

Forensic Evidence



Handbook

CONTENTS

Introduction	iii-iv
--------------------	--------

SECTION I: Crime Scenes

Armed Assault/Rape/Homicide	1-2
Arson	2-3
Bombing	3-4
Breaking & Entering	4
Clandestine Drug Laboratories.....	5
Hit & Run.....	6
Drug Violation.....	6-7
Suspicious Packages/Hazardous Substances...	7-8

SECTION II: Laboratory Submittal Forms

Laboratory Analysis Request	10
Latent Evidence Submission Envelope.....	10

SECTION III: Collection & Preservation

<i>Packaging Evidence Properly</i>	13
1. <i>Drug Chemistry</i>	14-15
Plant Material.....	15-16
Clandestine Laboratory Samples	16
Syringes, Sharps, Glass.....	17
Comparison Standards: Tampering Cases	17
2. <i>Fingerprints</i>	17
Comparison Standard/Inked Prints.....	18
Photographing Latent Prints	18
Latent Prints On Materials	18
Latent Prints On Surfaces.....	18
Latent Prints On Soft Surfaces.....	18
Latent Prints On Wet Surfaces	18-19
Packaging Fingerprint Evidence	19
Identification	19
3. <i>Firearms, Toolmarks, & Impressions</i>	19
Handguns & Shoulder Arms	19
Serial Number Restoration.....	20
Expended Bullets, Cartridge Cases, & Shotshells.....	20
Distance Determination.....	20

Footwear & Tire Impressions.....	20
Photographing Impressions.....	20-21
Lifting Residue Impressions	21
Casting Impressions.....	21
Toolmark Evidence.....	22
4. <i>DNA Analysis</i>	22
Blood	23
Semen.....	23-24
Other DNA Sources.....	24
Comparison Standards	24-25
Collection Buccal (Oral) Swabs	25
CODIS (COMbined DNA Index System)	25-26
5. <i>Toxicology</i>	26
Blood Alcohol Determinations	26-27
Drug Testing.....	27-28
Carbon Monoxide.....	28
Suspected Poisoning	28
6. <i>Trace Evidence</i>	28
Ignitable Liquids.....	28
Explosives.....	29
Fiber.....	29
Filaments.....	29
Glass	29
Gunshot Residue	30
Hair.....	30
Paint.....	30-31
Soil	31
7. <i>Miscellaneous</i>	31
Cigarette Butts & Tobacco	31
Jewelry	31
Small Objects.....	32
SECTION IV: Glossary.....	35-38

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 Crime 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;
- CODIS (COMBINED DNA INDEX SYSTEM)**—including sample collection from convicted offenders and management of the CODIS database;
- Drug Testing**—including street drugs, pharmaceuticals, and clandestine laboratories' precursors and products;
- Firearms**—including toolmarks, impressions, and serial number restoration;
- Latent Prints**—including evidence processing and Automated Fingerprint Identification System (AFIS) verification;
- Toxicology**—including alcohol and drug testing of blood, urine, and other body fluids as well as alcoholic beverages; and
- Trace Evidence**—including gunshot residue, explosives, ignitable liquids, hair, fiber, paint, glass, soil, filaments, and foreign substance identification.

The Missouri State Highway Patrol Crime Laboratory in Springfield is a full-service facility with analytical capabilities in the same areas as the Jefferson City location excluding CODIS.

At a minimum, the remaining satellite laboratories have analytical capabilities in the area of drug testing. Additional capabilities exist at some satellite laboratories. In the event a satellite laboratory does not provide the type of testing required, they will serve as a relay station for evidence bound for another laboratory.



