

# Forensic Evidence



# Handbook

# CONTENTS

---

<b>Introduction</b> .....	<b>1</b>
<b>SECTION I: Crime Scenes</b>	
Armed Assault/Rape/Homicide .....	3
Arson .....	5
Bombing .....	6
Breaking and Entering .....	7
Clandestine Drug Labs .....	8
Hit and Run .....	10
Drug Violations .....	11
Suspicious Packages/Hazardous Suubstances .....	12
<b>SECTION II: Laboratory Submittal Forms</b>	
Laboratory Analysis Request .....	13
Latent Evidence Submission Envelope .....	14
<b>SECTION III: Collection and Preservation</b>	
Tips For Packaging Evidence .....	15
1. Drug Chemistry .....	16
Liquids .....	16
Plant Material .....	16
Powders or Solids .....	17
Tablets and Capsules .....	17
Comparison Standards .....	17
Chemicals .....	18
2. Fingerprints .....	18
Comparison Standards/Inked Prints .....	19
Latent Prints on Absorbent Materials .....	19
Latent Prints on Hard Surfaces .....	19
Latent Prints on Soft Surfaces .....	19
Packaging Fingerprint Evidence .....	20
Latent Identification .....	20
3. Firearms, Toolmarks and Impressions .....	20
Handguns and Shoulder Arms .....	20
Serial Number Restoration .....	21
Expended Bullets, Cartridge Cases and Shotshells .....	21
Distance Determination .....	21
NIBIN .....	22
Footwear and Tire Impressions .....	22
Toolmark Evidence .....	23

4. DNA Analysis .....	24
Blood .....	24
Semen .....	25
Comparison Standards .....	25
5. Toxicology .....	27
Blood Alcohol Determinations .....	27
Toluene/Solvent Abuse/Glue Sniffing .....	27
Drug Testing .....	28
Carbon Monoxide .....	29
Poisoning .....	29
6. Trace Evidence .....	29
Ignitable Liquids .....	29
Explosives .....	30
Fiber .....	30
Filaments .....	30
Glass .....	30
Gunshot Residue .....	31
Hair .....	31
Paint .....	31
Soil .....	31
7. Miscellaneous .....	32
Cigarette butts .....	32
Jewelry .....	32
Small objects .....	32
Comparison Standard .....	33
<b>SECTION IV: Glossary .....</b>	<b>35</b>

# Introduction

---

The Crime Laboratory Division of the Missouri State Highway Patrol is pleased to provide the latest edition of the Forensic Evidence Handbook to all Law Enforcement Agencies. The Crime Laboratory offers Forensic services for all police agencies from strategically located laboratories throughout the state.

The Missouri State Highway Patrol Laboratory in Jefferson City is a full service facility with analytical capabilities in the areas of:

**DNA casework**

including blood, semen, other body fluids and body tissue

**DNA profiling**

including sample collection from convicted offenders and management of the CODIS data base

**Drug testing**

including street drugs, pharmaceuticals and clandestine lab precursors and products

**Firearms**

including toolmarks, impressions and serial number restoration

**Latent Prints**

including evidence processing and AFIS verification

**Toxicology**

including alcohol and drug testing of blood, urine and other body fluids as well as alcoholic beverages

**Trace Evidence**

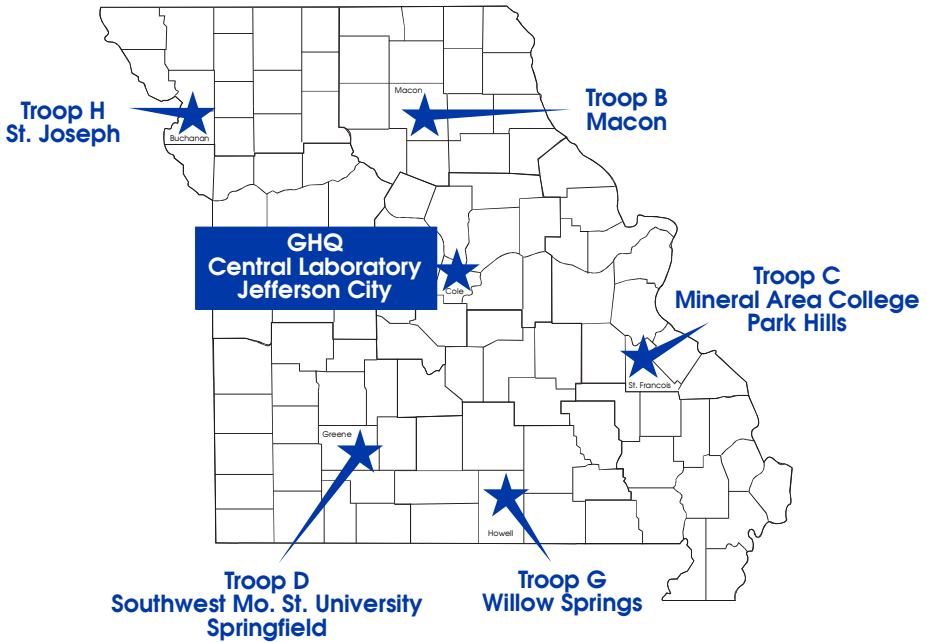
including gunshot residue, explosives, ignitable liquids, hair, fiber, paint, glass, soil, filaments and foreign substance identification

Satellite laboratories located in St. Joseph, Macon, Springfield, Willow Springs and Park Hills have analytical capabilities in the areas of:

Drug testing

Blood Alcohol analysis

The satellite laboratories also serve as relay stations for evidence bound for the Jefferson City laboratory.



## Satellite Laboratories

Troop B .....	660-385-2132
Troop C .....	573-431-0166
Troop D .....	417-895-6353
Troop G .....	417-469-1100
Troop H .....	816-387-2345
GHQ .....	573-526-6134

We hope that this handbook will prove to be of value to you in your investigations. We have tried to cover the major facets of investigation as well as evidence collection and preservation techniques; however, we realize that some questions will arise. When these questions present themselves, don't hesitate to call one of our laboratories.



# Section I

## Crime Scenes

# Armed Assault/Rape/Homicide

---

Violent crimes against persons usually involve some type of contact or struggle between the individuals. Consider the evidence you may encounter at the scene:

- Firearms and expended ammunition components
- Knives or other possible weapons
- Items containing latent fingerprints
- Impressions
- DNA evidence (Blood, Semen, Saliva, etc.)
- Trace evidence (Hair, Fiber, etc.)

If the victim is found dead, consider what type of weapon might have been used. Search the area for an item such as a knife, rope, wire, or brick that the assailant might have used and discarded as he fled the scene.

When a firearm is involved, search the area for projectiles and expended cartridge cases. Once a projectile is located, try to establish its path or line of fire. When investigating a closed area to establish the path of a projectile to the entry hole, try to establish the point where the assailant stood. Once this point is established, look for physical evidence relating to the assailant such as fingerprints, torn pieces of clothing, and cigarette butts.

If a firearm is recovered, the firearm may show fingerprints or have some uniqueness because of the presence of a serial number, scratches or other unusual features. Any of these can be used to establish the positive identity of a weapon. When a firearm is involved, do not overlook the provision of the Gun Control Act of 1968 and the possibility that the Bureau of Alcohol, Tobacco and Firearms, U.S. Department of Treasury, can trace firearms to the last retail purchaser.

If the incident involved the discharge of a firearm, administer a gunshot residue kit on the individual suspected of discharging the firearm. Keep in mind, however, that the elapsed time between the discharge and the collection of the gunshot residue kit is critical to the residue levels recovered. Gunshot residue is rapidly lost from the hands of an active person. When possible, administer the gunshot kit where the subject is apprehended and prior to transporting the subject and especially before any actions are taken that involve processing of the hands (e.g. fingerprinting).

