



NSP CRIME LABORATORY CRIME LABORATORY MANUAL TRACE



I. Fire Debris Evidence

One aspect of trace evidence analysis is the examination of debris and materials associated with suspected arson. Normally, the analysis of fire debris from suspected arsons is directed toward identifying the presence of any ignitable liquid residues. Fire debris samples should be collected as quickly as possible after the fire is extinguished and it is safe. The reason for this is that ignitable liquids are volatile and will evaporate.

- A. There are three types of containers that are recommended for packaging fire debris:
 1. Clean, unused lined or unlined paint cans (gallon size recommended, quart size is acceptable).
 2. Kapak fire debris plastic bags.
 3. Nylon fire debris plastic bags.
- B. There are several points to consider when packaging fire debris evidence:
 1. Do not use regular zip lock plastic bags because they permeable and will allow ignitable liquids to escape.
 2. Please do not fill the containers (cans or bags) more than 3/4ths full.
 3. Please DO NOT DRY the fire debris samples before submitting because the ignitable liquids will evaporate.
 4. The lids on paint cans should be sealed tightly.
 5. Please leave space (1.5 in X 1.5 in) on the lid of cans that is free from labeling or seals so the contents may be sampled through the lid.
 6. Kapak or nylon bags may be heat sealed or sealed with tape (we recommend Scotch Brand 3M 2" Commercial Grade (3750) packaging tape - cheaper brands do not work).
 7. The seals may be checked by carefully pressing on bags and checking if air escapes.
 8. If you use bags watch out for sharp items such as broken glass, nails, wood fragments, etc. that may puncture bag. Cans may be better for samples with sharp objects.

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9. Please remember to initial across all seals onto the container.
- C. Liquid samples of ignitable liquids require a different type of packaging.
1. The best is the Clan Lab sampling kit which contains an outer plastic bottle with lid that contains an inner glass vial with a tight fitting Teflon lined lid.
 2. Ignitable liquids such as gasoline will dissolve paper liners in most lids and will also dissolve some plastic bottles and cap liners and aluminum cap liners. The best are Teflon lined caps.
 3. Do not use any type of bag for liquid samples. Do not use any type of plastic vial - they will melt.
 4. The caps on the vials need to be sealed with evidence or clear tape such as 3M tape.
 5. 5ml of sample is more than enough for the purpose of analysis.
- D. Whenever possible, please take the time to send comparison samples of the materials (i.e. carpet, wood flooring, floor tile, etc.) submitted for analysis. Comparison samples are used for comparison with what is extracted from the submitted samples to see what may have come from the sample itself and what may be an ignitable liquid.

The most common ignitable liquid is gasoline. Other common ones are charcoal lighter fluids, mineral spirits and paint thinners. Ignitable liquids other than gasoline may be divided into seven categories. Each category is divided into light, medium and heavy. The categories and some examples of each are listed below:

Petroleum Distillates:

Light petroleum distillate ignitable liquid. Examples of light petroleum distillates are petroleum ether, some cigarette lighter fluids and some camping fluids.

Medium petroleum distillate ignitable liquid. Examples of medium petroleum distillates are some charcoal starters, some paint thinners, some mineral spirits and some dry cleaning solvents.



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Heavy petroleum distillate ignitable liquid. Examples of heavy petroleum distillates are kerosene, diesel fuel, some jet fuels, some charcoal starters and some automotive fuel system cleaners and treatments.

Isoparaffinic Products:

Light isoparaffinic product ignitable liquid. Examples of light isoparaffinic products are some specialty solvents

Medium isoparaffinic product ignitable liquid. Examples of medium isoparaffinic products are some charcoal starters, some paint thinners and some copier toners.

Heavy isoparaffinic product ignitable liquid. Examples of heavy isoparaffinic products are some commercial specialty solvents.

Aromatic Products:

Light aromatic product ignitable liquid. Examples of light aromatic products are some paint and varnish removers, some automotive parts cleaners, xylenes and toluene-based products.

