



**Trace Analysis Section**  
**Analysis of Fire Debris Evidence**  
Forensic Analysis Division



## 1. Standard Operating Procedure for the Analysis of Fire Debris Evidence

### 1.1. Scope

1.1.1. This document describes the procedure for analyzing fire debris evidence submitted to HFSC in the form of liquid samples or as fire debris samples (which may include unburned material associated with the investigation). This document covers the passive headspace concentration with activated charcoal extraction method for ignitable liquid residues on fire debris evidence.

### 1.2. Safety

- 1.2.1. Use appropriate personal safety protective equipment.
- 1.2.2. All extractions and elutions involving the use of solvents are performed under the hood.
- 1.2.3. Use extreme care when working with carbon disulfide. **When in use**, store under hood; **otherwise, store** in a flammable cabinet. **When transporting outside of the laboratory**, use a secondary container, and keep **the solvent** away from open flames.
- 1.2.4. Safety Data Sheets (SDS) regarding solvents, chemicals, and reagents used in the analysis of ignitable liquids are available in the Trace Section and may be accessed **electronically**. The content of SDS should be reviewed prior to using a specific chemical.

### 1.3. Definitions

#### 1.3.1. Headspace Extraction

1.3.1.1. The direct extraction of vapors above the sample using an airtight syringe. The sample container may be heated.

#### 1.3.2. Solvent Extraction

1.3.2.1. Solvent extraction is the extraction of ignitable liquid residues from fire debris evidence using a solvent such as pentane or carbon disulfide. After extraction the solvent is evaporated to approximately 1 mL or less and the resulting extract is analyzed. **This extraction process is described in ASTM E1386.**

#### 1.3.3. Adsorption Extraction

1.3.3.1. Adsorption extraction is a type of headspace extraction that concentrates ignitable liquid residue vapors above the sample onto a material with a good affinity for compounds of interest found in ignitable liquid residues. The material is called the adsorbent. The sample containers are typically heated.

#### 1.3.4. Passive Headspace Concentration with Activated Charcoal

1.3.4.1. Passive headspace concentration with activated charcoal is an adsorption extraction technique in which the adsorbent is a strip of activated charcoal that is suspended in the space above the sample. The sample container is closed and the adsorbent is



exposed to the diffusion of the vapors within the headspace. This is the most common method of extraction used by the HFSC Trace Analysis Section for the extraction of ignitable liquid residues.

#### 1.3.5. Organoleptic

1.3.5.1. Being, affecting, or relating to qualities (as taste, color, odor, and feel) of a substance (as a food or drug) that stimulate the sense organs.

#### 1.3.6. Activated Charcoal

1.3.6.1. Charcoal that has been heated or otherwise treated to increase its adsorptive power.

#### 1.3.7. Fire Debris Evidence

1.3.7.1. Liquid samples associated with a fire investigation, such as a charcoal lighter fluid container with a clear colorless liquid found at the scene.

1.3.7.2. Fire debris samples typically are burned or partially burned items found at a scene, such as an evidence container with a partially burned carpet. However, unburned items such as suspect clothing and empty container may also be submitted as fire debris evidence.

#### 1.3.8. Comparison Samples

1.3.8.1. Comparison samples are unburned or burned (pyrolyzed) material collected from the same substrate as the burned fire debris evidence suspected of containing an ignitable liquid or ignitable liquid residue. Pyrolyzed by-products and substrate materials in the fire debris could contribute compounds that are co-extracted with ignitable liquid residues and could interfere with the identification of an ignitable liquid in a sample. Combustion, evaporation, or biodegradation of ignitable liquids could result in missing compounds that may also complicate the identification of the ignitable liquid.

#### 1.3.9. Quality Checks

##### 1.3.9.1. Process Blank

1.3.9.1.1. A process blank is a quality test of the process used to check for contamination of the extraction of the ignitable liquid residue process from fire debris evidence.

1.3.9.1.2. A process blank involves the use of a container similar to the type of container holding the evidence. This container is then treated to the same procedures throughout the extraction and analysis process as the evidence. May also be referred to as a negative control or control blank.