If a shooting victim was in close proximity to the muzzle of the firearm, it may be possible to determine the shooting distance by examining gunpowder residues on the shooting victim in the vicinity of the bullet entrance. The outermost garment or contact surface will contain the gunpowder residues. The suspect firearm and ammunition used must be

submitted in order to conduct this exam. Generally, the practical limit of distance determination is about 3 feet from the muzzle. If shotshell is used, however, the pellet spread pattern is used for distance determination beyond the gunpowder deposition range.

If semen stains are present or the suspect could have been bleeding, submit the victim's clothing for DNA. This clothing may be a valuable source of trace evidence also (hair, fibers, etc.). The suspect's clothing should be collected if it is likely to have been stained with the victim's blood. NOTE: Any blood soaked clothing that will be submitted to the lab should be air dried completely and packaged in paper. Look in the area for articles of evidence dropped from the assailant's pockets or torn from his clothes.

Consider how the assailant and his victim reached the crime scene. If the victim was forced to walk or was dragged in a wooded area, there may be footwear impressions on the ground. Collect these. If the assailant used a vehicle to bring the victim to the area, search for any possible parking spots where tire impressions and footwear impressions may also be found and collected.

For additional information relating to the collection and packaging of evidence from these crime scenes, refer to Section III, Collection and Preservation of Evidence.

Fingerprints .....	Page 18
Firearms and Ammunition .....	Page 20
Hair and Fibers .....	Page 30
Impressions .....	Page 22
DNA Analysis .....	Page 24



# Arson

---

In an arson investigation, a main objective is to determine the point where the fire started. Physical evidence which is collected there can be an important clue to whether the fire was intentionally set. Fire debris collected near the origin of the fire will be tested for the presence of an accelerant.

Look for “trailers”, which are often indicated by clearly defined burned areas on carpet or wood floors. They often lead to a doorway so that the fire can be set from a safe distance. Look to see if any of the ordinary fire protection devices in the building have been tampered with or altered.

If the fire was set by use of an ignitable liquid, the liquid's container may still be at the scene or may have been disposed of nearby. Is there a probable spot for trash disposal in the area? The container may be a source for fingerprints and may have labeling of value for analysis or tracking purposes.

Consider where an entry to the building may have been made. Check to see if a door or window was forced open. Look for tool marks and other evidence that the arsonist may have left behind. Look for unusual open windows or holes between floors or walls. An arsonist often tries to provide extra ventilation to help the fire burn.

For additional information relating to the collection and packaging of fire debris evidence refer to Section III, Collection and Preservation of Evidence.

Ignitable Liquids .....	Page 29
Fingerprints .....	Page 18
Glass .....	Page 30
Hair and Fiber .....	Page 30
Toolmarks .....	Page 23
Impressions .....	Page 22

# Bombing

---

In a bombing situation investigative actions depend on whether it is a threatened bombing or an explosion that has already occurred. When there is a bomb threat, the validity of the threat must be determined as quickly as possible. Call in a team designated to conduct bomb searches of a threatened area. If a suspicious package is located, call in an appropriate bomb disposal team. **DO NOT TOUCH** - move the people away from the bomb, not the bomb away from the people! When bomb threats have been made by telephone, find out all you can about the caller from the person who received the call. If the threat was made by letter, carefully collect and preserve the letter so that any fingerprints, typewriting, handwriting, or the paper itself can be analyzed.

In a post-blast situation, there should first be a search conducted by bomb disposal experts to determine if there is a second bomb set as an entrapment device. Subsequently try to determine where the seat of the blast or point of detonation is and what kind of blast effects are displayed. Search outward from the bomb crater in ever-widening circles. Sift, sort, and collect samples of the rubble, keeping in mind that only a few bombs destroy all the components used in their construction. Pieces of wire may bear tool marks; pieces of the timing or triggering mechanism may be traceable to a manufacturer or dealer and pieces of an explosive wrapper may still retain enough of the date-shift-code to permit a trace through existing records to the last known purchaser.

For additional information relating to the collection and packaging of bombing evidence refer to Section III, Collection and Preservation of Evidence.

Ignitable Liquids and Explosives .....	Page 29
Fingerprints .....	Page 18
Hair and Fibers .....	Page 30
Impressions .....	Page 22
Toolmarks .....	Page 23

# Breaking and Entering

---

When investigating a scene of a breaking and entering offense, consider how the crime was perpetrated and collect evidence accordingly. Consider how the suspect entered the premises. Check the doors and windows. If entry was made through a door by prying, look for toolmarks and collect fingerprints. If entry was through a shattered window, collect the glass fragments. Do not handle the glass directly; fingerprints might be present. Look for clothing fibers which might have caught on the jagged glass, or blood deposited on the glass by a perpetrator who was cut by it.

Consider how the criminal might have approached or left the premises. Soft ground or soil outside might contain impressions. The soil may be carried inside revealing additional impressions and evidence of entry.

Consider what surfaces in the room might have been touched by the perpetrator. Fingerprints might appear on a table under a window where entry took place, on a metal filing cabinet which was left ajar, or on any object that might have been held by the intruder.

Collect articles which might be considered out of place. For example, collect any half-used packs of matches or cigarette butts lying on the floor as possible evidence. Look for articles of clothing, a hat or handkerchief, which are in an unusual place in or near where the offense occurred.

For additional information relating to the collection and packaging of evidence these crime scenes refer to Section III, Collection and Preservation of Evidence.

Fingerprints .....	Page 18
Glass .....	Page 30
Hair and Fiber .....	Page 30
Impressions .....	Page 22
Toolmarks .....	Page 23
Miscellaneous/Cigarette Butts .....	Page 32
Paint .....	Page 31
DNA Analysis .....	Page 24
Soil .....	Page 31

# Clandestine Drug Labs

---

Clandestine laboratories have been found in isolated farm houses, cabins, motel rooms, rental storage units, commercial properties, motor vehicles and travel trailers. Operations have ranged from the crude to the sophisticated.

An indication that a clandestine laboratory is operating in a particular area is a low selling price, a large amount of stimulants available, purchases of substantial quantities of over-the-counter stimulants from drug and grocery stores, purchases of large quantities of solvents from hardware stores and stealing of chemicals from vet and farm supply stores. Other signs are unusual odors, excessive use of utilities, frequent freight deliveries, and unusual frequency of activities at the lab site.

Raiding a clandestine laboratory can be dangerous because of the possibility of fire, explosion, and toxic inhalation of chemical fumes. Law enforcement officers without proper training and personal protective equipment should not raid a clandestine laboratory. After an entry team has physically secured the clandestine lab, qualified safety certified clandestine lab investigators or criminalists should perform a safety assessment of the lab, remove/separate incompatible evidence and place this in a safe location (preferably outdoors or in a well-ventilated area). After the laboratory site has been deemed safe by a safety certified investigator, properly equipped investigators can then identify, collect and preserve evidence by selecting those items necessary to prove the case.

The collection of evidence from a clandestine laboratory should include photographing the entire laboratory. Any latent prints tire tracks, foot wear impressions and trace evidence should be collected before items are moved. Items to be seized include the finished product, precursors, raw materials, manufacturing equipment and all literature and formulas. Not all evidence seized should be sent to the crime lab. Select representative test samples of finished product and precursors. Photograph each sample container with the bulk container from which it was removed, along with a ruler, for comparison purposes. Photographs will be taken level to the surface on which the containers rest and parallel to and at eye level to the liquid surface of the substances being photographed. Submit the test samples, photographs and all copies of literature and formulas to the crime lab for examination. Investigators should prepare a complete inventory of all items seized. Finally, dispose of all chemicals properly. A licensed hazardous waste hauler should be utilized to safely dispose of chemicals and solvents.

For additional information relating to the types of evidence possibly found in association with such a crime scene, refer to Section III, Collection and Preservation of Evidence.