Laboratories

Troop B

308 Pine Crest Drive
 Macon, MO 63552
 (660) 385-2132

Troop E

122 S. Ellis Street
 Cape Girardeau, MO 63703
 (573) 290-5130

Troop C

5268 Flat River Road
 Park Hills, MO 63601
 (573) 431-0166 ext. 2243

Troop G

1226 Business 60/63
 Willow Springs, MO 65793-0010
 (417) 469-1100

Troop D

425 E. Phelps Street
 Springfield, MO 65806
 (417) 868-9400

Troop H

3525 North Belt Highway
 St. Joseph, MO 64506
 (816) 387-2345 ext. 266

Troop D

5109 S. Grand Avenue
 Carthage, MO 64836
 (417) 359-1560

GHQ

1510 E. Elm Street
 Jefferson City, MO 65101
 (573) 526-6134

We hope this handbook proves valuable to you in your investigations. We have tried to cover the major facets of investigations, as well as evidence collection and preservation techniques. However, we realize 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 cartridge components;
- Knives or other possible weapons;
- Items containing latent fingerprints;
- Impressions;
- DNA evidence (blood, semen, saliva, etc.); and
- 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 object 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 lost rapidly from the hands of an active person. When possible, administer the gunshot kit where the subject is apprehended, prior to transporting the subject, and especially before any actions are taken that involve processing of the hands (i.e. 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 residue on the shooting victim in the vicinity of the bullet entrance. The outermost garment of contact surface will contain the gunpowder residue. The suspect firearm and ammunition used must be submitted in order to conduct this exam. Generally, the practical limit of distance determination is about three feet from the muzzle. If a 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 laboratory 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 also may be found and collected.

A search of a suspect's vehicle or residence might yield hair, fiber, DNA, or fingerprints from the victim. Always consider the preservation of the victim's clothing and collection of biological standards from the victim (hair and oral swabs) and from the suspect, if available. Consider the collection of any other known standard substances that may be useful for linking the suspect to a victim or location.

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	Pages 17-19
Firearms & Ammunition.....	Pages 19-20
Impressions.....	Pages 20-22
DNA Analysis.....	Page 22
Fibers & Hair	Pages 29-30

Arson

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

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 toolmarks and other evidence 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.

Fingerprints.....	Pages 17-19
Toolmarks	Page 22
Impressions	Pages 20-22
Ignitable Liquids.....	Page 28-29
Glass	Page 29
Fibers & Hair.....	Pages 29-30

Bombing

In a bombing situation, investigative actions depend upon whether it is a threatened bombing or an explosion that has occurred already. 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 toolmarks; 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.

If a suspect is developed, consider searching for bomb-making components in his possession.

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

Fingerprints	Pages 17-19
Impressions.....	Pages 20-22
Toolmarks.....	Page 22
Ignitable Liquids & Explosives	Pages 28-29
Fibers & Hair	Pages 29-30

Breaking & 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 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 lawbreaker.

Collect articles that 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. Consult with the victim(s) to determine what items are out of place or don't belong at the scene.

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

Fingerprints	Pages 17-19
Impressions.....	Pages 20-22
Toolmarks	Page 22
DNA Analysis.....	Page 22
Glass.....	Page 29
Fibers & Hair	Pages 29-30
Paints	Pages 30-31
Soil.....	Page 31
Miscellaneous / Cigarette Butts	Page 31

Clandestine Drug Labs

Clandestine laboratories are a significant problem in the state of Missouri. These laboratories are diverse, range in size and complexity, and implement various manufacturing methods. These factors present additional challenges to officers during collection, preservation, and presentation of drug manufacturing cases.

Raiding a clandestine laboratory can be dangerous because of the possibility of fire, explosion, and inhalation of toxic 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 laboratory investigators should perform a safety assessment of the laboratory, and remove/separate incompatible evidence and place that evidence 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 finished product, precursors, raw materials, manufacturing equipment, and all literature. Not all evidence seized should be sent to the crime laboratory. Select representative samples of a finished product and precursors. Photograph each sample container together with the bulk container from which it was removed. 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 laboratory 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 dispose of chemicals and solvents safely.

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.

Drug Evidence.....	Page 14
Chemicals.....	Page 16
Fingerprints.....	Pages 17-19
Firearms & Ammunition.....	Pages 19-20
Impressions.....	Pages 20-22
Toxicology.....	Page 26
Ignitable Liquids & Explosives.....	Pages 28-29
Paint.....	Pages 30-31
Soil.....	Page 31

Hit & 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. Intact, multi-layered paint chips found on the victim's clothing or recovered at the scene can be searched in a vehicle paint database for a hit list of possible vehicle makes and models. Examine the vehicle for possible blood transfer from the victim.

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. These fragmented parts can provide an excellent fracture match relationship 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.