Medium aromatic product ignitable liquid. Examples of medium aromatic products are some automotive parts cleaners, some specialty cleaning solvents, some insecticide vehicles and some fuel additives.

Heavy aromatic product ignitable liquid. Examples of heavy aromatic products are some insecticide vehicles and some industrial cleaning solvents.

Naphthenic-Paraffinic :

Light naphthenic-paraffinic product ignitable liquid. Examples of light naphthenic products are cyclohexane based solvents and products.

Medium naphthenic-paraffinic product ignitable liquid. Examples of medium naphthenic products are some charcoal starters, some insecticide vehicles and some lamp oils.

Heavy naphthenic-paraffinic product ignitable liquid. Examples of heavy naphthenic products are some insecticide vehicles, some lamp oils, some torch fuels and some industrial solvents.

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Normal Alkane Products:

Light normal alkane product ignitable liquid. Examples of light normal alkane products are some solvents (pentane, hexane and heptane).

Medium normal alkane product ignitable liquid. Examples of medium normal alkane products are some candle oils and some copier toners.

Heavy normal alkane product ignitable liquid. Examples of heavy normal alkane products are some candle oils, some lamp oils, carbonless forms and some copier toners.

Oxygenated Solvents:

Light oxygenated solvents product ignitable liquid. Examples of light oxygenated solvents products are alcohols, ketones, some lacquer thinners, some fuel additives and surface preparation solvents.

Medium oxygenated solvents product ignitable liquid. Examples of medium oxygenated solvents products are some lacquer thinners, some industrial solvents, some metal cleaners, some gloss removers and some wood finishing products.

Others-Miscellaneous:

Light others-miscellaneous ignitable liquid. Examples of light others-miscellaneous are some single component products, some blended products and some enamel reducers.

Medium others-miscellaneous ignitable liquid. Examples of medium others-miscellaneous are some turpentine products, some blended products and various specialty products.

Heavy others-miscellaneous ignitable liquid. Examples of heavy others-miscellaneous are some blended products and various specialty products.

For an ignitable liquid to be identified, it must stand out from the background of combustion products, pyrolysis products and substrate background of the sample. This will vary for each sample submitted.

There are a number of solid materials that can be used as incendiaries such as

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sugar-chlorate, thermite, white phosphorus and many more. The identification of these materials can be performed and is similar to the examinations for explosives. (See packaging instructions for III. Chemical Residue Evidence from Fire Debris or Explosives Cases)

II. Explosives Evidence

Explosives maybe divided into two classes - low order explosives and high order explosives. Generally low order explosives must be confined and deflagrate (confined burning) producing a shock wave less than 3200 feet/second. Examples are black powder and flash powder. High explosives do not need to be confined and detonate producing a shock wave greater than 3200 feet/second. Examples are dynamite and C4.

A. The types of explosive samples that may be encountered in the Crime Laboratory can be classified into these areas:

Black powder

Black powder is usually a mixture of potassium nitrate, charcoal (carbon) and sulfur.

Black Powder Substitutes

Pyrodex is an example of a black powder substitute. It contains potassium nitrate, sulfur, charcoal, potassium perchlorate, potassium benzoate and dicyanamide.

Flash powder

Flash powder is usually a mixture of aluminum, potassium perchlorate and sulfur

Pyrotechnics - Fireworks

Fireworks may contain black powder, flash powder and/or other inorganic materials.

Smokeless gunpowder

Smokeless gunpowder is used to load and reload cartridges and shells used in hand guns, rifles and shotguns. The major types are single base - nitrocelluse and double base - nitrocellulose and nitroglycerin. Triple



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base smokeless gunpowder, containing nitrocellulose, nitroglycerin and nitroguanidine, has been manufactured in Europe.