Ignitable Liquids and Explosives ..... Page 29  
Chemicals ..... Page 18  
Fingerprints ..... Page 18  
Firearms and Ammunition ..... Page 20  
Drug Evidence ..... Page 16  
Impressions ..... Page 25  
Paint ..... Page 31  
Soil ..... Page 31  
Toxicology ..... Page 27

# Hit and Run

---

## Struck Pedestrian:

The clothing of a pedestrian frequently has transfer substances that can be associated to the striking vehicle. Paint scrapings will adhere to metal rivets and snaps of the clothing. Other fragments and debris can be caught in seams and pockets. This type of 'trace evidence' can be lost if the clothing is not handled and packaged properly.

If a suspect vehicle is located, examine it carefully for clothing fiber or clothing dye transfers. Look for fabric pattern impressions. Look for broken objects that may catch 'trace evidence' transfers or be the source of transfer evidence. Collect paint, glass and broken parts as standards.

## Struck Vehicle:

Vehicles involved in collisions frequently transfer paint smears or other substances from one vehicle to the other. Many times fragmented parts are left at the scene of the collision that make excellent fracture match relationships back to the vehicle.

If a suspect vehicle is found abandoned, consider what personal articles, papers, fingerprints, or sources of DNA are present that can be collected and used to establish the identity of the driver.

For additional information relating to the collection and packaging of 'hit and run' evidence refer to Section III, Collection and Preservation of Evidence.

Glass .....	Page 30
Hair and Fiber .....	Page 30
Impressions .....	Page 22
Paint .....	Page 31
DNA Analysis .....	Page 24

# Drug Violation

---

Sometimes evidence of a drug violation, such as a syringe, paper wrapping, crack baggy, or marijuana cigarette, is discovered in plain view and collected during the investigation of an unrelated offense. In the majority of cases, however, drug evidence is obtained through direct purchase by undercover officers or as a result of planned drug raids and extensive searches.

When searching for and collecting evidence in a room, first look for the typical hiding places such as in drawers, books, shoe boxes, mattresses, or behind picture frames. Then look for the less obvious hiding places such as in light fixtures, heating ducts, secret panels, tape cartridges, etc. While searching, keep in mind that any hiding place may contain fingerprints. Use the same search techniques in searches of persons and vehicles.

Most drug violators, other than distributors, resort to theft to finance their purchases. During your search be on the lookout for stolen property.

Due to concern about the accidental spread of hepatitis and AIDS, carefully search hidden areas. If it is necessary to reach into areas not visible by the naked eye, do so with great care. The danger of syringe needles, razor blades, knives and other sharp objects is always present. Gloves can provide some protection, but they can be punctured or cut.

If the suspect is unknown, fingerprints may be the only evidence available for suspect identification. Before leaving the crime scene, whether it is an automobile or a room, consider all the places that the violator is likely to have touched. Check all these areas for fingerprints.

For additional information relating to the types of evidence possibly found in association with the drug related crime scene, refer to Section III, Collection and Preservation of Evidence.

Fingerprints .....	Page 18
Drug Evidence .....	Page 16
Toxicology .....	Page 27

# Suspicious Packages/ Hazardous Substances

---

Packages and letters have been used to transport hazardous substances such as anthrax or explosives. Most suspicious packages have been hoaxes. However, all suspicious package situations must be handled in a careful and reasonable manner.

Some characteristics of suspicious packages and envelopes include the following:

- Inappropriate or unusual labeling
  - Excessive postage
  - Misspellings of common words
  - Strange return address or no return address
  - Incorrect title or title without a name
  - Not addressed to a specific person
  - Marked with restrictions such as “Personal” or “Confidential”
  - Postmarked from a city or state that does not match return address
- Appearance
  - Powdery substance felt through or appearing on the package or envelope
  - Discolorations, odor or oily stains
  - Excessive packaging material such as masking tape, string, etc.
  - Lopsided, “lumpy” or uneven envelope
- Excessive weight

If a suspicious package appears to be a credible threat then:

- Secure the area.
- Notify the local HAZMAT Team.
- Notify the regional office of the FBI and ask for the regional Weapons of Mass Destruction (WMD) coordinator. Phone numbers:
  - Eastern MO — St. Louis Regional Office — (314) 231-4324
  - Western MO — Kansas City Regional Office — (816) 512-8200 (Joplin)
  - Central MO — Jefferson City Area Office — (573) 636-8814 (St. Joseph and Springfield)
- Notify the local public health agency or the Missouri Department of Health and Senior Services at (800) 392-0272 (available 24 hours a day).
- Create list of names and telephone numbers for all persons who may have handled the letter or package.
- Notify persons who have handled the item to place all contaminated clothing worn when in contact with the item into plastic bags to be made available to local law enforcement, if needed. Instruct these persons to shower as soon as possible.







# Section II

## Laboratory Submittal Forms

## LABORATORY ANALYSIS REQUEST FORMS:

One such form should be filled out for each case submitted. Include on this form each piece of evidence submitted and the type of analysis or examination you desire. Be specific.

### LATENT EVIDENCE SUBMISSION ENVELOPE:

	<b>MISSOURI STATE HIGHWAY PATROL</b> <b>CRIMINAL LABORATORY DIVISION</b> 1510 E. ELM STREET JEFFERSON CITY, MO 65102-0568		DATE	MSHP LAB NO.
			AGENCY CASE NO.	
<b>LABORATORY ANALYSIS REQUEST</b> (To be completed by investigating officer)			AGENCY IDENTIFIER NO. (ORI)	
<small>SHP - 411D 1/96</small>			STATUS OF CASE <input type="checkbox"/> NEW <input type="checkbox"/> ADD-ON <input type="checkbox"/> REOPEN	
SUBMITTING AGENCY			INVESTIGATING OFFICER	INVESTIGATING OFFICE PHONE NO. (       )
TYPE OF CRIME			DATE OF CRIME	COUNTY OF CRIME
VICTIM(S) (INCLUDE DOB, RACE, SID, ETC.)			SUSPECT(S) (INCLUDE DOB, RACE, SID, ETC.)	
SUMMARY OF INCIDENT: (Include where crime occurred, all individuals involved, relationships between individuals, any unusual circumstances, etc.)				
DESCRIPTION OF EVIDENCE (Continue on back if necessary)				
ITEM(S) SUBMITTED	LOCATION AND DATE OF RECOVERY	OWNER OF ITEM	EXAM REQUESTED (Be specific)	
SPECIAL INSTRUCTIONS (Continue on back if necessary)				

These envelopes are designed to give the utmost protection to your evidence and to minimize the chance of misplacement. Please make use of these latent evidence submission envelopes when latent prints are submitted.

If you are unfamiliar with these forms or your supply diminishes, contact one of the Crime Laboratories throughout the state.