1.3.9.1.2.1. **For fire debris evidence**, the container used for the process blank is either a new container or a container previously used as a process blank that has been deemed free from ignitable liquid contaminants. These containers are only used for process blanks. If a process blank indicates signs of contamination, the container is discarded.



1.3.9.1.2.2. For solvent extractions, the container used for the process blank (glassware) is the same container that is used for the solvent extraction of the sample.

1.3.9.1.2.3. Data for process blanks is kept in a log book and copies may be placed in the case record.

#### 1.3.9.2. Performance Control

1.3.9.2.1. A performance control is a quality test of the process used to extract ignitable liquids from fire debris evidence.

1.3.9.2.1.1. For extractions using passive headspace concentration with activated charcoal, a performance control involves the use of a new empty container similar to the type of container holding the evidence. A clean substrate, typically a Kimwipe®, is placed in the unused container, and then impregnated with approximately 1 – 2 µL of a known ignitable liquid. The container is treated to the same procedures throughout the extraction and analysis process as the evidence. Also referred to as a positive recovery control.

1.3.9.2.1.2. For solvent extractions, a performance control involves rinsing or impregnating a material similar to the sample with a small amount of an ignitable liquid (approximately ¼ to ½ mL of a medium to heavy fraction), then allowing it to dry briefly (for approximately 1 minute). A solvent extraction is then performed on the item.

#### 1.3.9.3. Solvent Quality Check

1.3.9.3.1. A solvent quality check is the analysis of a bottle of new solvent prior to use in case work. It may also be appropriate to perform a solvent quality check on a solvent that has been previously quality checked but has not been used in over a year.

#### 1.3.9.4. Solvent Blank

1.3.9.4.1. A solvent blank is the analysis of a neat solvent, usually pentane or carbon disulfide. The solvent blank is analyzed on the GC-MS between each sample to ensure that there is no carry-over between samples. The solvent used for the solvent blank is usually the same solvent used to elute the sample; however, additional solvents may also be analyzed to ensure against carry-over.

#### 1.3.9.5. Charcoal Strip Blank

1.3.9.5.1. A charcoal strip blank is the analysis of a charcoal strip from a new lot of charcoal strips prior to case work. It may also be appropriate to perform a charcoal strip blank on a lot of charcoal strips that have been previously quality checked but not used in over a year.

#### 1.3.9.6. Oven Blank



1.3.9.6.1. An oven blank is the analysis of the inside of oven using passive head space analysis to ensure that the interior of the oven has not become contaminated with ignitable liquid vapors.

1.3.9.7. Positive Controls

1.3.9.7.1. A positive control is a standard (such as the test mixture) or known ignitable liquid (such as gasoline) placed in an appropriate amount of solvent and analyzed by gas chromatograph-mass selective detector (GC-MS). Positive controls are used to demonstrate that the instrumentation used to analyze fire debris evidence is performing as expected.

**1.4. QA/QC**

1.4.1. Charcoal Strip Quality Check

1.4.1.1. Each lot of charcoal strips is checked prior to use in case work as follows:

1.4.1.1.1. A new, unused charcoal strip is placed inside a GC-MS vial. Enough of an appropriate solvent is added to cover the strip. The vial is briefly vortexed prior to analysis by GC-MS.

1.4.1.1.2. New lots of charcoal strips should also be analyzed prior to use in case work by analyzing a process blank and a performance control.

1.4.1.2. The lot of charcoal strips is acceptable if:

1.4.1.2.1. The charcoal strip blank and the process blank are free from identifiable ignitable liquid residues. Low levels of some volatile organic compounds (such as toluene or limonene) may be present in the atmosphere. The presence of low levels (typically less than 10,000 counts) of these compounds in the blank is acceptable.

1.4.1.2.2. The performance control shows a count of at least 3,300 for the ethylmethylbenzene peak; the octane peak has the 43, 57, 71 and 85 ions present, and the decane peak has the 43, 57, 71, 85 and 142 ions present.

1.4.1.3. Data files from the GC-MS are retained in the laboratory.

1.4.2. Solvent Quality Checks

1.4.2.1. Solvents are checked prior to case work as follows:

1.4.2.1.1. 20 mL of solvent is evaporated to 1 mL and analyzed by GC-MS using the appropriate method.