Impressions.....	Pages 20-22
DNA Analysis.....	Page 22
Glass.....	Page 29
Fibers & Hair	Pages 29-30
Paints	Page 30

Drug Violation

Often, evidence of a drug violation, such as a syringe, paper wrapping, powder residue, or marijuana cigarette is discovered in plain view and collected during the investigation of an unrelated offense. Drug evidence is obtained, also, 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, shoeboxes, 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 blood borne pathogens, cautiously 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 syringes, needles, razor

blades, knives, and other sharp objects is always present. Gloves may provide some protection, but they can be punctured or cut. Also, certain chemicals can penetrate gloves.

If the suspect is unknown, fingerprints may be the only evidence available for suspect identification. Before leaving the crime scene, 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 a drug-related crime scene, refer to Section III, Collection and Preservation of Evidence.

Food & Drug Specimens	Pages 14-16
Fingerprints.....	Pages 17-19
Toxicology	Page 26

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*; and
 - 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.; and
 - Lopsided, "lumpy", or uneven envelope.
- *Excessive weight*

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

- Secure the area.

- Notify the local Hazardous Materials (HAZMAT) team.
- Notify the regional office of the FBI and ask for the regional Weapons of Mass Destruction (WMD) coordinator.

Phone numbers:

St. Louis Regional Office — (314) 231-4324

Kansas City Regional Office — (816) 512-8200

- Notify the local public health agency or the Missouri Department of Health and Senior Services at (800) 392-0272 (available 24 hours a day). This phone is answered by an automated attendant, which provides an option to choose in case of an emergency.
- Create a 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

A Laboratory Analysis Request should be filled out for each case submitted. Include on this form each item of evidence submitted for analysis and choose the specific type(s) of analysis or examination desired from the list provided. To locate the Web-based Laboratory Analysis Request form visit www.mshp.dps.mo.gov and click on the "Law Enforcement Portal" button near the top of the web page. Click on "LAR" under Quick Links or scroll down to the LAR description. Register for access to the Web LAR with your agency ORI as directed by the web site. The laboratory strongly encourages all non-Patrol agencies to utilize the Web LAR as the information provided is downloaded directly into the laboratory's information system. This significantly decreases the amount of time that property officers must spend at the laboratory submitting evidence.

The "summary of incident" field should be clear and specific. The "Items Submitted" field should be an accurate description of the evidence, and should not introduce bias/assumptions. For example, drug evidence items should be described as "powder residue", "plant residue", "plant material", "blue tablet labeled M120" and NOT described as "cocaine" or "crack". Thorough documentation must be submitted to the laboratory for items undergoing DNA examinations. The recovery location of the evidence and how the evidence relates to the crime that occurred is essential to determine if the sample is eligible for CODIS entry.

LATENT EVIDENCE SUBMISSION ENVELOPE

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 the forms or your envelope supply diminishes, contact any of the crime laboratories throughout the state.

MISSOURI STATE HIGHWAY PATROL CRIME LABORATORY DIVISION		DATE
LATENT EVIDENCE SUBMISSION ENVELOPE (Complete one form per case)		AGENCY IDENTIFIER NO. (ORI)
LABORATORY USE ONLY		AGENCY CASE NO.
SH-415C - 08/08		MSP/LABORATORY NO.
		OTHER
This evidence received prior laboratory examination? <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> 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	COUNTY OF CRIME	DATE OF CRIME
VICTIM(S) (Include DOB, SIC F, etc.)		
SUSPECT(S) (Include DOB, SIC F, etc.)		
BRIEF SUMMARY OF INCIDENT		
Technical description of evidence submitted and specific examinations requested (All containers must be sealed and identified)		



Section III

**Collection &
Preservation of
Evidence**

Packaging Evidence Properly

1. **ALWAYS** utilize a laboratory analysis request form. The Patrol laboratories strongly recommend that non-Patrol agencies register for and use the Web LAR for submittal of evidence to the crime laboratories. (See Section II, p. 10)
2. Latent Evidence Submission envelopes 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. **ALWAYS** package firearms separately from other evidence. (Firearms are checked immediately to make certain they are unloaded.) If available, please use cardboard boxes specifically designed for firearms evidence.
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. Toxicology evidence from sexual assault investigations must be packaged and submitted separately.
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. It may be advantageous to remove and repackage drug evidence from any original containers needing fingerprint examination. Submitting these items in separate containers will prevent delay of drug analysis results.
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 laboratory. **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. **DO NOT** submit syringes which do not contain visible liquid or residue. Syringes should be packaged separately and 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. **AIR-DRY** before submitting.
14. **DO NOT** submit syringes, drug paraphernalia, or miscellaneous items that do not need to be analyzed.
15. Sharps, such as knives and glass, must be submitted in a hard-sided container. The container should protect those handling the evidence and prevent the breakage of fragile evidence. **DO NOT** package sharps in a paper or plastic bag.
16. Suspected marijuana plants should be dried, the leaves removed from the stalks, and only leaves submitted.