MISSOURI STATE HIGHWAY PATROL CRIMINAL LABORATORY DIVISION 1510 EAST ELM STREET JEFFERSON CITY, MISSOURI 65102-0568 (573) 526-6134		DATE
<b>LATENT EVIDENCE SUBMISSION ENVELOPE</b> (Complete one form per case)  SHP-415A 3/96		AGENCY IDENTIFIER NO. (ORI)
		AGENCY CASE NO.
		MSHP LABORATORY NO.
		OTHER
LABORATORY USE ONLY		
Has evidence received prior laboratory examinations? <input type="checkbox"/> YES <input type="checkbox"/> NO		Status of case <input type="checkbox"/> NEW <input type="checkbox"/> ADD-ON <input type="checkbox"/> RE-OPEN
SUBMITTING AGENCY	INVESTIGATING OFFICER	PHONE NO. (Include area code)
TYPE OF CRIME	DATE OF CRIME	
VICTIM(S) (include DOB, SID #, etc.)		
SUSPECT(S) (include DOB, SID #, etc.)		
BRIEF SUMMARY OF INCIDENT		
Itemized description of evidence submitted and specific examinations requested (all containers must be sealed and identified)		



# Section III

## Collection and Preservation

# Tips For Proper Evidence Packaging

---

1. **ALWAYS** submit a completed SHP-411 (Laboratory Analysis Request) with each case. Use more than one if necessary.
2. Latent Evidence Submission envelopes (SHP-415) should be used **ONLY** with 10-print cards or latent print cards. Other types of packaging should be used for evidence to be processed.
3. **DO NOT** package weapons with items of clothing or drug paraphernalia. (Firearms are checked immediately to make certain they are unloaded).
4. **ALWAYS** package urine **SEPARATELY** from blood. Leave expansion room in urine containers, they will be stored in the freezer.
5. **ALWAYS** package tubes of blood **SEPARATELY** from clothing. Whole blood should be stored in a refrigerator.
6. Sexual Assault kits should **NEVER** be packaged with clothing. The kits contain whole blood and should be stored in a refrigerator.
7. Whole blood should **ALWAYS** be packaged **SEPARATELY** from drug-related items.
8. **NEVER** package items for prints with items for DNA, trace, firearms identification, etc.
9. **DO NOT** submit any amount of anhydrous ammonia, hydrogen chloride gas, sodium metal, or any gas in a compressed gas cylinder.
10. **DO NOT** submit open liquor containers to the lab. **ALL** containers should be capped and sealed.
11. Evidence stained with body fluids (blood, semen, etc.) **MUST BE AIR-DRIED COMPLETELY** prior to packaging in paper and submission to the laboratory.
12. **DO NOT** submit syringes with uncapped needles, knives or razor blades without protective coverings. **DO NOT** submit syringes which do not contain visible liquid or residue. Syringes and other sharps should be submitted in a hard-sided container such as a sealable plastic tube.
13. **DO NOT** submit wet or moist marijuana in plastic bags to the lab, i.e. **AIR-DRY** before submitting.
14. **DO NOT** submit syringes, drug paraphernalia or miscellaneous items which do not need to be analyzed.

# Collection And Preservation

---

It is important that each item submitted as evidence be sealed, **WITH TAMPER PROOF EVIDENCE TAPE**, dated, initialed, and labeled as to it's contents and it's association with the victim or suspect.

Evidence stained with body fluids (blood, semen, etc.) **MUST BE AIR-DRIED COMPLETELY** prior to packaging and submission to laboratory. Separately package and seal all items in breathable, non-plastic (e.g. paper), loose-fitting containers. Packages should not be tightly bound; the criminalists must return items to these containers and seal them following examinations. Items to be examined by more than one section should be packaged and stored by prioritization of exams. For example, latent print evidence can not be frozen.

## 1. Drug Chemistry

Since food and drug specimens exhibit a wide variety of identifiable characteristics, they may corroborate other evidence or link a suspect with a crime scene. When handling this evidence, it is important to prevent any contamination among the specimens or from other sources. Do not package too much evidence into a container, it could cause a break in the evidence container with loss of integrity of the evidence. Also, do not completely cover the evidence container with evidence tape, this could prevent the container from being adequately sealed later.

### ■ LIQUIDS

Collect a maximum of one ounce of the specimen, using an approved container. An approved container is a one ounce glass vial with a Teflon liner and a screw cap, stored in a Nalgene protective plastic capped bottle. Seal the container with evidence tape and label it with your initials, the date and exhibit number. Collect a comparison standard of the same brand, concentration and lot number when tampering of medical, food or other commercial products is suspected. Submit both unknown and comparison liquid samples to the crime lab.

### ■ PLANT MATERIAL

Without heating, thoroughly dry sample in a secure area by spreading it on a clean paper for at least 24 hours. After sample has been dried, place in a pillbox, a vial or other container, and secure with adhesive tape.

**DO NOT MIX SAMPLES. PACKAGE EACH SEPARATELY TO AVOID MIXING DURING TRANSPORT.** Label the outside of the container with your initials, the date, and an exhibit number. If wet plant material is collected in evidence containers (especially plastic bags), it will mold and degrade to the point where positive test results may not be obtained. These molds are also hazardous to your health.

When numerous plants, bales, or bundles of plant material are seized, submit to the lab **only representative samples** of plant material from these items. Photograph the entire number of original evidence items with a ruler as scale and also weigh them. **Do not submit to the lab the entire amount** of evidence in a large drug seizure. The lab does not have sufficient evidence locker space for all drug seizures. Also, small amounts of drugs submitted to the laboratory allow for quicker testing.

## ■ POWDERS OR SOLIDS

Place in a container such as a pillbox, plastic vial, or pharmacy fold, etc. Seal container and label with your initials, the date, and an exhibit number. Refrigerate samples as needed. **DO NOT ADD PRESERVATIVES TO SOLID FOOD SAMPLES.**

## ■ TABLETS AND CAPSULES

Place in a container such as a pillbox, plastic vial, etc. Avoid submitting obvious non-controlled, over-the-counter medications unless specifically necessary to aid in the investigation of a clandestine laboratory case. Seal container and label with your initials, the date, and an exhibit number.

### **Comparison Standard: Liquids, Powders, Solids, Tablets, and Capsules**

In cases where medication tampering is suspected, collect known standards of the same brand, concentration of dosage and lot number for liquids in syringes, ampoules and vials, if appropriate. Also collect known standards of tablets and capsules. When collecting standards, search the refrigerator, cupboards, and storage places for similar substances. **DO NOT REMOVE PILLS, CAPSULES, POWDERS, OR LIQUIDS FROM THEIR ORIGINAL CONTAINER.**

**NEVER MIX SPECIMENS.**

## ■ CHEMICALS

Due to hazardous chemicals being used to manufacture drugs and liquid chemicals used to contain drugs, safety precautions need to be taken by all personnel in handling this type of evidence. To minimize hazards to personnel and facilities, certain chemicals will not be accepted into the crime lab, in any amount, and minimum quantities of other chemicals will only be accepted in approved containers.

An **approved container** is a one ounce glass vial with a Teflon liner and a screw cap, stored in a Nalgene protective plastic capped bottle.

### **Unacceptable Chemical Evidence**

It consists of any amount of anhydrous ammonia, hydrogen chloride gas, sodium metal and any type of gas in a compressed gas cylinder. Also quantities of more than one ounce (which is considered a representative sample) of any liquid or solid chemical used to manufacture drugs or any liquid chemical which contains drugs are unacceptable chemical evidence. Finally, representative samples of one ounce or less of any acceptable chemical used to manufacture drugs or liquid chemicals used to store drugs which is not submitted in an approved container is also unacceptable chemical evidence.

### **Acceptable Chemical Evidence**

It consists of up to one ounce of liquid chemicals used to manufacture or store drugs, provided the samples are submitted in an approved container. Solid drug materials will continue to be accepted into the crime lab, such as, powders, resins, plant material, etc.; however, it is recommended that representative one ounce samples be submitted for analysis.

If chemical evidence from clandestine labs is brought to the crime lab which exceeds the one ounce representative sample size (and is not unacceptable in any amount) the laboratory evidence clerk will contact a drug criminalist familiar with clandestine lab evidence. The criminalist will assist the submitting officer in properly and safely collecting representative samples in approved containers using the lab fume hood. The approved sample containers will then be accepted into the lab as evidence. The remaining bulk amounts of chemical evidence will be returned with the submitting officer.

## **2. Fingerprints**

Generally, latent fingerprints on nonporous materials deteriorate rapidly upon prolonged exposure to high temperature and humidity; consequently, items should be processed and/or forwarded to a lab as



soon as possible. With the assistance of the Automated Fingerprint Identification System (AFIS), we are now able to search the entire fingerprint file without a suspect. A thorough file search can be made only if correct processing procedures are followed to obtain the best latent print evidence.