1.4.2.2. The solvent is acceptable if it is free from identifiable ignitable liquid residues. Low levels of some volatile organic compounds may be present in the atmosphere. The solvent is acceptable for use in casework even if these compounds are present.

1.4.2.3. Data from the GC-MS is retained in the laboratory.

1.4.3. Oven Quality Checks



1.4.3.1. Oven temperatures are recorded **on the Oven Log sheet each week of use and on the Analysis of Fire Debris Evidence Worksheet each day of use.**

1.4.3.1.1. **The usual oven temperature for fire debris analysis is 60°C (+/- 10°C). The oven temperature may be lowered or increased (up to 85°C). A higher oven temperature may be useful for heavy petroleum distillate or heavy product recoveries.**

1.4.3.2. Oven blanks are analyzed monthly at a minimum. If the oven becomes contaminated or requires maintenance, it is checked as follows:

1.4.3.2.1. If necessary, clean the oven with DI water.

1.4.3.2.2. Suspend a charcoal strip inside the oven and heat for 4 – 24 hours at approximately 60°C.

1.4.3.2.3. Place the charcoal strip in a GC-MS vial, add approximately 0.5 mL of solvent to the vial, vortex briefly, and then analyze by GC-MS using the appropriate method.

1.4.3.3. The oven may be used in casework if the oven blank is free from identifiable ignitable liquid residues. Some volatile organic compounds may be present in the atmosphere. The oven is acceptable for use in casework even if these compounds are present.

1.4.3.4. Data from the GC-MS is retained in the laboratory.

### **1.5. Standards, Ignitable Liquid Reference Products, and Reference Materials**

1.5.1. Standards are chemicals purchased from approved vendors. Standards are used in the classification of ignitable liquids.

1.5.2. Ignitable liquid reference products are commercial products containing ignitable liquid ingredients. These products can also be used in the classification of ignitable liquids.

1.5.3. Reference materials are standards purchased from an approved vendor and accompanied by a Certificate of Analysis.

1.5.4. The test mixture is a reference material used in the analysis of ignitable liquids to ensure that the instrument (GC-MS) is operating as expected. A suggested list for the test mixture is listed in the Trace Quality Assurance Overview.

### **1.6. Instrumentation Requirements**

1.6.1. A gas chromatograph-mass selective detector (GC-MS) is used for the analysis of fire debris evidence.

1.6.2. The carrier gas for the GC-MS shall be high purity helium, typically 99.995% or better.

1.6.3. The instrument shall be capable of detecting each component of the test mixture. The test mixture should be analyzed each day of use, at a minimum.



- 1.6.4. Typically fire debris evidence is analyzed using an auto-liquid sampler (ALS) using either split or splitless injections. However, it may be necessary in some instances to use manual injections.
- 1.6.5. Instrument specifications, including instrument name, method used, and operator, are listed on the instrument data or case notes.

### **1.7. Materials and Equipment**

- Vials (e.g. GC-MS auto-sampler vials, crimp top or screw top with inserts).
- Solvent (e.g. carbon disulfide or pentane), all solvents are of sufficient purity (typically 99% or better) so as to not contribute compounds that interfere with the identification of ignitable liquid residues.
- Activated charcoal strips (also referred to as charcoal strips, activated carbon strips, carbon strips, or strips).
- Twine, string, or un-waxed dental floss.
- Paper clips.
- Standards, ignitable liquid reference products (e.g. 50% evaporated gasoline, diesel fuel, mineral spirits), and/or reference materials.
- **Glassware**

