

**STATE OF FLORIDA
DEPARTMENT OF FINANCIAL SERVICES
DIVISION OF STATE FIRE MARSHAL
Bureau of Forensic Fire and Explosives Analysis**

**GUIDE TO THE COLLECTION, PACKAGING, SUBMISSION AND
ANALYSIS OF EVIDENCE**

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AN ASCLD/LAB-International ACCREDITED LABORATORY
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This document is intended to be your guide to maximizing the quality of the results you receive from us. It tells you, the investigator, the minimum requirements we have for the evidence you may submit. This Guide focuses on evidence from fires where the presence and identity of ignitable liquids is the key issue as this type of evidence is the bulk of our analytical requests. Other types of criminal evidence may be submitted, and this Guide attempts to provide basic instruction on submission and analysis.

Even before the sample comes to the Bureau, there are measures you can take in your collection and packaging of evidence that will improve our chances of finding and identifying ignitable liquid residues explosives, chemical reaction bombs and, unknown chemicals. There are procedures that must be followed for proper submission of forensic video samples. Following a proper submission procedure and giving complete information on submission forms can aid the analyst in preparing your case. While this document will not attempt to make an investigator an expert in the field of chemistry or video analysis, it is proper that the investigator should understand the fundamentals of how analyses are conducted.

It is hoped that this guide will become a resource to which you will often refer

Sincerely,

*Carl E. Chasteen, Chief of Forensic Services
Bureau of Forensic Fire and Explosives Analysis*



NOTE: *Evidence will be accepted from public law enforcement agencies and fire service agencies in matters related to criminal investigations. Other evidence may be accepted from other public agencies in special circumstances, but must be approved by the Bureau Chief. Submission procedures for evidence other than fire debris may require exceptions to this Guide. Please call the Bureau to determine the proper procedures for these items.*

I. COLLECTION OF EVIDENCE

A. FIRE DEBRIS

- a. Isolate the fire scene as quickly as possible making certain to limit access until after you have viewed the scene and selected samples.
- b. Determine the fire's area(s) or point(s) of origin and the presence of any indicators of ignitable liquid burning. Use your experience and observations. Other tools that may successfully indicate the presence of ignitable liquids are combustible gas meters and specially trained dogs.
- c. Isolate the area of origin and select samples from within it. Remember, if the area where you take the sample did not have any ignitable liquid poured on it, the laboratory cannot find any ignitable liquids on that sample. It is recommended that multiple samples be selected should there be an indication that ignitable liquid was poured in a trail.
- d. Two or three small samples are better than one large one. **DO NOT** fill any container more than half (50%) to seventy-five (75%) percent full.

- e. Take care not to cross-contaminate the samples. If you are using tools such as carpet cutters, saws, or shovels, clean them between samples. Warm soapy water followed by a water rinse should sufficiently clean the tool. To test this, you may wipe the tool after cleaning with a paper towel and submit it for testing, as a comparison sample with the case. Your hands and gloves may also act as carriers of cross-contamination. Wear latex gloves when collecting samples and dispose of them between samples. **DO NOT** put them in the evidence container.
- f. Carefully photograph and record the location of the fire scene and the samples you take.
- g. If possible, obtain comparison samples. A comparison sample is a sample of the same type of material as the suspect sample which, to the best of your knowledge, had no ignitable liquid applied to it. While most comparison samples may be construction materials (wood, carpet, drywall, foam padding, etc...) a prudent investigator will also determine what, if any, ignitable liquids were stored or used at a scene. It may not be possible to isolate and submit a sample of every ignitable liquid noted at a scene, but you should document the brands of materials found or used.
- h. Be aware that many manufactured items may contain trace residues of ignitable liquids as artifacts of their manufacture. This is another reason that comparison samples and exemplars are important to collect. It may allow us to definitively determine if any ignitable liquids found in a sample were present as artifacts of the materials in the samples or were foreign to the materials in the sample.
- i. Be certain that the sample selected is relevant to the fire scene.

B. EXPLOSIVES AND CHEMICAL REACTION BOMBS

- a. The best sample is any unconsumed or unreacted product found in the scene or adhering to post-blast fragments of the device.
- b. **UNDER NO CIRCUMSTANCE SHOULD YOU SEND THE LAB AN INTACT INCENDIARY OR EXPLOSIVE DEVICE.**
- c. Devices are to be “rendered safe” before any samples are taken. Previous testing has indicated that PAN devices leave little if any residue on items

that have been rendered safe. However, details as to the items(s) used to “render safe” any device should be included in the submission details. If, possible and safe, a comparison sample of the material should also be submitted.

- d. Be aware that comparison samples of the soil, flooring, concrete, etc... in the area should be collected, if possible.
- e. Un-contaminated comparison samples establish a baseline of what chemicals were inherent to the scene.
- f. Post explosion debris and components (such as pipe bomb fragments, end caps, plastic bottles, paper tubes, etc...) should be sent to the lab so that they can be examined under the microscope and/or extracted for analysis. Due to the potential for corrosive action or production of static electrical charges, metal containers and some plastic containers should be avoided. Glass jars or paper envelopes or bags can be used.
- g. Materials that are distinct and easily separable should be sent in separate containers (e.g. the liquid and the foil balls from a plastic CRB bottle would be sent as three separate items: The Bottle, The Foil, and TheLiquid).
- h. Swabs of areas or surfaces which were in the path of the pressure wave may contain unconsumed material as well as post-explosion residues.
 - 1. The quantity may not be sufficient for an identification.
 - 2. Contaminants inherent to the surfaces may render analyses inconclusive
 - 3. Comparison samples (of any swabs) and the surfaces are very important
- i. For clandestine explosives laboratories or workshops, the scene should be treated with the same or greater precautions as with a clandestine drug laboratory. The recommendations for collection of **CHEMICAL EVIDENCE** (next section) should be followed.