Chemical Reaction “MacGyver” and Pressure Bombs

These types of explosives work on a chemical reaction, either acidic or basic, that will produce a gas, usually hydrogen that will build up and eventually rupture the container that it is in, usually a plastic pop container. A variation is the use of dry ice or liquid nitrogen instead of a chemical reaction mixture. The dry ice bomb will usually leave no evidence, other than the debris may be cold if the investigators arrive just after the explosion. The carbon dioxide or nitrogen that caused the container to rupture dissipates into the air.

- B. The following types of explosives are very rarely, if ever, seen in the Crime Laboratory:

Dynamites

Nitroglycerine based dynamite has been mostly replaced by water gels/slurries and emulsion type explosives.

Organic based explosives other than smokeless gunpowder

This group would include TNT, C-4 military explosive, RDX and others.

- C. Evidence which will be of value in the laboratory may include:

1. All pipe or exploded container fragments.
2. Soils from the immediate area of an explosion.
3. Unexplained debris such as match heads, gray or black residues, any residue that is physically different from its surroundings.
4. Any wires, batteries, fuses, timing devices, delay mechanisms, and switches.

- D. Collection and Packaging of Explosives Evidence:

1. Suspected Explosive Powders:
 - a. Suspected explosive powders should be placed in special anti-static zip-lock bags that are available. **SUSPECTED EXPLOSIVE**

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POWDER SHOULD NOT BE PLACED IN REGULAR PLASTIC BAGS, SUCH AS ZIP-LOCK BAGS.

- b. Suspected explosive powders may be placed in clean, unused metal cans. The seals should be of tape and should be over the top lid.
- c. Suspected explosive powders may be placed in a sealed envelope or a sealed paper bag. The seals should be of tape and should be over ALL the seams of the envelope or paper bag.

2. Explosive Residues and Samples:

Explosive residues and samples from the area of blast should be placed in clean, unused metal cans. If metal cans are not available, paper bags may be used. The seals should be of tape and should be over the top as well as ALL other seams.

3. Live Explosive Devices:

THE LABORATORY DOES NOT ACCEPT LIVE EXPLOSIVE DEVICES. THEY SHOULD BE RENDERED SAFE BEFORE SUBMITTING TO THE LAB.

III. Chemical Residue Evidence from Fire Debris or Explosives Cases:

The Crime Laboratory only performs analysis on chemical residues from explosive devices and certain fire debris evidence.

Depending on the nature of the sample any of the following (listed in decreasing chemical resistance) may be used to contain the sample:

- 1. Glass bottle with Teflon lined cap (most chemically resistant).
- 2. Nylon or Kapak fire debris evidence bag with the top heat sealed or taped closed.
- 3. An empty film canister with the lid taped closed.
- 4. A self-seal bag (i.e. Zip-Lock) with the top taped closed.
- 5. A clean metal paint can with a lid that is tape sealed.



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6. An envelope or paper bag with the top as well as ALL other seams taped closed.

IV. What Does "SEALED" Really Mean?

1. Envelope - Taped on the top flap, corners, and all other seams.
2. Paper bag - Taped completely closed across the top opening AND all other seams.
3. Glass vial - Top screwed on tightly with tape around the top to secure it.
4. Nylon or Kapak bags – Heat sealed or taped so that when pressure is applied, no air escapes.
5. Box - Openings completely taped closed.
6. Plastic self-seal bag - Sealed by hand and then taped across the top.
7. Film canisters - Lid snapped on and taped across the top.
8. NEVER USE STAPLES TO CLOSE EVIDENCE PACKAGES. THIS IS A SAFETY HAZARD TO ANALYSTS WORKING ON THE CASE. STAPLES ARE NOT ACCEPTABLE UNDER ANY CIRCUMSTANCES.

If latent fingerprint tests or DNA tests are to be performed on any of the samples, be sure to indicate it on the submittal AND on the evidence so there is no possibility of damaging this evidence during other analyses.

If you have ANY QUESTIONS, CONCERNS or DOUBTS as to how to handle a sample, please CALL THE LABORATORY for guidance. It is better to take a few extra moments to be sure you are doing something properly, rather than potentially compromising a sample.