## ■ COMPARISON STANDARD/INKED PRINTS

Collect fingerprints and palm prints of suspect, other persons under investigation, and any other person who may have touched the object bearing the latent print. Designate either on the print card or in a cover letter whether the inked prints are from the suspect or are for elimination. Place fingerprint cards in a stiff envelope to protect them from being bent. Seal the envelope and label it with your initials, the date, and an exhibit number. (See page 11)

## ■ LATENT PRINTS ON ABSORBENT MATERIALS

Place the paper, cardboard, or other absorbent material in a plastic bag or cellophane protector. **Do not handle the material with your fingers -wear gloves or use forceps to maneuver the materials. Do not attempt to develop latent fingerprints on absorbent surfaces yourself.** Questioned document evidence can be destroyed if processed for fingerprints; therefore, questioned document examinations must be completed prior to evidence being processed for fingerprints. Label the container with your initials, the date, and an exhibit number. Collect all necessary comparison standards.

## ■ LATENT PRINTS ON HARD SURFACES

Use fingerprint powder (preferably black or bichromatic powder) to dust plastic cards, metal plates, glass bottles, or other hard surfaced objects for latent fingerprints. Remove developed prints with lifting tape and place the tape on a 3" X 5" card which contrasts in color with the dusting powder used. Mark the card with a description of the surface from which the print was lifted, your initials, the date, and an exhibit number. Place the 3" X 5" cards in an envelope, label it appropriately, initial, date and seal the envelope. Collect all necessary comparison standards.

## ■ LATENT PRINTS ON SOFT SURFACES

Carefully remove putty, caulking compound or other soft material bearing visible fingerprint impressions. Leave as much excess material

surrounding the fingerprint as possible. Glue the mass of material to a stiff section of cardboard that is marked with your initials, the date, and an exhibit number. Tape a protective cover over the specimen. A paper cup or baby food jar is useful for this purpose. **Do not touch or otherwise distort the fingerprint.**

## ■ PACKAGING FINGERPRINT EVIDENCE

Use ingenuity to construct special containers to protect latent print bearing nonporous surfaces. Never place cotton, other cloth, paper, or plastic directly on the evidence surface that potentially bears the latent fingerprint. Insure that two surfaces bearing latent prints do not come into contact during packaging and transport to the laboratory. Paper or cardboard that is oriented and secured in such a way that it does not come into direct contact with the potential print bearing surface may be used to protect the latent print surface. Latent prints on absorbent materials are incorporated into the surface of the material, therefore loss of these prints through friction and surface contacts is of lesser concern. More than one absorbent material specimen (paper, cardboard, etc.) may be placed in one container for submission to the laboratory.

## ■ IDENTIFICATION

There is no set size requirement of a latent print for positive identification, and there is no specific number of characteristics required to effect an identification. As a general rule, if the investigator develops an area which appears to have several ridges, regardless of the size of the area, it should be lifted, marked, and submitted to the laboratory.

# 3. Firearms, Toolmarks And Impressions

Firearms leave unique markings on expended ammunition components as well as detectable residues on the shooter's hands.

## ■ HANDGUNS AND SHOULDER ARMS

All firearms should be **unloaded**, packaged separately, and properly sealed in appropriate container(s) before submission to the laboratory. Do not package firearms in any type of plastic bag or plastic wrapper.

*Contact the  
Laboratory  
when in  
Doubt.*

**Never insert anything into a firearm's barrel, cylinder, or action (e.g. plastic ties, flex cuffs, pens, pencils, etc.)** These items can alter a firearm's identifying characteristics and damage its working parts. Notes describing the position(s) of expended cartridge cases, live cartridges, safeties, hammers, etc. should be made if pertinent to an investigation.

If a firearm in a body of water is to be collected, ***it should remain in the original water.*** A water tight container such as a lidded plastic dish, capped PVC pipe, etc. should be lowered into the water and allowed to fill. This allows the firearm to be placed in the container without exposing it to the air.

## ■ SERIAL NUMBER RESTORATION

If a firearm's serial number has been defaced or obliterated, it's restoration can be attempted. Prior to packaging and submission to the laboratory, make identifying marks such as your initials on the firearm for future identification.

## ■ EXPENDED BULLETS, CARTRIDGE CASES AND

### SHOTSHELLS

All expended ammunition components should be packaged and sealed in appropriate container(s).

***Do not*** scratch, scribe or mark the sides or bearing surface of a bullet. The base or nose areas of a bullet can be marked for identification purposes.

***Do not*** scratch, scribe or mark the headstamp or primer areas of a cartridge case or shotshell. A cartridge case can be marked for identification purposes near or in the open mouth area. A shotshell can be marked for identification purposes near the crimp or open mouth area.

### Distance Determination

Determination of shooting distance for a single projectile firearm discharge is based on gunpowder residue deposited around the bullet entry hole. The outermost garment or contact surface will contain the gunpowder residues. Generally, the practical limit of distance determination is about 3 feet. Beyond 3 to 4 feet sporadic gunpowder particles do not form a reproducible pattern and are therefore not suitable for range determination.

If shotshell is used, the pellet spread pattern is used for distance determination when beyond the gunpowder deposition range.

When distance determination is requested, submit the suspect firearm with the same ammunition that was used along with the outermost clothing that contains the bullet hole(s).

## ■ NIBIN/National Integrated Ballistics Identification Network

NIBIN is a national computer network in which images of expended ammunition components are captured and stored in a database. Cartridge cases, bullets, and bullet fragments recovered at crime scenes and those obtained from test firing a firearm in the laboratory, **may** be entered into the database. Each time a cartridge or bullet is entered, the computer finds and exhibits “candidate” images with similar characteristics to the one entered in hope of finding a “match”.

All caliber’s will be considered for entry. Examples are .22, .25 Auto, .380 Auto, 9mm, .38/357, 10mm, .40, .44, .45 Auto, .410 gauge, 12 gauge, 20 gauge, etc. Bullets that are .22 caliber lead and bullets which don’t bear conventional rifling will not be entered. Cartridge cases which are not generally ejected at the crime scene will not be entered. Examples are cartridge cases fired in revolvers and single shot and double barrel firearms.

All entries and non entries will be based on entry criteria developed by the Firearm/Toolmark Section of the laboratory and will be at the discretion of the State NIBIN Administrator.

## ■ FOOTWEAR AND TIRE IMPRESSIONS

Shoes, boots and tires to be compared to questioned impressions should be submitted to the laboratory. Each item should be securely packaged and properly sealed in an appropriate container(s). **Do not** remove any dirt, mud, debris, etc. which has adhered to the footwear or tires.

### Photographing Impressions

Impressions should be properly photographed with a ruled scale before lifting or casting. An impression should be photographed from directly above using a detachable flash or light source (the use of a tripod is recommended). Each impression should be flashed from three or four different directions with the light source held low and to the side. Black and white film gives the best quality photographs for forensic comparison purposes. Photographs of impressions to be used for comparison purposes should be enlarged 1:1 or natural size prior to submission to the laboratory.

## **Lifting Residue Impressions**

Adhesive lifters, gelatin lifters and electrostatic lifting techniques may be utilized to recover and preserve residue impressions. These are impressions made from residues (blood, dirt, etc.) which have adhered to the outsole of a shoe or tire tread and then were deposited onto a hard surface. Residue impressions are fragile in nature and can be easily or unintentionally destroyed. Therefore they should be submitted to the laboratory. If this is not possible, sufficient care should be exercised when attempting to lift an impression from a surface. Impression lifts should be packaged separately and submitted to the laboratory in properly sealed containers.

## **Casting Impressions**

Dental stone or die stone casting material is recommended for the casting of three dimensional impressions (impressions in dirt, mud, snow etc.). Casting techniques should be practiced prior to attempting to cast impressions at crime scene. The use of Plaster of Paris for casting impressions is discouraged.