C. CHEMICAL EVIDENCE (Clandestine Laboratory and Unknowns)

- a. Isolate the scene as quickly as possible making certain to limit access until after the scene has been determined to be safe for entry.
- b. Determine if there are unopened containers of chemicals with intact labels. Use your experience and observations. Photograph in place and with labels turned toward the camera.

- c. Determine if there are opened or unlabeled containers of chemicals to be tested. Use your experience and observations. Photograph in place.
- d. Loose chemicals or chemicals from inside containers used for "cooking" must be treated with extreme caution.
- e. Select samples to be analyzed and package according to type. Liquids or slurries require separate packaging than dry powders. Be certain to label all samples collected and relate to a description on the submission form.
- f. Two or three small samples are better than one large one. **DO NOT** fill any container more than half (50%) to seventy-five (75%) percent full.
- g. Take care not to cross-contaminate the samples. If you are using tools to pick up or transfer chemicals into submission containers, be certain to clean and dry the tools between each sample. Warm soapy water followed by a water rinse and drying should sufficiently clean the tool. Your hands and gloves may also act as carriers of cross-contamination. Wear nitrile or other chemically resistant gloves when collecting samples and dispose of them between samples. **DO NOT** put them in the evidence container.



II. PACKAGING SAMPLES

A. Containers – General Considerations

1. Essential properties
 - a. Unused
 - b. Airtight (For all Fire Debris and most Explosives or Chemical Items)
 - c. Clean--no hydrocarbon or other chemical residue
 - d. Inert--will not break down when heated or in contact with solvents
 - e. Will not promote a static electrical charge (For Explosives)
2. A properly packaged container satisfies the following criteria:
 - a. It seals any volatile liquid or chemicals and protects them from evaporative loss.
 - b. It avoids contamination from one sample to another or from any external source.
 - c. It indicates the chain of custody and shows the protection of the collected material from the crime scene through analysis.
3. Seals
 - a. A clean seal is essential. For metal cans, clean the “V” channel of the can rim before placing the lid on the can.
 - b. Containers must be completely sealed to prevent any passage of vapors or contaminants into or out of the container. Be certain can lids are tight all the way around. For plastic bags (Section B 2), they must be heat sealed completely with no flaws in the seam if they are being used for fire debris samples..
 - c. Tamper evident tape (tamper proof tape) must be placed across the container lid/seam in such a manner that the item cannot be partially or completely opened without tearing the tape.
 1. Three pieces of tape at 2:00, 6:00 and 10:00 are recommended on cans.
 2. A crisscross of tape over the lid of a jar extending to the sides of the jar or bottle is also appropriate.
 3. Bags (plastic or paper) must have the tape seal across the original or any subsequent openings (cuts).
 - d. Seals and Tape must be initialed/signed by the investigator of record. The date of the seal should also be included.

B. Container types

1. Metal cans

- a. Use only clean, non-rusted, containers. Unused metal cans with tight fitting lids are the best. Cans with lids that do not fit or holes rusted through may be returned at the discretion of the Bureau.
- b. To combat rusting, epoxy lined cans may be used. Can linings other than epoxy should not be used until after the laboratory has tested a sample for the presence of interferences.
- c. Submit an unused comparison can when lined cans are used.
- d. Cans should not be referred to as "paint cans" on official forms as they did not hold paint. Refer to them as "metal cans".

2. Plastic Bags/Bottles:

- a. The only plastic bags acceptable for fire debris evidence submitted to the Bureau are:
 - i. polyester bags
 - ii. polyamide (nylon 11) bags
 - iii. nylon 6 bags
 - iv. May be used after consultation with the laboratory and only with samples of a size or shape that will not fit into a metal can.
 - v. Avoid puncture. Punctured bags will be returned.
 - vi. Plastic bags should not be left in a hot area (such as a car's trunk) for longer than a month. Doing so increases the potential that certain chemicals will bleed off the plastic and allow it to crack.
- b. For non-fire debris evidence: such as solid items for explosives analysis, powders and crystals from clandestine lab scenes; polyethylene, polypropylene, polyester, or polycarbonate bags or bottles may be used.

3. Glass jars:

- a. Teflon® lined caps - Non Teflon® seals that are in contact with solvent may dissolve and contaminate samples.
- b. Pre-cleaned - certified free from hydrocarbon residue are preferred.
- c. Submit an unused comparison jar when an uncertified jar is used.
- d. Breakable - Use care in the storage and transport of glass jars.

4. NEVER fill a container to more than seventy-five percent (75%) of capacity. **DO NOT** over-stuff cans. The method used for fire debris analysis in the laboratory for recovering ignitable liquid residues requires an adequate headspace above the debris for the volatilization of trace ignitable liquids. **If the can is too full, the quality of the fire debris analysis will suffer.** For other evidence, the 50% to 75% rule will accommodate minor off-gassing of the sample.

C. Unsuitable containers for fire debris

1. Paper bags
2. Plastic containers, including cans with plastic lids, gaskets, or plastic bags
3. Previously used containers, such as pickle jars, which could contain traces of contaminating substance
4. Containers that may be contaminated by manufacturing process residues
5. Nylon bags other than those noted above unless the lab has tested the item.
6. Contact the Lab to test other products for contamination, at (850)530-2700.
7. IF IN DOUBT, Contact the laboratory for advice.