### **1.8. Case Notes and Worksheets**

- 1.8.1. The "Analysis of Fire Debris Evidence Inventory Sheet", "Analysis of Fire Debris Evidence Worksheet", and "Trace Evidence Case Notes" worksheets are used to record case information, case notes, extraction procedures, instrumental parameters, conclusions, and other case related documentation as needed.
- 1.8.2. The forensic case number (unique identifier), date, and analyst's initials are listed on each worksheet.
- 1.8.3. A description of the evidence packaging and the physical state (i.e. contents of package) of the evidence shall be entered on the evidence description line.
  - 1.8.3.1. Example of observed contents:
    - 1.8.3.1.1. Metal cans containing fire debris.
    - 1.8.3.1.2. Glass jar containing yellow liquid.
- 1.8.4. Recording the odor of the fire debris evidence may be useful, but testing for the presence of odor (organoleptic analysis) is at the discretion of the analyst as samples may contain toxic or hazardous materials.
  - 1.8.4.1. For organoleptic analysis, gently waft vapors from the sample container towards your nose and carefully sniff the vapors. Heat-seal or tightly shut the container. Note the odor on the worksheet under the case notes section.



## 1.9. Procedure

- 1.9.1. The sampling process and analysis depend on container integrity. Due to the volatility of sample components, care must be taken to ensure the samples do not evaporate or otherwise change composition. Fire debris evidence containers should be opened for as little time as possible.
- 1.9.2. Fire debris evidence usually comes to the lab in the form of a liquid housed in an appropriate **air-tight** container (such as a commercial container, plastic bottle or glass jar) or as fire debris housed in an appropriate **air-tight** container (such as a paint-style metal can or nylon bag). **Exceptions are made for evidence that needs other types of examinations, such as latent prints or DNA. When other types of examinations are needed, arrangements will be made with the other section(s) as to the best way to sample and preserve the evidence.**
- 1.9.3. **Improperly packaged fire debris evidence will be re-packaged prior to analysis for ignitable liquids. If the evidence is improperly packaged such that the analysis is no longer appropriate, the case may be rejected and the evidence returned unanalyzed. A report will be issued stating the reason the case was closed.**
- 1.9.4. Sampling Policy for Fire Debris Evidence
  - 1.9.4.1. An item that is submitted for ignitable liquid analysis is considered a sample unit.
    - 1.9.4.1.1. If a container of fire debris is submitted, it is considered one sample unit. The container is analyzed by passive headspace concentration with activated charcoal or other appropriate method. The charcoal strip is representative of the whole sample.
    - 1.9.4.1.2. When evidence cannot be examined for ignitable liquids, the submitting agency is notified and the reasons documented in the case file.
- 1.9.5. **Neat** liquid samples
  - 1.9.5.1. Analysis of liquid samples by GC-MS:
    - 1.9.5.1.1. Obtain and label appropriate vials, one per sample, one for a solvent blank, and one for a positive control.
    - 1.9.5.1.2. For each sample, add approximately 10  $\mu\text{L}$  of liquid sample to a vial containing approximately 1 mL of solvent. If a strong odor is present, dilute as necessary.
    - 1.9.5.1.3. For the solvent blank, fill a vial with solvent.
    - 1.9.5.1.4. For the positive control, add approximately 1  $\mu\text{L}$  of a standard or reference material (diluted as necessary) to a vial containing approximately 1 mL of solvent.
    - 1.9.5.1.5. Cap the vials.
    - 1.9.5.1.6. Enter appropriate information on the Analysis of Fire Debris Evidence Worksheet.
    - 1.9.5.1.7. Using the appropriate instrumental method, analyze the following:



