirts).

4 Two-Way transfer

"Two-way transfer" is a term used to describe contact between two items that results in fibres being transferred in both directions between them. This type of finding is relatively rare in practice and usually occurs where both sets of items shed their fibres readily and/or the contact between them is prolonged, repeated or heavy. This type of finding is generally considered to be more evidentially significant than a one-way transfer.

5 Secondary Transfer

In addition to the above direct transfer of fibres from one item to another, fibres may also be transferred, to a lesser extent, between items which do not come into direct contact with each other. "Secondary Transfer" is a term used to describe the mechanism by which fibres from one surface are transferred to another surface, via an intermediary surface. For example, fibres from surface 'A' are transferred onto surface 'B', and surface 'B' is subsequently in contact with surface 'C'. Fibres from surface 'A' may therefore then be transferred secondarily to surface 'C'.

6 Linking fibres/Fibre populations

Sometimes a direct transfer of fibres between items may not occur because, for example, the items themselves may not shed fibres. However, on occasion, it may be possible to demonstrate that fibres from an unknown source (e.g. a third item) can be found on both the clothing of the individual and the 'scene'. These fibres are referred to as 'linking fibres' or fibre 'populations'. For example, a blanket is in contact with a car seat and fibres are transferred from the blanket to the surfaces of the seat. During any subsequent contact between that surface and an individual sitting in that seat, these blanket fibres could be

transferred from the seat to the individual's clothing thus providing a link between them, but without the clothing and the blanket being in direct contact with each other.

7 Fibre retention

Fibres that have been transferred to another surface can fall off and be lost over a period of time. The rate at which fibres are lost depends upon a number of factors, including the ability of the recipient surface to retain fibres and the degree of disturbance that occurs to that surface. For instance, the extent to which garments are worn or seats are used will affect fibre loss from their surfaces. Coarsely woven and knitted fabrics tend to retain transferred fibres to a greater degree than finely woven materials. As a guide, tests have shown that approximately eighty per cent of fibres transferred to a garment will be lost within three to four hours of normal wear. Fibres that have been transferred to a stationary object, such as a car seat, may persist for longer, provided that the surface is not disturbed too much.

8 Fibre recovery

Transferred fibres can be recovered from the surfaces of items by systematically applying strips of adhesive tape. The more a tape is used the weaker the adhesiveness of its surface will become and thus it will become less capable of recovering fibres. The tapes can then be attached to thin clear plastic sheets thus securely preserving any recovered fibres for more detailed examination. The tapes used to recover fibres in this way are often referred to as "fibre lifts", "tape lifts" or "tapings".

9 Fibre identification and comparison

Recovered fibres that appear superficially similar to those from a particular garment are individually removed from the tapes and, after preparation, the types of fibres are identified, and these fibres are then compared with the garment fibres under a high-power microscope. Different lighting conditions including white light and fluorescent light are used. Some or all of the fibres that are found to be microscopically indistinguishable from the proposed source may be selected for instrumental colour and/or chemical analysis. Instrumental colour analysis is a technique employed to examine and compare the dyes used to colour fibres. This technique called microspectrophotometry (MSP) measures the absorption of electromagnetic radiation (light) in the visible region and, where appropriate, the ultraviolet region (UVMSP) of the electromagnetic radiation spectrum. Different dyes will absorb differently (depending on the structure of the dye and the fibre to which it is bonded) and therefore, the resulting spectra can be compared. When the spectra match, the fibres are deemed indistinguishable from each other. Instrumental chemical analysis (FTIR) is a technique whereby the infrared region of the electromagnetic spectrum is used and is employed to analyse the molecular structure of synthetic (man-made) fibres and thus confirm the identity of the fibres.

10 Evidential significance

When no differences are found between recovered and constituent fibres in all tests performed, the fibres are said to be 'indistinguishable' and provide evidence of possible fibre transfer, which can support the assertion that the donor and recipient items have been in contact. This degree of support will vary and is evaluated based on the experience of the Reporting Scientist by considering various factors such as:

- how readily or otherwise the fabrics involved shed their constituent fibres and the proportion of each fibre 'type' shed from a blended fabric,

- how readily or otherwise the fabrics involved would be expected to retain transferred fibres,
- the number of transferred fibres found,
- the colour/type/rarity of the transferred fibres in the general textile fibre population,
- whether the transfer of fibres was in one direction or in both directions,
- the presence of a clump of multiple matching fibres.

Other pertinent information (e.g. published scientific literature) may also be used in evaluating the scientific findings.

11 Supporting Documentation

List of all supporting documentation referred to within this document:

Document name	Document number	Responsible department
MG22A	SFR MG22A	FCN Science Pillar
MG22B	SFR MG22B	FCN Science Pillar
MG22C	SFR MG22C	FCN Science Pillar
MG22D	SFR MG22D	FCN Science Pillar
SFR Annex	SFR2 Annex	FCN Science Pillar
Case Management Risk Form	SFR Case Management Risk Form	FCN Science Pillar
National Guidance for Streamlined Forensic Reporting	FCN-SP-MGT-GUI-0004	FCN Science Pillar