III. SUBMISSION

A. General Submission and Shipping Requirements

1. Put only one case in each box. Placing several samples in plastic bags or small vials in one large container can lead to cross-contamination. Items packaged together in this manner will be treated as a single submission.
2. Use plain boxes
 - a. Labels must not imply the box contains specific ignitable liquids (unless they are standards for comparison).
 - b. Avoid writing that is not specific to the case
 - c. Do not reuse boxes returned by the laboratory
3. Do not delay in shipping the evidence to the laboratory. The time between the fire or other incident, sealing of the evidence in the container, and shipping to the laboratory can affect on laboratory's ability to recover any ignitable liquid, explosives, or chemical residues. It is best to collect and send the samples as soon as possible.
4. Liquid samples must be placed in clean glass vials with screw-on lids. **DO NOT** use rubber stoppered serum vials. **DO NOT** fill the container more than 50% full.

- a. **DO NOT** send more than one-half a fluid ounce (15 milliliters) of a petroleum product to the laboratory. Add sufficient absorbent material (paper towel, gauze pad, etc...) to the liquid sample in the vial to take up the free liquid. Seal the vial lid. **DO NOT** use paraffin to secure the lid. Tamper evident tape may be used. The vial then needs to be packaged with additional absorbent material on the outside of the vial and sealed inside a pint or quart can. **REMEMBER** to submit comparison samples of any absorbent material used to absorb free liquids.
 - b. For acids or non-ignitable liquid samples, the liquid quantity should be limited to one-half a fluid ounce (15 milliliters). No absorbent should be used for the liquid, but it should be doubly contained inside an outer container to prevent leakage or loss of the sample should the primary container break.
5. Cans and containers found on the scene should have any liquid removed. If the liquid is suspected of being an ignitable liquid follow the instructions in #4 above. Seal the holes on the container with a cork stopper and tape over, then place the evidence into an approved container of appropriate size.

CAUTION! If the can is suspected to have fingerprints, do not use a plastic bag, but package it according to Florida Department of Law Enforcement or Federal Bureau of Investigations procedures. It will not be appropriate for ignitable liquid analysis. It is the investigator's responsibility to choose the forensic method that would provide the "best evidence".

6. Tissue and body parts should be preserved **only** by freezing the sample. Caution the coroner or medical examiner that you do not want any preservatives placed on the tissue. Contact the laboratory **BEFORE** shipping. The tissue should first be frozen and packed in a sealed ice chest. Water Ice and Dry Ice are not recommended as there are distinct shipping issues with either. Freezing followed by overnight hand or courier delivery allows the frozen items to slowly thaw. They will then be ready for analysis when they arrive at the bureau.
7. Body parts or other items with the potential to have been contaminated by bodily fluids (such as a victim's or suspect's clothing) **must** be labeled as containing a **BIOHAZARD** before shipping to the bureau.
8. Once the sample has been selected and placed in a container, seal the container tightly so as to remove the possibility of the evaporation of any volatile liquid or chemical residues or the contamination of the evidence sample.

9. Mark the outside of the container with your initials, the incident location, your agency case number, the contents, and the location where found. This information may be placed either on an evidence label or written directly on the container's surface using a permanent marker.

Other valuable information that may be included: the incident date, the date and time the sample was collected, and your exhibit number. Please be certain to leave some room on the container for the laboratory to place its own markings.

B. Getting your Evidence to the Bureau

1. Whichever method of delivery you use, you must be certain that the requirements for a proper chain-of-custody are fulfilled.
2. **Hand Delivery** - The bureau is open between 8:00 am to 5:00 pm, Monday through Friday. If you are delivering the evidence yourself, or if you are having it transported by another investigator, please plan to arrive within that time period. If, due to an unusual circumstance, evidence cannot be delivered within those time periods, please call the laboratory at 850-539-2700 to make alternative arrangements. When you bring in your evidence, please fill out one of **our** evidence submission forms.
3. **Courier** - A completed evidence submission form should accompany the evidence. Only certified carrier services should be used (example: United Parcel Services, Federal Express, Purolator, United States Postal Service, Airborne). Evidence must be traceable through the carrier such as having a certified or registered mail receipt number. Shipped evidence must meet Federal Department of Transportation requirements as well as company specific policies. If known dangerous goods are being shipped, there are restrictions. It may be best to ship these items by ground or to consider hand delivery.

C. The Evidence Submission Form

By completely and properly filling out the submission form (APPENDIX 2), the investigator is documenting all the information necessary for the bureau to track and process the case. The submission form will also provide a chain of custody for the evidence's receipt and return. This Bureau uses a computerized laboratory information management system. Because of this, there are certain items of information that are required in order to properly log your case. By using **our** evidence submission form you can be assured that all of the information we need is included.

To help you to learn about the evidence submission form, the following information is provided. Please refer to the evidence submission form contained in this guide.

1. Mark the appropriate box to indicate whether this is a **new case or additional evidence** to an older one. Include the case number of the original case for additional items. This way we can insure that the same analyst works on all associated samples.
 2. **BFFEA Number** - Leave this space blank unless you are sending an addition to a previous submission and you know the old laboratory case number.
 3. **Agency Number** - Type in **YOUR agency's case number** for the case. This is a necessary identifier for our database. **DO NOT** use a dispatch number.
 4. **Submitting Agent** - First and last name of the investigator, detective, or agent of record. You should also indicate any alternate submitters in this area or the remarks area, so that information can be released to them as well
 5. **Email** – The submitting agent's email address.
 6. **Agency** - The name of the agency for whom the submitting agent works.
 7. **Tel. No.** - The submitting agent's full telephone number, please include area code and/or extensions. (SUNCOM numbers may be included)
 8. **Agency Address** - The complete address (street, city, and zip code) of the agency location where reports and evidence may be shipped.
 9. **Cell No.** – The submitting Agent's cellular telephone number
 10. **Property Owner/Occupant** - Full name of the owner or occupant of the item or property involved in the incident. If this is undetermined, write "UNKNOWN" in the space. If you find out at a later date, please contact the laboratory so that we may update our records.
 11. **Incident Address** - The full address of where the incident occurred or where the evidence was taken. Include street address, city or village, and zip code. If it is a fire involving a movable object (car, boat, motorcycle), give a description of where the object was found.
 12. **Nature of Incident** - What type of crime and to what do you refer: (e.g. "suspicious fire", "structure fire", "vehicle fire", "explosion", "criminal damaging", etc...).
 13. **Incident Date** - The date the incident occurred.
- 12. List of laboratory tests** - This is the list of tests performed by Bureau of Forensic Fire and Explosives Analysis. You are to use the letter code beside them to designate the test(s) requested on the "List of Evidence Submitted".