- 1.9.5.1.7.1. Solvent blank (run again between each subsequent injection).
- 1.9.5.1.7.2. Test mixture (once per autosampler sequence and once per day of use at minimum).
- 1.9.5.1.7.3. Samples.
- 1.9.5.1.7.4. Positive control.
- 1.9.5.2. If the initial data shows that a sample contains possible compounds of interest that are too weak for identification and does not have an interfering substrate contribution, the sample is concentrated and re-analyzed at least once. If the data shows that a sample is too strong (e.g. resulting in retention time shifts, corruption of mass spectral data, etc.), the sample is diluted as necessary and re-analyzed.
- 1.9.6. Liquid samples placed on absorbent material (Solvent Extraction)
  - 1.9.6.1. Submission of liquid fire debris samples may occur in the form of a liquid poured onto an absorbent material which has then been placed in an appropriate air-tight container. The solvent extraction method works well for medium to heavy ignitable liquid classes (C8 and greater). These samples are extracted using the solvent extraction method only following passive headspace concentration with activated charcoal or when there is previous knowledge that the product contains a heavy ignitable liquid (such as a product label).
    - 1.9.6.1.1. Solvent extraction involves placing the sample in a piece of glassware, such as a beaker, then extracting it with a suitable solvent, such as pentane or carbon disulfide.
    - 1.9.6.1.2. Select an appropriately sized piece of clean glassware and rinse it with about 20 mL of the solvent. Allow the solvent to evaporate to approximately 1 mL. Transfer the evaporated solvent to a GC-MS vial for analysis. The evaporated solvent will serve as the process blank.
    - 1.9.6.1.3. A portion ( $\frac{1}{2}$  or less) of the absorbent material is removed from the container. Note any obvious odor.
    - 1.9.6.1.4. Place the sample in the same piece of glassware used for the process blank (this ensures that any interfering compounds present in the glassware can be accounted for in the process blank and thus explained in regards to the sample).
    - 1.9.6.1.5. Add enough solvent to cover the sample (a minimum amount of solvent should be used).
    - 1.9.6.1.6. Remove the sample from the solvent and allow the solvent from the sample to drip into the container.
    - 1.9.6.1.7. Place the extracted sample on a clean surface under the hood and allow it to dry. Once dry the extracted sample is sealed in an airtight container for return to the submitting agency.



1.9.6.1.8. The solvent extract is allowed to evaporate to approximately 1 mL then transferred to a GC-MS vial for analysis.

1.9.6.1.9. Using the appropriate instrumental method, analyze the following:

- Solvent blank (re-analyze between each subsequent injection)
- Test mixture
- Sample Extracts (including the process blank, any additional process controls and performance controls)
- Positive control

1.9.6.2. If the initial data shows that a sample extract contains possible compounds of interest that are too weak for identification and does not have an interfering substrate contribution, the sample extract is concentrated (either by evaporation, injecting a larger volume, decreasing the split ratio, or using a splitless method) and re-analyzed at least once. If the data shows that a sample extract is too strong (e.g. resulting in retention time shifts, corruption of mass spectral data, etc.), the sample extract is diluted as necessary and re-analyzed.

#### 1.9.7. Fire Debris Samples

1.9.7.1. Passive head space concentration with activated charcoal strips:

1.9.7.1.1. Obtain an empty container to be used for the process blank if required.

1.9.7.1.2. Secure a charcoal strip onto a new paper clip and attach to the lid or an upper surface above the fire debris sample within the container then heat-seal or tightly shut the container. The charcoal strip must hang freely above the fire debris to ensure maximum air flow. Repeat these steps for the empty container if a process blank is required.

1.9.7.1.3. The container should be placed inside of a labeled polymer bag. The polymer bag is then properly sealed and placed in the oven. If polymer bags are not available, the evidence container must be properly sealed and a process blank must be prepared and analyzed.

1.9.7.1.3.1. Typically containers are heated overnight at approximately 60°C. The time needed to heat samples is sample dependent and up to the discretion of the analyst.

1.9.7.1.3.1.1. If a strong odor associated with an ignitable liquid is present in the sample, it may need to be heated for only 3 hours or less at approximately 60°C, or left at room temperature overnight.

1.9.7.1.3.1.2. If latent print examination or DNA analysis of the evidence is required, extract the sample at room temperature for two to four days.

1.9.7.1.3.1.3. Room temperature extraction may also be appropriate for the extraction of low molecular weight compounds (e.g. methanol).