*Ziploc bag casting method utilizing dental or die stone* - A one gallon size plastic Ziploc bag is ideal for the storing, mixing and casting process. Approximately 12 ounces of water should be mixed with 2 pounds of dental or die stone. A 12 ounce beverage container can be sufficient to make a cast of a footwear impression. \* The water can be added to the pre-measured casting material in the plastic bag and mixed in the bag. The casting material should be the consistency of pancake batter. Pour the casting solution slowly so it gently flows into the side of the impression instead of directly onto the impression. When the dental or die stone has “set up” place your initials, date, case information, etc. into the backside of the cast. Dental and die stone casts generally set up in approximately 1 hour. **Do not** remove any dirt, mud, debris, etc. which has adhered to the cast.

Each cast should be securely packaged and properly sealed in an appropriate container(s) using shredded paper, packing peanuts, tissue, etc.

\* Additional casting material will be needed for larger impressions such as tire tread impressions.

## **■ TOOLMARK EVIDENCE**

### **Tools**

**Do not** remove trace evidence such as paint transfers, insulation, wood particles, debris, etc. which has adhered to the tool. The “working areas” of a suspect tool should be preserved in some manner to prevent loss of trace evidence and to protect its working parts.

## Toolmark Impressions

**Do not** insert a suspect tool into a toolmark. Items such as wires, chain links, pipe, etc. which have questioned toolmarks should be submitted. The areas which were cut or removed by the submitting agency should be distinguished from the questioned areas by the use of tags, labels, taping, bending, inking, etc.

## Casting of Toolmarks

MIKROSIL or silicon type materials are recommended for the casting of questioned toolmarks on items that can not be submitted.

Each tool, item, or cast should be securely packaged and properly sealed in an appropriate container.

# 4. DNA Analysis

Body fluid stains are valuable evidence, which can be used to associate a suspect with the crime or eliminate him from consideration. How biological evidence is collected will affect how it can be analyzed today or twenty years from now in a post conviction case.

## ■ BLOOD

### When materials stained with blood are to be sent to the laboratory:

Air dry the stained evidence on a piece of clean paper placed in a ventilated area. Place the dried item in a paper container (bag, envelope, box), identify the contents, seal, initial and date. Any debris which falls from the item onto the paper during the drying process should also be placed in a smaller container, sealed, initialed, dated, and placed into the container with the evidence. **DO NOT PACKAGE ITEMS WHILE THEY ARE STILL MOIST. ALLOW THEM TO DRY THOROUGHLY.** Package items from the victim(s) and suspect(s) into separate containers. Collect a comparison standard from each individual involved in the incident. Dry specimens completely for transport to the laboratory.

### When materials stained with blood cannot be sent to the laboratory:

- **Porous material (cloth, leather, ...)** cut the area believed to be stained.
- **Nonporous material (glass, metal, ...)** remove the stain by scraping with a clean knife or razor blade. Scrape the dried fluid into a paper fold. Place the paper fold into an envelope. Be very

conscious of unsealed seams where sample may fall out and become lost or contaminate other items of evidence.

- Remove stain with **small** pieces of a cotton swab or gauze pad which have been moistened slightly with water. Sample must be well concentrated. Air dry the sample completely prior to packaging in paper.
- **Liquid stains** may be collected by soaking sample onto clean cotton swabs or gauze. Sample must be well concentrated. Air dry the sample completely prior to packaging in paper.

Label all containers with an exhibit number then seal, initial and date. Collect a comparison standard from each individual associated with the incident. Refrigerate any liquid blood tubes until ready for transport to the laboratory.

## ■ SEMEN

Air dry the stained material on a piece of clean paper placed in a ventilated area. Condoms should be frozen soon after collection if drying is not possible. Stained areas on large items or items that cannot be sent to the laboratory may be cut out and submitted. Place the dried material in a paper bag, label the bag with an exhibit number, and seal, initial, and date. **DO NOT PACKAGE ITEMS WHEN THEY ARE STILL MOIST. ALLOW THEM TO DRY THOROUGHLY.** Obtain samples from the victim of a sexual assault using the Missouri State Sexual Assault Kit. Label the completed kits with exhibit numbers, initials, date, and apply proper seal.

**Refrigerate** the kits until transported to the laboratory. Also obtain comparison standards (blood or buccal swabs) from any suspects or other individuals involved in the case. Hair standards for Trace evidence analysis may be collected at this time.

*NOTE:* Sexual Assault Kits can be obtained from any Crime Laboratory in the state.

## ■ COMPARISON STANDARDS

For a complete DNA analysis, comparison standards from all individuals known to be associated with the crime or crime scene are needed. There is a general misconception with regard to the use of comparison standards in DNA analysis. At the present time a DNA profile is **NOT** a fingerprint or unique identification. Although a person's DNA is unique to only them, the DNA molecule also has many

common genes between individuals, such as genes for arms, legs, hair, eyes, etc. The current technology only allows the laboratory to analyze a small number of “genes” that may differ between one person and another. In the future this number may increase to the point that the exact origin of a stain can be determined without reasonable doubt. Until that time there will be population frequency estimates included in MSHP DNA laboratory reports. A frequency of 1 in 1,000,000 for example **estimates** that a given DNA profile will be found once in every one million individuals, twice in every two million individuals, or one hundred times in every one hundred million individuals. This statistic indicates that in the State of Missouri alone five people may share the same DNA profile. Therefore, it is not impossible that a victim and suspect of a crime have the same or similar profiles.

One of the underlying principles behind forensic analysis is the concept that when two individuals come in contact with one another, or if an individual comes in contact with an object, there is a high probability of transfer of biological material, skin, hair, etc. The transfer does not always have to be as obvious as blood. If contact or transfer occurs between two individuals it is likely that both individuals’ DNA profiles may be present. When DNA profiles are developed from evidence it is imperative that comparison standards from **ALL** individuals known to be associated with the crime scene are also analyzed to effectively interpret test results. This allows elimination of those individuals that are not consistent with the DNA profiles. It also avoids wrongful implication of an innocent person if two individuals happen to have a profile in common. In addition to standards from victims and suspects, it may be necessary to obtain standards from anyone known to be involved with the crime or crime scene such as boyfriends, husbands, housekeepers, baby-sitters, or other participants.

When obtaining comparison standards one of the following two methods is preferred.

- Blood standards: should be collected in purple-capped (EDTA) vacutainer tubes. (If toxicology exams are also desired, collect an additional blood sample in a "gray" stoppered blood tube, as outlined in Section 5 - Toxicology.
- Buccal (oral) swabs: may be substituted for blood if **specific collection instructions are followed.**

### **Collecting Buccal (oral) swabs:**

The buccal swab is designed to recover epithelial (skin) tissue from the interior of the cheek. Have the individual vigorously (without



causing injury) rub the swab along the interior cheek for approximately 30 seconds to a minute. The swab must be rubbed vigorously to increase the chance of recovering an adequate amount of cheek cells. The swab should be allowed to air dry, placed into an envelope, sealed, initialed, and submitted to the laboratory in a timely manner.

In order to provide the best service to our submitting agencies, it is essential that the laboratory know how each piece of evidence is associated with the individuals involved in the case. These associations should be detailed on a SHP-411 Laboratory Evidence Submission Form. (See Section II) With this information the laboratory can concentrate on the most productive evidence, properly interpret the results obtained, and provide a more informative report.

## **5. Toxicology**

### **■ SAFETY**

All biological fluids are biohazardous. Assume that all specimens are infected with something. Wear latex gloves when handling blood or urine specimens. Package samples in a way that will contain any leakage. Wash your hands thoroughly after handling any blood or urine specimen. Do not store blood or urine specimens in a place where you also store food or drinks. Notify the laboratory if you know the suspect is infected with any disease.