(A) - "**Determine presence and/or identity of ignitable liquid residues**"- The code A in the "list of evidence submitted" indicates

that you want the analyst to determine if an ignitable liquid is present in that particular sample.

(V) – **“Video/Digital Analysis”** – The request is for the analyst to open the media, render it readable (if possible), and extract images and information that will aid an investigation.

(E/I) – **“Explosives/Incendiaries”** – A battery of tests to determine the presence and identity of un-reacted materials or the presence of residues consistent with explosives or incendiaries.

(CRB) – **“Chemical Reaction Bomb”** – A battery of tests will be conducted to ascertain if the item and materials submitted contain components or residues of chemical reaction/pop bottle bombs.

(HO) - **"Hold Only -No Test Requested"** –Items the investigator does not need to have tested, but which he/she wishes to maintain with the other evidence to preserve the chain-of-custody.

(C) - **"Comparison Sample"** - Should be unburned material from the fire scene identical to the suspect sample and which the investigator is relatively certain contains no ignitable liquid. It may also be a known liquid or other material, obtained by the investigator, to be compared with the unknown.

(P) – **“Prints”** – Items requested for latent fingerprints will be submitted by the Bureau to the local Florida Department of Law Enforcement Laboratory for processing (using chemical, alternate light, or other methods to examine items for the presence of latent fingerprints).

(O) - **"Other Requests"** - Other tests on the evidence that may be required. This must be explained in the remarks section or cleared by an analyst before being used. These requests may require the laboratory to send the evidence to a different laboratory. Please call the laboratory prior to using this designation.

13. **List of Evidence Submitted** - Give a complete description of each item of evidence – suggested items to include: container type and size, contents, and location obtained:

Use only one line for each piece of evidence

Do not refer to suspect liquids by name (gasoline, kerosene, etc.) unless you personally purchased the liquid. We recommend that you simply call it a liquid.

14. **Tests** - Indicate the test letter code (see 12) to be performed on each item submitted. Typically, only one test per item will be indicated. If more than one type of test is needed, it may be necessary to decide which is of greater value as some tests will interfere with others. The investigator should contact the laboratory in advance of making multiple test requests.
15. **Chain of Custody** - This area will show the chain of custody of the evidence from the time it is collected, through submission to the laboratory, to the time it is either returned or stored by the laboratory.
16. **Print Agent Name**- The printed name of the individual initiating an action.
17. **Agent Signature** – The signature of the person on the “**Print Agent Name**” line.
18. **Transfer** - The action taken. e.g. "sent to lab", "received by lab".
19. **Date/time** - The date and time of the action (the time is not essential as you may not know when the item was picked up by the courier service.
20. **Remarks** - For explanations or additional comments by the submitting agent about the case. These can often help the analyst in examining your case. If a canine team were used to assist in your sample selection this would be an appropriate place to note that fact.

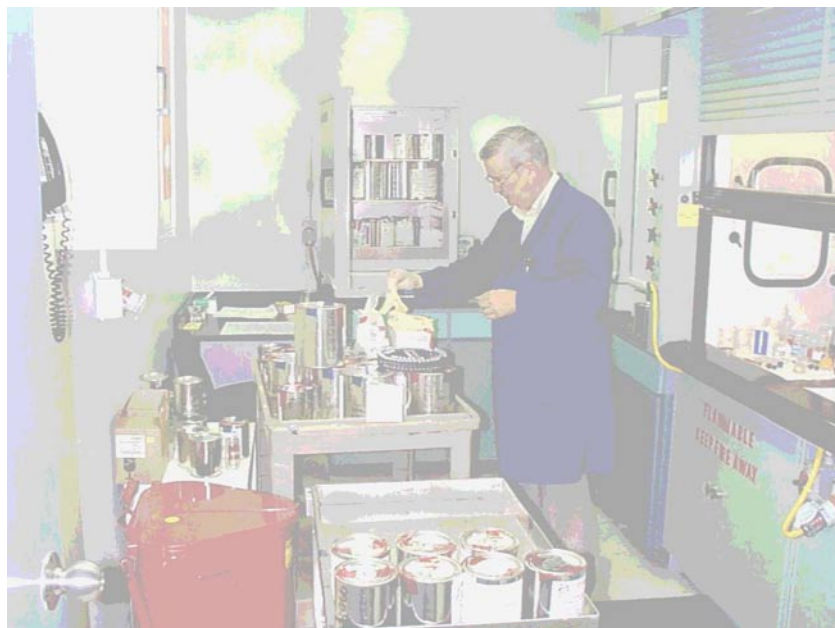
This is where the submitter would request for the case to be a RUSH case. A reasons must be given and the investigator must be available for results. A case submitted by an investigator who is leaving for a week long vacation can't be that urgent. The criteria that the laboratory will consider in giving a case a RUSH priority:

- a. Fatality - If a fatality occurred in the fire it should have rush priority.
 - b. Injured victims or first responders from any phase of the fire (including suppression, investigation, or clean-up) or scene examination.
 - c. Major events with significant dollar losses.
 - d. Suspect in custody/impending court.
20. **For BFFEA Use Only: (Return Note, Received Via, Returned Via, Status, and Disposition)** - This area will be used by the Bureau to note internally tracked information.