- 1.9.7.1.3.2. Remove the charcoal strips from the containers after they have cooled to room temperature.
- 1.9.7.1.3.3. Cut or tear the charcoal strips in half. Place one half into a GC-MS vial for analysis following the procedure described below. The remaining half of the charcoal strip is returned unanalyzed to the submitting agency.
- 1.9.7.1.4. Analysis of the activated charcoal strip in the GC-MS vial:
  - 1.9.7.1.4.1. Add enough solvent to the vial to cover the charcoal strip.
  - 1.9.7.1.4.2. Vortex briefly.
  - 1.9.7.1.4.3. The solvent may be transferred to a vial insert if appropriate.
  - 1.9.7.1.4.4. Using the appropriate instrumental method, analyze the following:
    - Solvent blank (re-analyze between each subsequent injection)
    - Test mixture
    - Sample Extracts (including any process controls and performance controls)
    - Positive control
- 1.9.7.2. If the initial data shows that a sample extract contains possible compounds of interest that are too weak for identification and does not have an interfering substrate contribution, the sample extract is concentrated (either by evaporation, injecting a larger volume, decreasing the split ratio, or using a splitless method) and re-analyzed at least once. If the data shows that a sample extract is too strong (e.g. resulting in retention time shifts, corruption of mass spectral data, etc.), the sample extract is diluted as necessary and re-analyzed.
- 1.9.8. Infrequently Used Tests
  - 1.9.8.1. Solvent extractions
    - 1.9.8.1.1. Solvent extractions may be performed on other types of items (besides liquids poured onto absorbent materials). Examples of such items include porous materials like clothing, towels, plastic containers, caps, and paper, or non-porous materials such as broken glass.
    - 1.9.8.1.2. The procedure is the same as described above; however, efforts should be made to either avoid using the entire sample or saving a portion of the evaporated sample for return to the submitting agency. If the entire sample requires rinsing with a solvent, such as might be required for glassware or small items, permission shall be obtained from interested parties prior to the extraction procedure.
      - 1.9.8.1.2.1. The portion of the sample in the GC-MS vial will be returned to the customer.



- 1.9.8.1.3. The solvent extraction method is only used following passive headspace concentration using activated charcoal. Solvent extraction may be useful or even necessary for the extraction of heavy petroleum distillates.
- 1.9.8.1.4. A variation of the solvent extraction method can be used to concentrate the levels of a heavy petroleum fraction that is mixed with a lighter fraction. An example is analysis of the gasoline/motor oil mixtures used in two-stroke engines. The oil component is usually quite low compared to the gasoline and may be missed during passive headspace extraction. Again, this solvent extraction is performed after extraction by the passive headspace method.
  - 1.9.8.1.4.1. Concentration of the heavier fraction is achieved by allowing the extracted solvent and light petroleum fraction to evaporate to near dryness. The remaining oily residue is then dissolved in a suitable solvent (such as pentane or carbon disulfide) and placed in a GC-MS vial for analysis.
- 1.9.8.2. Since solvent extractions may not be routinely performed, a performance control should be done on a substrate similar to the sample prior to analysis of the sample if such a substrate can be obtained.
- 1.9.8.3. For less frequently encountered substances, or for less commonly used instrumental methods, standards should be analyzed within the same timeframe that the evidence sample is tested **if they are available**. **If a standard is run and used for identification purposes**, a copy of the data from the standard **shall** be retained in the case **record**. An acceptable timeframe would be within a 30 day period as long as instrumental conditions affecting retention time are not changed (such as column replacement or method modifications).

## 1.10. Data Interpretation and Analysis

- 1.10.1. Chromatograms and mass spectra are either printed or stored electronically for the samples, controls, and standards.
- 1.10.2. Retention times and mass spectra fragmentation are compared with standards, ignitable liquid reference products, or reference materials. The retention time shall be within a 0.1 minute window and the data fragmentation shall correspond to standards, ignitable liquid reference products, reference materials, and/or spectral library matches in order for a compound or its isomer to be identified. Note: Variations between library reference spectra and sample spectra may be the result of differences in concentrations. Poor retention time and/or mass spectral fragmentation may also be the result of variations in concentration between standards and sample components. Dilution or concentration of samples or standards may be necessary. Other factors that may affect the



quality of data involve injection techniques or the need for instrument maintenance. Refer the Trace Quality Assurance Overview on instrument maintenance.

