



SUBJECT The Importance of Collecting Comparison Samples
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Introduction

Comparison samples are a necessary part of any fire investigation. When samples of fire debris are collected for ignitable liquid residue analysis or vegetable oil analysis, they should be accompanied by comparison samples. However, some examiners do not understand the reasons as to why such samples are necessary, or how they should be collected. This Technical Bulletin explains the purpose of comparison samples as they relate to the laboratory analysis of fire debris.

What are comparison samples?

“Comparison sample” is defined in ASTM E3197-20 as follows:

- (1) A sample of material collected from a fire scene which is, to the best of the collector’s knowledge, similar with respect to relevant characteristics to a sample suspected of containing an ignitable substance, but which is not expected to contain an ignitable substance.*
- (2) A sample of suspected ignitable substance submitted for the purpose of comparing with any ignitable substance separated from a debris sample.*

ASTM E3197

So, a comparison sample can basically be any material that is believed to be free of ignitable liquid residues. E3197 makes two additional notes regarding the definitions above. First, a comparison sample should not be confused with a control sample. A control sample is a material of established origin that is used to evaluate the performance of a test or comparison. The laboratory uses control samples to verify testing results are accurate. Samples of materials from fire scenes generally cannot be considered control samples.

Second, a comparison sample taken from a fire scene can never be guaranteed to be free of ignitable liquids. Materials can be contaminated with ignitable liquid residues during manufacture, installation, everyday use, cleaning, or during the fire itself. Unlike a control sample, a comparison sample’s history and origin are unknown. Therefore, presence of an ignitable liquid in a comparison sample does not necessarily mean that the liquid is inherent to the material. Only the examination of a control sample, obtained from the manufacturer and with a known history, can be used to determine whether ignitable liquids are naturally present in a particular material.

Why collect comparison samples?

...it is essential the investigator recognize the critical importance of comparison samples.

DeHaan & Ilove, p. 584

Why do we need to make comparisons? Making comparisons is an integral part of any forensic discipline, including fire scene examination. Fire examiners are constantly making comparisons, such as comparing damage between rooms in a structure, comparing burn patterns on adjacent walls, or comparing information from multiple witness accounts.

Consider the example of a row of identical townhouses built on the same street. A fire which destroys one townhouse leaving no recognisable internal structure would be difficult to examine as the layout is completely unknown. However, examination of an adjacent, identical townhouse would reveal what the structure was like within the destroyed dwelling. Likewise, the contents of a room may be completely unrecognisable after a fire. Viewing prior photographs of the room's contents and comparing it to the burned contents may allow some level of reconstruction and analysis to take place. These types of comparisons may provide data to assist with an examination which would be more difficult otherwise.

Similarly, examination of an electrical appliance can be difficult when a fire has destroyed the electrical components within it. Therefore, examiners and electrical engineers rely on comparison units, schematic diagrams, and operating manuals to determine how the damaged appliance was constructed. Only then can assumptions be made about the operation of the appliance or how its electrical components failed. In this way, a melted mass of unknown parts may be identifiable as specific components if the contents of the mass are known.

Comparison samples are also necessary for the laboratory to properly evaluate analysis results from fire debris samples. Comparison samples allow the laboratory to verify the contribution of a substrate to a particular sample. The analyst can then consider this contribution when evaluating results from debris samples, making it easier to reach a determination as to the presence of ignitable liquids or vegetable oils.

To ensure that the lab will be able to distinguish minute traces of accelerants from the semivolatile decomposition products of synthetics, comparison samples are very important.

DeHaan & Ilove, p. 302

This is important because most items and substrates present in modern fire scenes are petroleum-based. The background products they contain, and the pyrolysis products they produce when burned, can be the same as those in many ignitable liquids. Some substrates can mimic the appearance of an ignitable liquid residue or can otherwise skew the analysis data, making it difficult to ascertain the presence of an ignitable liquid.

There are numerous examples of common household materials containing detectable levels of petroleum products. Without an appropriate comparison sample, it is difficult for the analyst to form an opinion as to whether or not a recovered ignitable liquid is incidental or foreign to the tested material.

Stauffer, Dolan & Newman, p. 175

While these effects may not ultimately prevent classification of an ignitable liquid, problems arise when ignitable liquid residues are present in small amounts, or when substrate materials produce high concentrations of pyrolysis products. In these situations, comparison samples may allow for positive identification of ignitable liquids which would otherwise be impossible.

Comparison samples allow the laboratory to evaluate the possible contributions of volatile pyrolysis products to the analysis...

NFPA 921, p. 194

When should comparison samples be collected?

When physical evidence is collected for examination and testing, it is often necessary to also collect comparison samples. The collection of comparison samples is especially important in the collection of materials that are believed to contain liquid or solid accelerant...

NFPA 921, p. 194

The short answer is: **always**.

Comparison samples may not be required for the valid identification of ignitable liquid residues in all cases, however, the determination of whether comparison samples are necessary cannot be made by the fire examiner. This determination can only be made by the laboratory analyst. For this reason, comparison samples should always be collected and submitted to the laboratory as a matter of course.

It is strongly recommended that comparison samples be collected...

Lentini, p. 139

NFPA 921 advises that comparison samples should be “collected from an area that the investigator believes is free of [...] accelerants” (p. 194). Lentini also suggests that examiners should “select materials that are identical, or nearly identical, to the materials suspected of containing ignitable liquid residue” (p. 139). Ultimately, the choice of sampling location is at the discretion of the fire investigator and their judgement.

Comparison samples are collected in the same manner as regular “unknown” samples of fire debris. The same collection techniques and packaging materials should be used. However, the examiner must ensure that the material sampled is as similar as possible to the unknown sample. If the debris sample contains carpet and underlay, then the comparison sample should also contain carpet and underlay. Unburned comparison samples are preferable, but if they are unobtainable, comparison materials burned to a similar degree as other samples are acceptable. Labels should be completed as normal, but “comparison sample” should be added to the sample description.

Bibliography

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