D. Sample Disposition

The room available in our evidence storage area is limited. All case samples submitted by agencies outside of the Division of State Fire Marshal will be returned to the submitter. Case samples submitted by Division of State Fire Marshal's Bureau of Fire and Arson Investigation will be transferred to the BFAI long term storage area.

Evidence held in the BFAI long term evidence storage area is wholly under the control of the BFAI representative stationed at the laboratory. All requests for return of stored evidence for court must be coordinated through BFAI.



IV. ANALYSIS

A. FIRE DEBRIS

It is beyond the scope of this document to completely explain the processes and chemistry involved in all laboratory analyses. Because the majority of the forensic requests sent to the bureau focus on the recovery and identification of ignitable liquids, this section will attempt to highlight the most important parts of the process. Thus, when you receive your results from the bureau you will have a better understanding of how the results were obtained.

Your evidence is received by the bureau and secured in a locked evidence room. A file for your case containing the submission sheet is prepared and all necessary information concerning the case is logged into the computer system. The case is then assigned to an analyst. The analyst takes the file, removes the evidence from storage, and prepares it for analysis. For fire debris, the analyst records information concerning the evidence in the case file (description, status of seal, etc...). The analyst then places an activated carbon strip (membrane) in the vapor space of the evidence can. In most instances, the can will be heated at 66° C for 16 hours.

The bureau has experimentally determined this to be the optimum time and temperature to cause trapped traces of ignitable liquid molecules to pass into the vapor state and attach themselves to the carbon strip. The carbon strip is then removed, placed in a glass vial, and carbon disulfide (CS₂) is added. The carbon disulfide is a solvent that is extremely efficient at removing the extracted ignitable liquids from the carbon strip. The result is a liquid extract that will be tested by instrumental methods.

The preferred instrument for fire debris analysis begins with a Gas Chromatograph. The use of gas chromatography allows the components of these complex mixtures to be separated by their volatility and molecular size. Ignitable liquids, are mixtures of many different substances (for example, gasoline contains over 400 chemicals). Once separated, the components are introduced into a detector. All samples are analyzed on a Mass Spectral Detector (GC/MS).

The technique can identify ignitable liquids from the extremely volatile and simple like methyl alcohol to the very complex and relatively large molecules found in deteriorated diesel fuel. GC/MS provides a three dimensional picture. Graphs are created by plotting the time it takes for an individual chemical to pass through the gas chromatograph and into the detector. The detector's response is created as the various molecules enter. The response is directly proportional to the concentration of that particular component in the sample. Each component will be bombarded by a beam of electrons and made to break apart into various fragments of different size. The combination of fragments produced is indicative of a particular chemical or class of chemicals and is called a mass spectrum (MS)

The graph showing the total number of molecular fragments produced by the detector against the particular time they exited from the chromatograph is called a total ion chromatogram (TIC). For various complex ignitable liquids, the TIC by itself may be characteristic of different ignitable liquids. However, the value of GC/MS is that the TIC can be further examined by dividing it into selected molecular profiles. For example, experimentation has shown that a molecular fragment that weighs 57 atomic mass units (amu) is indicative of a type of organic chemical compound called an alkane. We also know that alkane compounds will occur in a regular and predictable pattern in petroleum distillates. Once the total ion chromatogram of a sample is collected, the computer can reconstruct the chromatogram showing only those chemical components with a 57 amu fragment. By analyzing a large number of different fragments with these reconstructed ion chromatograms, the different blends of chemical compounds characteristic of particular ignitable liquids are determined and identifications can be made.

The reasons that analyses are not always clear are complex and depend on a large number of variables. Ignitable liquids differ from each other by the number and proportions of their components. Lacquer thinners are mostly composed of smaller molecules with high volatility. While gasoline contains many high volatiles, it also contains components of lower volatility and extends across a wider range. Kerosene contains few high volatiles, but many mid-range and low volatiles. These are examples of only three types of ignitable liquids. There are many others that may contain very different components anywhere along the range.

As ignitable liquids are exposed to heat from fires or evaporation, they lose many of their most volatile components. This deterioration changes the pattern in the chromatogram. The analyst must be able to understand the deterioration variable in order to interpret the chromatogram. In most cases, even with 95% deteriorated gasoline, enough components remain to allow the analyst to identify the pattern.

Possibly the greatest interference is the fact that so called “pyrolysis” products (products from the thermal degradation of materials) are formed in fires and most materials in a fire scene contain inherent organic chemicals. Most everything in our homes, at our work, inside our vehicles or covering our bodies is made from very complex organic molecules. Clothes, carpet, bedding, upholstery, and even the human body contain large complex organic molecules. As these complex molecules burn, they may break apart into a variety of smaller molecules. Many of these same molecules also occur in ignitable liquids. The process for recovering ignitable liquid residues from fire debris extracts these molecules along with the ignitable liquid molecules. While the interference patterns are usually different in proportion and composition from those of ignitable liquids, the concentration of interference products in a sample of debris may be higher than the concentration of ignitable liquid residue. If this occurs, the ignitable liquid pattern may seem to be obscured and may be unrecognized on initial examination. This is where the value of GC/MS comes in. The utilization of reconstructed ion chromatograms and the determination of the identity of particular compounds can often clarify if what was found is an ignitable liquid or a product created by the materials at the scene.