### **■ BLOOD ALCOHOL DETERMINATIONS**

Whole blood is the best body fluid for alcohol testing. Serum, plasma, and vitreous humor are acceptable specimens but only if they contain the proper preservatives. Urine is not a reliable specimen for accurately determining a blood alcohol level. Urine will not be analyzed for alcohol.

Blood and blood products must be collected in a sterile gray stopper blood collection tubes which contain the additives sodium fluoride (NaF) and potassium oxalate (K<sub>2</sub>Ox). Samples which do not contain sodium fluoride will not be analyzed for alcohol. If your sample is also needed as a reference standard for DNA, collect a separate duplicate sample in a purple capped tube also.

The site of blood collection on the suspect's arm must be cleansed with a non-alcoholic antiseptic. The most common non-alcoholic antiseptic is povidone-iodine (Betadine). Sterile water and ordinary tap

water are not antiseptics and do not fulfill the requirements of the law. Be aware that some antiseptics contain both alcohol and povidone-iodine and are labeled as such; do not use antiseptics containing any form of alcohol. The package from the antiseptic swab or pad must be preserved to prove in court that a non-alcoholic antiseptic was used. Do not preserve the swab or pad itself.

The blood specimen must be drawn using a new, sterile needle. The package from the needle must be preserved to prove in court that the legal collection requirements were followed. Do not preserve the needle itself, discard the needle in a proper sharps container.

After the blood is collected, mix the blood and the additives in the tube by gently inverting the tube at least 20 times. This will prevent the blood from clotting. Mark the tube with the person's name, your initials, and your case number, if available. One tube of blood (10 milliliters) is sufficient for alcohol testing.

Do not collect multiple specimens at different times in an attempt to demonstrate what the suspect's blood alcohol level may have been earlier. This process is likely to only complicate the case, and will not increase the ability of the toxicologist to "back calculate" the suspect's blood alcohol level.

Do not freeze the blood sample because the tube may break. Protect the blood sample from extreme heat, such as exists in a hot car during the summer. Extreme heat will cause the blood to congeal and render it impossible to analyze. Do not apply evidence tape to the blood tube itself. The blood specimen will be stable for many months at room temperature. If properly packaged, blood specimens may be sent to the laboratory through the US Mail.

### **Toluene/Solvent Abuse/Glue Sniffing**

Collect a blood sample as described above.

## **■ DRUG TESTING**

Both blood and urine may be tested for drugs. Drug tests on their own will not establish impairment at the time of arrest. The officer's observations of the suspect's degree of impairment will be critical to prosecuting a drug impairment case. It is recommended that both blood and urine be collected from the suspect.

Blood must be collected as described in "Blood Alcohol Determinations". Collect two tubes of blood (20 milliliters) for drug testing.

Urine must be collected in a clean, dry, leak-proof, plastic container. Urine collection must be observed to prevent the suspect from adulterating the sample. An observer of the same gender as the suspect

should accompany the suspect into the restroom stall and actually observe the urine flowing into the cup. At least 50 milliliters of urine should be collected. If the suspect cannot provide sufficient urine, have the suspect drink a glass of water and wait 15 minutes to try again. Once the urine is collected, mark the container with the suspect's name, your initials, and your case number, if available. Seal the container with evidence tape and initial the seal as well. The specimen container should then be double-bagged in leak-proof plastic bags. Zipper seal plastic bags work the best. You may place the double-bagged specimen in a paper bag or box, or submit it as is, but always seal and initial the outermost container.

If the urine sample cannot be delivered to the laboratory within 24 hours of collection, the urine must be refrigerated. This is a legal requirement. For long term storage (more than a day) the urine sample must be frozen. Do not send urine specimens through the US Mail.

Please indicate on the Laboratory Analysis Request form, SHP-411, which drugs you think the person might have ingested.

## ■ CARBON MONOXIDE

Collect blood as described in "Blood Alcohol Determinations".

## ■ SUSPECTED POISONINGS

Collect blood and urine as described above. Stomach contents can be useful in investigating poisonings. If stomach contents are available, package and store them as you would a urine sample. Tissue samples, hair samples, and other biological samples may also be useful. Please consult the laboratory before submitting evidence from a suspected poisoning case.

# 6. Trace Evidence

## ■ Ignitable Liquids

When fire debris is collected for the identification of an "ignitable liquid", the important concern is the type of container used for the preservation of the debris. Several containers are acceptable; glass jars, metal cans, nylon bags and "Kapak" bags. Unacceptable containers include paper bags, cardboard boxes and ordinary plastic

bags. The use of an unacceptable container exposes the sample to possible contamination. The laboratory will only analyze properly packaged fire debris evidence.

## ■ **EXPLOSIVES**

Any explosive device must be rendered safe before submission to the laboratory. Explosive components and residues will then be analyzed for chemical composition and identification. When possible, package explosive debris in the same manner as fire debris.

## ■ **FIBER**

Fiber transfer evidence can be significant in establishing a link between clothing and an object that came into forcible contact with the clothing, such as “hit & run” cases or assaults or homicides that involve blunt trauma. Carpet fibers are easily shed and attach to items on contact and can be useful in tracking an object to a particular residence or vehicle. Fiber collection techniques include tape lifting, vacuuming, or individual fiber collection when located.

## ■ **FILAMENTS**

An ON or OFF condition of a vehicle lamp at the time of a crash can frequently be determined by examining the filaments of that lamp. When submitting vehicle lamps for filament examinations, submit the entire lamp housing if possible, in that way the original orientation of the lamps is preserved. Broken lamp assemblies often provide excellent evidence of an ON or OFF condition. Take care to retain the pieces of the lamp. Filament evidence should be considered fragile and packaged as such so further damage does not occur during subsequent handling.

## ■ **GLASS**

Where the crime scene involves broken glass, the suspect’s clothing and shoes may contain glass fragments. Fragment sizes not readily visible to the unaided eye may still be usable for glass comparison analysis. Please handle and package evidence carefully to prevent loss of small fragments. It is recommended that the laboratory search clothing items and shoes for glass fragments.

## ■ GUNSHOT RESIDUE

### **The Gunshot Residue Kit**

The Missouri State Highway Patrol Crime Laboratory currently supplies the SEM/EDX Gunshot Residue Kit to law enforcement agencies. The kit contains two tape lift collection stubs (one for each hand), a pair of gloves and an instruction/data sheet. It is important to complete the data sheet. When possible, administer the gunshot residue kit where the subject is apprehended and prior to transporting the subject and especially before any other actions are taken that involve processing of the hands (e.g. fingerprinting). Gunshot residues rapidly decrease in concentration through normal activity within about 2 hours and are readily removed by washing of the hands.

**Caution! During collection of the kit, avoid blood on the hands. Blood defeats the adhesive of the collection stub. Try to sample around the blood.**

## ■ HAIR

Hair can be readily transferred from one person to another, especially in a physical altercation. Hair is also randomly dropped from the body as a natural process. Hair is a biological specimen of the body and may be associated back to its source through DNA analysis (although DNA is not always successfully extracted from hair). Hair collection techniques include tape lifting, vacuuming, or individual collection of single hairs as they are located. For microscopic comparison purposes, proper hair standards should consist of 50 randomly pulled head hairs and 25 randomly pulled pubic hairs.

## ■ PAINT

An available data base system of automotive paints allows paint analysis the possibility of classifying a paint to a specific make and model vehicle. This degree of identification requires that the entire paint layer structure must be present in the sample. Paint transfer in general, whether vehicular or architectural, provides good analytical data. Collect paint scrapings in paper folds, metal canisters or pill boxes. Avoid plastic bags.