- 1.10.3. Guidelines for data interpretation and classification are listed in the ASTM classification schemes, such as ASTM E1618.
- 1.10.4. Identification of ignitable liquid classes and sub-classes follow ASTM guidelines. The analyst uses laboratory standards and reference materials analyzed by the same method and instrument when identifying ignitable liquids.
- 1.10.5. Specific chromatography patterns and the presence of certain compounds identify gasoline. ASTM guidelines and the use of gasoline analyzed by the analyst are used to identify gasoline in the samples.
- 1.10.6. Pyrolysis by-products and substrate material in fire debris could contribute compounds that are co-extracted with the ignitable liquid residues that could interfere with the identification of an ignitable liquid in a sample. Combustion, evaporation, or biodegradation of ignitable liquids could result in missing compounds that could also complicate the identification of the ignitable liquid. The ASTM protocol discusses substrate interferences and SWGFEX has a searchable substrate database. Comparison samples provided by the submitting agency are used to determine if interfering compounds are present.
- 1.10.7. Fire Debris macros based on extracted ion profile patterns for GC-MS data interpretation and identification may be used in data processing and can be useful when complex patterns are present. For a single compound such as ethanol, the characteristic extraction ions (i.e. 31, 45) can be used for identification.
- 1.10.8. Analytical results and conclusions for each sample are recorded on the worksheet.

### **1.11. Report Writing**

- 1.11.1. The final report format follows HFSC requirements.
- 1.11.2. The report includes the forensic case number (unique identifier), evidence description, method of analysis, and results and conclusions.
- 1.11.3. The following are examples of typical wording used to report the identification of ignitable liquids:
  - 1.11.3.1. A light petroleum distillate was identified in item 1. Examples of a light petroleum distillate include, but are not limited to: petroleum ether, some cigarette lighter fluids, and some camping fuels.
  - 1.11.3.2. A medium petroleum distillate was identified in item 1. Examples of medium petroleum distillates include, but are not limited to: some charcoal starters, some paint thinners, and some dry cleaning solvents.
  - 1.11.3.3. Gasoline was identified in Item 1.



1.11.4. The following are examples of typical wording used to report no identifiable ignitable liquids:

1.11.4.1. No ignitable liquid residue was detected in item 1.

1.11.4.2. No ignitable liquid residue was identified in item 1.

1.11.5. The term “not detected” describes a response below the detection limit of the instrument. The term “not identified” may be used when other compounds are detected but are not associated with an ignitable liquid and most likely correspond to interfering compounds contributed by the substrate.

1.11.6. Reports listing opinions and/or interpretations of data shall have a note in the report stating that these are the opinions/interpretations of the analyst.

### **1.12. Sample Disposition**

1.12.1. Evidence is returned to the submitting agency.

1.12.2. Sample extracts used for GC-MS analysis are properly disposed of by HFSC unless other arrangements have been made with the submitting agency. The unused portion of the charcoal strip is returned to the submitting agency along with the original evidence.

### **1.13. Review and Release of Reports**

1.13.1. All reports undergo a technical review (performed by a qualified examiner) and an administrative review.

1.13.2. Report distribution is directed by HFSC policy.

### **1.14. References**

1.14.1. Texas Department of Insurance, State Fire Marshal’s Office, Forensic Arson Laboratory, Evidence Collection and Submission Handbook, 2001 Revision.

1.14.2. ASTM E1412, "Standard Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Passive Headspace Concentration with Activated Charcoal"

1.14.3. ASTM E1618, “Test Method for Ignitable Liquid Residues in Extracts from Fire Debris Samples by Gas Chromatography – Mass Spectrometry”.

1.14.4. Newman, Gilbert, and Lothridge, GC-MS Guide to Ignitable Liquids, CRC Press, 1998.

1.14.5. Stauffer, E., Dolan, J., and Newman, R., Fire Debris Analysis, Elsevier Inc. 2008

1.14.6. ASTM E1386, “Standard Practice for Separation of Ignitable Liquid Residues from Fire Debris Samples by Solvent Extraction”

1.14.7. Montana Forensic Science Division Laboratory Chemical Analysis Unit C-530-E Ignitable Liquid Residues from Fire Debris by Passive Headspace Concentration with Activated Charcoal

1.14.8. Pasadena Police Department Regional Crime Laboratory Standard Operating Procedures Trace Evidence



**Trace Analysis Section**  
**Analysis of Fire Debris Evidence**  
Forensic Analysis Division

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