Once the appropriate techniques have been employed and quality assurance requirements have been met, the analyst enters the results of the analysis into the laboratory computer system and causes a report to be printed. The case file then reviewed by another analyst with expertise in fire debris analysis. During review, both the interpretation of the data and structure of the report and documentation are checked. If discrepancies are found, suggestions are made to the analyst. Once both analysts are in agreement and the Bureau Chief are satisfied, a report is released.

Your case belongs to you. We will not release information about your case to anyone but you, someone you authorize, someone in your chain of command, or an appropriate officer of the court while the investigation is still active. We will strive to maintain confidentiality at all times, and to achieve it, we keep all files and records in secured areas. The computer system we use has several levels of passwords and security controls. The facility is kept secured and only authorized personnel may enter. The facility is further divided into areas or rooms that are more secure than others. These items as well as others are part of the effort of the Bureau of Forensic Fire and Explosives Analysis to provide quality service to its “customers”.

B. CHEMICAL ANALYSES (Including Explosives, Chemical Reaction Bombs, and General Unknowns/Clandestine Laboratory Chemicals)

It is beyond the scope of this document to completely explain the processes and chemistry involved in all laboratory analyses. Clandestine laboratory evidence may be divided into two basic types of analyses. First, is the identification of solvents that have been used in the "cooking" process. Second, is the identification of powders, crystals, or residue and suspected acids or caustic solutions. These two types of analyses require the use of different tools in order to characterize the chemicals present.

We will first consider the solvents to be identified. Some solvents are derived from or are distillates of petroleum. Others are low molecular weight oxygenated solvents that have been synthetically prepared or isolated. Because the majority of the regular forensic requests sent to the Bureau focuses on the recovery and identification of ignitable liquids, these analyses are routine. The previous section highlighted the most important parts of the process for identifying ignitable liquids and solvents and will not be repeated here.

In this section we will focus on the identification of powders, crystals, residues, acids, and caustics. Most of these are composed of inorganic chemicals and will require a combination of multiple techniques for confirmation. All, however, begin with observation. The initial tests performed will be at the analyst's discretion and based on the results of microscopic or macroscopic observations and screening tests. The analyst should obtain consistent results with at least two different test methods before making a conclusion, unless a single confirmatory test method is available. Wet chemical tests may be used in some instances as confirmatory, but the use of various types of instrumental analysis for confirmation is preferred.

The choice of instrumental technique is dependant on the results of previous observations and screening tests. Instrumental techniques available include ion chromatography (with conductivity detection of cations and mass detection of anions), Fourier Transform Infrared Spectroscopy, Ion Mobility Spectrometry, X-Ray Fluorescence Spectroscopy, and Raman Spectroscopy.

Ion Chromatography is the preferred confirmatory method for inorganic ions. Fourier Transform Infrared Spectroscopy (FTIR) may be used on either inorganic or organic samples though inorganic spectra are typically less informative and often produce inconclusive results. FTIR is best applied to pure organic compounds. FTIR is useful in identifying mixtures of organic materials only when the mixture is uniform and consistent with standards. For example: comparison of the spectra obtained from an extract of a suspected smokeless powder with an extract of a standard smokeless powder. Ion Mobility Spectrometry is used in this laboratory as a screening method for high explosives. XRF Spectroscopy allows for the identification of the elemental constituents (from Sodium to Uranium) of materials and requires minimal sample preparation. Raman Spectroscopy is an alternative to FTIR that requires minimal sample preparation and is useful for inorganic samples.

C. DIGITAL AND FORENSIC VIDEO EVIDENCE

Film, Digital Images or Video Media may be sent to the Bureau of Forensic Fire and Explosives Analysis by mail or a courier service (Federal Express, United Postal Service, Airborne Express, etc...), or hand delivered. Once items are received, they are placed into an electronic folder that is assigned to the investigator of record with that folder being named with the appropriate agency number associated with the images. A separate digital image log in form is maintained.

For processing Digital Images, the Equipment used consists of a Digital Darkroom System and software. The process may begin with either the Picture Transfer Application for the digital camera (as provided by the camera manufacturer) or a direct download from the flash or other media. The Picture Transfer Application is a software utility developed for one-step downloading of files from a camera or flash card. The images are then placed into a database where information associated with the image can be linked to the image. The database that we currently utilize is Canto Cumulus. With it, we can organize, track, preview, copy, move, annotate and archive virtually any type of digital media, including graphic, page layout, presentation, sound and video files. Most images are transferred into .jpeg or .tiff file format to be placed into Cumulus database. For management of the images, Adobe Photoshop Crime Scene software is utilized. For archival of Digital Images a CD or DVD dedicated to the investigator (or Agency) of record is created.

For Forensic Video processing, the equipment used includes playback devices such as video cassette recorders, CD / DVD players, digital media players, or monitors. For the forensic video analysis system(s), these systems include: Ocean Luggable AVID Express Pro or the Digital Mixed-Media Rack System. Once received into the Bureau and documented, the procedure would begin with the creation of a forensic video/audio worksheet.

The analysis of video evidence begins with the visual inspection of the video evidence where the condition of the cassette housing and tape media is noted. Then the condition of digital media is inspected and any conditions are noted along with any corrective actions taken. For the media, we must then enable any record-protection, or write-protection device and select the appropriate playback device(s) for the video evidence.

At this point, we must determine if the submission is an original or copy. If considered a copy, we will contact the submitter and request the original. If the copy is the best available, we will proceed with the analysis. Because the media may archive considerable video information we must attempt to locate the video segment area of interest as indicated in the submitter's request for analysis. If audio evidence is recorded in conjunction with the video evidence, we must ensure the audio evidence is noted, and analyzed with the video evidence. We will then generate an uncompressed or lossless compressed digital copy of the video segment area of interest for analysis. This maintains the original submission without affecting it.