## ■ SOIL

The success or failure of soil comparisons usually depends on either soil quantity or soil contamination. Soil smears frequently are not representative sample of the source soil's mineral content and therefore

are insufficient in quantity. Soil found on shoe soles and automotive tires may have sufficient quantity, but are generally contaminated by debris collected after leaving the area of interest and therefore show many differences from the source soil. Collect soil samples in any container appropriate for the moisture content of the particular soil sample.

**NOTE:** Many Trace Evidence exams require the comparison of a collected sample of unknown origin to samples of known origin in an effort to determine the source of the substance. If those standards of known origin (hair, fiber, paint, glass, etc.) are collected as they are encountered, much time can be saved from tracking down standards at a later date. Also, if you tape lift or vacuum a vehicle carpet - collect fiber standards from the carpeting at that time.

## 7. Miscellaneous

Such items as cigarette butts, tobacco, beverage cans, jewelry, or envelopes all serve as evidence to associate individuals to crimes. For instance, DNA can frequently be recovered from objects that were handled by an individual. Cigarette butts, beverage can lids, and licked envelope flaps all can be good sources of DNA.

### ■ CIGARETTE BUTTS

Pick up the cigarette butt on a piece of paper or with clean tweezers and place in a paper container (bag, envelope, or box). **Do not handle the cigarette butt directly with your hands.** Label the container with the exhibit number, your initials, the date, and location found. Seal the container(s) and submit these items to the laboratory as soon as possible.

### ■ JEWELRY

Handle with tweezers or cloth gloves. Dust for fingerprints, if applicable and place in a suitable crush-proof container. Label each sample container by writing on it in ink your initials, the date, and an exhibit number.

### ■ SMALL OBJECTS

At each crime scene, search for small objects such as burned matches, broken fingernails, hair strands, cigarette butts, etc. Those

items may contain a subject's DNA. Items such as fiber, paint transfer, glass fragments, soil and foreign substances may be useful for Trace Evidence comparisons. Remember comparison standards for Trace Evidence. Follow procedures outlined in this handbook for each of the known items. If you do not have specific directions for an item of evidence, place it in a crush-proof container without touching it directly with your fingers. Seal and identify the container by writing on it in ink your initials, the date, and an exhibit number.

**Comparison Standard:**

Keep in mind that the purpose of the comparison standard is to make an association with unknown items collected at the crime scene to an individual or to another originating object or location.



# Section IV

## Glossary



# Glossary

---

**Accelerant** - A flammable liquid or material used to increase rate and/or intensity of burning.

**Anticoagulant** - A chemical substance which retards the clotting of blood.

**Atomic Absorption** - An instrumental method of chemical analysis in **(AA)** which a solution is atomized in a flame or furnace and the atoms of the solution absorb certain wavelengths of light peculiar to the atoms in each substance.

**Blood Group** - The classification of blood according to chemical characteristics of the blood cells.

**Catalyst** - A substance that initiates a chemical reaction. **WARNING:** Catalysts may be highly reactive and may react violently with water, air, or solvents. Examples: Lithium strips (water reactive), Sodium metal (water reactive), Raney nickel (air and solvent reactive).

**Chemical Analysis** - An analysis which reveals the chemical composition of a pure substance or mixture by type (qualitative) and/or by the amount of each component present (quantitative).

**Clandestine Laboratory** - An illicit operation consisting of a sufficient combination of apparatus and chemicals that either has been or could be used in the manufacture or synthesis of controlled substances.

**Common Origin** - Materials originating from the same source, natural or manufactured.

**Coroner** - An official responsible for an inquiry into the causes and circumstances of any violent, unexpected, or suspicious death occurring within his jurisdiction.

**Elemental Analysis** - The determination of which chemical elements are in a sample and in what concentrations.

**Emission Spectroscopy** - A method of chemical analysis. A sample is burned in an electric arc and the various elements present are identified by the wavelength of the emitted light.

**Filters** - As used in photography: a transparent material such as colored glass that absorbs light of certain wavelengths or colors selectively and is used for modifying light that reaches a sensitized photographic material. Also called color filters.

**Flameless Atomic Absorption** - A variation of atomic absorption which uses a source of heat other than a flame for atomization.

**Gas Chromatography** - A method for the separation of complex mixtures into their individual components. As vapor of the mixture is passed through a column, the individual components dissolve to varying extents in a liquid within the column and a separation is effected. The separated components provide an indication of the identity of the original mixture.

**Gunshot Residue** - Material from the primer, powder, cartridge case, and bullet deposited on the hands of the shooter or on a wound of a victim shot at close proximity during a firearm discharge. Barium and antimony from the primer compound are principal gunshot residue components.

**Infrared** - Term used to describe rays of the electromagnetic spectrum contiguous to the red end of the visible spectrum, but invisible and of greater wavelength than red light.

**LMG Test** - Lueco Malachite Green. A screening test for blood.

**Medical Examiner** - A physician, usually a pathologist, authorized by statute to perform medical legal investigations in violent or suspicious deaths.

**Melting Point Examination** - A determination of the temperature at which a solid is converted into a liquid.

**Microchemical Tests** - Chemical tests performed on extremely limited amounts of a sample, often requiring observation of the test with a microscope.

**Microscopic Comparison** - An examination of two items made with the aid of a microscope to identify similar or dissimilar characteristics not visible to the unaided eye.

**Mineralogical Identity** - Determination of the mineral(s) presenting a sample.

**Molotov Cocktail** - An incendiary device consisting of an ignition source and a breakable container containing a flammable liquid.

**Neutron Activation Analysis (NAA)** - A sensitive method of chemical analysis utilizing the measurement of radioactivity induced into a sample to determine the type and amount of each chemical element present.

**Particle Size Distribution** - A measurement of that portion of a total sample represented by each of the different sized particles present.

**PCR** - polymerase chain reaction. A process where certain areas of the DNA molecule are copied repeatedly.

**Polarizing Screens** - Used in photography to decrease reflection by causing lightwaves to vibrate in a definite pattern, e.g., to straighten out diffused lightwaves.

**Polymer** - Substance consisting of large molecules formed from small molecules of the same type, the components of which have a definite, special arrangement. These materials affect the elasticity and consistency of products.

**Precursor Chemical** - A primary chemical that is chemically changed into the finished controlled substance product. Usually in connection with a clandestine laboratory. Examples: ephedrine, pseudoephedrine, phenyl-2-propanone.

**Pyrolysis Gas Chromatography** - High temperature decomposition of a substance into characteristic gaseous fragments, which are examined by gas chromatography to provide identification of the original material.

**Reagent Chemical** - Chemicals used in reactions to convert the precursor into the finished product. Examples: Hydrochloric Acid, Iodine crystals, anhydrous ammonia, red phosphorus.

**Scanning Electron Microscope / Energy Dispersive X-ray Analyzer (SEM/EDX)** - Instrument used to locate small particles and determine their elemental composition.

**Solvents** - Chemicals used to separate, purify, or dissolve other chemicals in a chemical reaction. Examples: White gas (naphtha, camp fuel), Freon, Alcohol, Ether.

**Specimen** - Sample to be examined or item of interest.

**Spectroscopic Analysis** - Chemical analysis based upon the measurement of emission or absorption of light.

**Spectrophotometry** - The measurement of the relative intensities of light in different parts of a spectrum.

**Standard** - Material of a known origin or composition used as a reference or as a basis for comparison.

**STR** - short tandem repeat. Areas of the DNA molecule that can be typed for comparisons between crime scene samples and comparison standards.

**Thin Layer Chromatography** - A technique for separating chemical compounds by means of a thin layer of absorbent material coated onto a supporting plate.

**Ultraviolet** - Term used to describe invisible rays of the electromagnetic spectrum lying outside of the violet end of the visible spectrum.

**Volatile Congeners** - Natural flavor components in alcoholic beverages which are derived from raw materials (grain, sugar, grapes, etc.) used to make the product.

**X-Ray Diffraction** - Unique scattering of X-rays as a function of the crystal structure of a solid material.