When working with video evidence, it is necessary to note available details regarding the type of system used to generate the recording submitted. Available details include, but are not limited to:

- (a) Number of camera views
- (b) Time/Date stamp if available
- (c) Record mode if available
- (d) Type of compression used if available
- (e) Color mode

(f) Processing equipment (e.g. multiplexer, split-screen...)

We will then process the digital copy using the appropriate tools available in the Forensic Video Analysis System. The processes may include, but are not limited to:

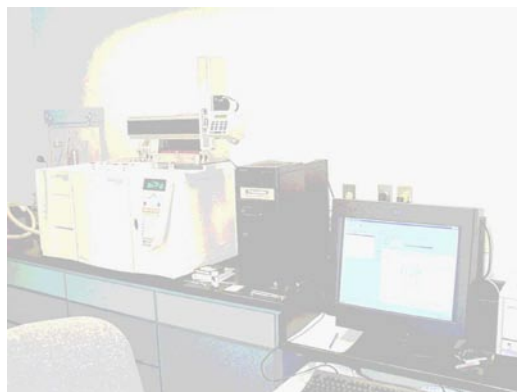
- (a) Levels and contrast adjustments
- (b) Field de-interlacing
- (c) Camera view isolation
- (d) Real-time processing
- (e) Image stabilization
- (f) Magnification
- (g) Subject highlighting
- (h) Frame averaging
- (i) Channel isolation
- (j) Audio clarification

Once processed, we will determine a suitable derivative output of the processed digital copy. The output may include, but is not limited to:

- (a) Analog videotape
- (b) Digital media
- (c) Print media

We will also maintain an archive of the digital copy and electronic versions of the derivative output. These back-up devices include, but are not limited to:

- (a) Recordable only CD's
- (b) Recordable only DVD's
- (c) External hard-drives
- (d) Digital media tape (enable any record-protection device)
- (e) Analog media tape (enable any record-protection device)



APPENDIX 1

GLOSSARY OF TERMS

- ACCELERANT -** Anything that speeds up a process. In fire investigation, the term “accelerant” refers to ignitable liquids deliberately applied to speed up a fire. Most of these are products of petroleum refining.
- CROSS-CONTAMINATE -**When materials from one sample contact material in another. This can be from either physical touching or the inter-mingling of vapors.
- EVIDENTIARY VALUE -** The value of item as evidence.
- EXPLOSIVES -** Materials that, when subjected to shock, heat, flame, or friction burn at a very fast rate or disintegrate to form large volumes of gases.
- GAS CHROMATOGRAPHY-** A chemical separations method employing a gas such as hydrogen or helium to cause a vaporized mixture of chemicals to pass through a specialized tube where the mixture of chemicals will be separated. This separation is based on each chemical's tendency to pass over the tube's coating. The resulting graphs are called **chromatograms**.
- INCENDIARIES -** Mixtures of oxidizing agents and fuels that are easily ignited to initiate fire.
- IGNITABLE LIQUIDS -** Mixtures of organic chemicals with a boiling range above normal ambient temperatures. The mixture may be considered flammable (Flash point below 100° C) or combustible (Flash point above 100° C). Ignitable liquids may be simple such as isopropyl alcohol (a single component) or complex such as gasoline (over 400 components).
- MASS SPECTROSCOPY -** An instrumental technique that can be used as a detector for gas chromatography. As organic chemicals, which have been separated by gas chromatography, exit the gas chromatograph, they are bombarded with electrons. This causes them to fragment (break apart) into distinct patterns. Familiarity with ignitable liquid classes teaches the analyst the various classes of organic compounds contained in ignitable liquids. Re-construction of chromatograms by specific fragments allows the analyst to "see" ignitable liquids that may be otherwise obscured.

- OXIDIZERS -** Materials that provide oxygen for chemical reactions either with slight heating or at room temperature. In contact with organic chemicals, they can react vigorously to ignite fires or explosions.
- PYROLYSIS -** The breaking down of complex materials into simpler, smaller materials by oxidation or heating. The smaller materials may often re-combine, depending on conditions, to make different complex molecules.
- TAMPER EVIDENT TAPE –** Specialty tape used to seal evidence that cannot be removed from the container to which it is attached without shredding or tearing.
- VOLATILITY -** The ease that a substance passes from being a solid or a liquid to being a vapor



**Chief Financial
Officer &
State Fire Marshal
Jeff Atwater**

Appendix 2 (Footer Not Included)
Bureau of Forensic Fire & Explosives Analysis
 38 Academy Drive
 Havana, FL 32333
 Phone: 850-539-2700
 Fax: 850-539-9662

EVIDENCE SUBMISSION FORM - Please complete all relevant blank areas.						
Submission of evidence relinquishes all decisions regarding analytical processing and choice of methods to BFFEA						
<input type="checkbox"/>	New Case	<input type="checkbox"/>	Suspected Homicide	<input type="checkbox"/>	Special Testing (explain in "Remarks")	BFFEA (Lab) Assigned #
<input type="checkbox"/>	Additional Evidence	<input type="checkbox"/>	Fatality	<input type="checkbox"/>	RUSH Request (explain in "Remarks")	Your Agency Case #
Submitting Agent:					Email	
Agency Name:					Tel. #	() -
Agency Address:					Cell. #	() -
Property Owner or Occupant:					Canine Alert?	
Incident Address:						
Nature of Incident (Please describe):					Incident date:	
List of Laboratory Tests (Choose one of the letter codes below to be put into the "Test Requested" column):						
(A)	Determine presence/identity of ignitable liquids	(V)	Video/Digital Analysis			
(E/I)	Explosives/Incendiaries		cal Reaction Bomb Determination			
(HO)	Hold only - No test requested	(C)	Comparison Sample			
(CL)	Unidentified Chemicals/Clandestine Lab (NO DRUGS)	(O)	Other requests - Explain in remarks section			
List of evidence submitted (Container, content, location collected):						Test Requested
1.						
2.						
3.						
4.						
5.						
6.						
Chain of Custody (Indicate who had possession, to whom or where it was transferred, and when it was done):						
	<u>Print Agent Name</u>	<u>Agent Signature</u>	<u>Transfer</u>		<u>Date and Time</u>	
1.						
2.						
3.						
4.						
5.						
REMARKS (any specific precautions or notes concerning the evidence?):						
For BFFEA Use Only:		Received via:				

APPENDIX 3

Deleted

APPENDIX 4

HOW TO SHIP KNOWN IGNITABLE LIQUIDS

A. Packaging for flammable liquids

1. The laboratory recommends that you ship all known ignitable liquids under the **Excepted Quantities** guidelines
 - i. No more than 30ml (1 oz.) per vial , no more than 500ml (16.6 oz.) per box
 - ii. Each vial must be packed in a metal can with surrounding packing material
 - iii. Each can in the box must also have surrounding packing material
2. The airbill must be marked for ground shipping and for dangerous goods, shipper's declaration not required
3. The outside of the box must be labeled with an excepted quantities label.
 - i. The label must be marked with appropriate class, most everything you will send to the lab will be a class 3
 - ii. The label must also have the appropriate UN or ID number as well.
 - a. Petroleum Distillates UN 1268
 - b. Gasoline UN 1203
 - c. Kerosene UN 1223
 - d. All other UN numbers call the laboratory for assistance.

DANGEROUS GOODS IN EXCEPTED QUANTITIES

This package contains dangerous goods in excepted small quantities and is in all respects in compliance with the applicable international and national government regulations and the IATA Dangerous Goods Regulations

Signature of Shipper

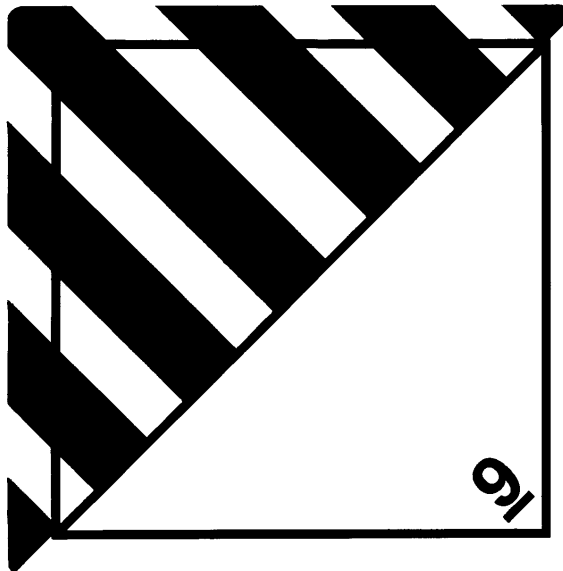
Title _____ Date _____

Name and address of Shipper

This package contains substance(s) in Class(es)
(check applicable box(es))

Class: 2 3 4 5 6 8 9

and the applicable UN Numbers are:



Appendix 5

Ignitable Liquid Classifications Report Findings (Based on interpretations from ASTM E1618)

Classification Name – Analysts must sometimes choose one classification over another by how the item best fits the ASTM description.	Approximate Peak Spread (n-Alkane Carbon Numbers)	Examples – These examples are not exclusive. Marketing of refinery products often results in a single refinery product being sold under a variety of labels.
Gasoline	C4 to C12	All grades and brands of automobile gasoline and gasohol.
Light Petroleum Distillate	C4 to C11	Cigarette Lighter Fluid, some Camping Fuels, various commercial solvents.
Medium Petroleum Distillate	C8 to C12	Mineral Spirits, some Charcoal Lighters, some Paint Thinners, some Insecticide or polish solvents.
Heavy Petroleum Distillate	C9 to C23	Fuel Oil #1, Jet “A” Aviation Fuel, some Charcoal Starters, some Lamp Oils, some Paint Thinners, some Insecticide or polish solvents, Kerosene Heater Fuel, Fuel Oil #2, Diesel Fuel, some Lamp Oils, some Tar and Asphalt Removers
Oxygenated Solvents – The laboratory often reports this finding as the specific chemical identified.	Variable	Alcohols (Methyl, Ethyl, Isopropyl), Ketones (Acetone, Methyl Ethyl Ketone).
Isoparaffinic Hydrocarbon Mixtures	Variable	some Charcoal Lighters, some Odorless Solvents, some Paint Thinners, some Insecticide or polish solvents, some Lamp Oils.
Normal Paraffinic Mixtures	Variable	Specialty Products, some Liquid Candles, some Lamp Oils, some Insecticide or polish solvents.
Aromatic Solvents	Variable	Aromatic Naphtha solvents in paint and plastics, other specialty solvents.
Naphthenic/Paraffinic solvents	Variable	Specialty solvent and fuel products derived from petroleum distillate products treated to derivatize the normal alkanes and aromatics.

This document, "GUIDE TO THE COLLECTION, PACKAGING, SUBMISSION AND ANALYSIS OF EVIDENCE FROM FIRES" was produced at the Bureau of Forensic Fire and Explosives Analysis. It was revised from a previous publication and has shared elements with the Ohio and Texas Fire Marshal's laboratory evidence submission guides. Photographs are the property of the State of Florida and were taken by Bureau of Forensic Fire and Explosives Analysis Staff.

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