Collection & Preservation Of Evidence

It is important that each item submitted as evidence be sealed with **TAMPER EVIDENT EVIDENCE TAPE**, dated, initialed, and labeled as to its contents and its 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 cannot be frozen.

1. Drug Chemistry

When handling drug evidence it is important to prevent contamination between the specimens and from outside sources. Hazardous chemical samples from clandestine laboratories, sharps, and syringes are just a few of the hazards to be aware of when handling and packaging drug evidence. These hazards also have additional packaging requirements in order to protect the integrity of the evidence and ensure the safety of those handling the evidence.

The Drug Chemistry Section strives to provide quality analysis in a timely fashion. Cooperation from submitting agencies to limit the amount of evidence submitted is crucial in maintaining efficiency, resulting in decreased turnaround time for our submitting agencies. *The following are a few general guidelines to consider when submitting drug evidence:*

- **SUBMIT** only the most probative items.
- **AVOID** submitting extraneous paraphernalia, especially in instances where there is a weighable amount of powder, plant material, etc. Generally, only one paraphernalia item per suspect will be tested.
- **DO NOT** submit items that do not have a visible residue. They will not be examined.
- **CONSIDER** submitting representative samples of a bulk quantity of material.
- **DO NOT** submit field test kits as they contain chemicals, some hazardous, and should be treated as such. If you feel they must be submitted, please follow the guidelines for chemical/ clandestine laboratory evidence. Field test kits are not tested by the laboratory.
- **DO** clearly mark probable cause items.
- **ALWAYS** properly label and package biohazard items. This includes bloody items and items recovered from body cavities.
- **ALWAYS** clean items that have been recovered from body cavities.

General Evidence Packaging Guidelines

- Be conscientious of the weight of the evidence you are submitting to the laboratory and package it in appropriately sized containers.
- Do not completely cover the container in evidence tape.
- Keep in mind that the criminalist has to open the container, remove the evidence, and place it back into the same container. Do not overstuff containers, so that it becomes difficult to place all items back in the container after analysis.

■ ***Plant Material***

It is always important to ensure that plant material is completely dry before packaging and submitting to the laboratory. Failure to thoroughly dry plant material before packaging may result in the growth of mold. This makes proper analysis difficult at the least, but could potentially change the condition of the plant material so severely that it becomes unsuitable for analysis. Additionally, inhalation of mold spores can result in respiratory problems. After the sample has dried, place it in a box, paper bag, or other container, and secure it with evidence tape.

For large plant material seizures the evidence should be well documented before submission to the laboratory. This includes taking photographs, obtaining an accurate count of the number of plants, and recording a gross weight and any other information that the agency may need. Representative samples may be taken to avoid bulk submission. Please call the laboratory with any questions about bulk sample submission or representative sampling.

Additional guidelines for plant material submission:

- Plants seized from grow operations should be dried, have their leaves stripped, and only the leafy material submitted to the laboratory.
- **DO NOT** submit dirt, growing media, fertilizers, or plant containers.
- **DO NOT** submit mature stalks.
- General Drug Items: Powder, Tablet, Capsule, Liquid, etc.
- General evidence packaging guidelines should be followed for solid items. Remember to use size appropriate packaging, as a single tablet or small plastic bag corner can get lost in an oversize container. If necessary, additional internal packaging can be added to secure the item.
- Generally, any marked tablet or capsule that does not contain a substance scheduled by the state of Missouri will not be tested. Additionally, only one tablet per schedule will be tested.
- Liquids that are not related to a clandestine laboratory investigation should be packaged in a manner that prevents leakage and evaporation. Clandestine laboratory approved containers can be used to submit these items and ensure that spillage does not occur.
- **AVOID** submitting obvious non-controlled, over-the-counter medica-

tions. Resources such as the Physician's Desk reference, poison control, and www.drugs.com can assist in preliminary identification of tablets and capsules.

- **ALWAYS** freeze food items and place beverages in the refrigerator prior to submission. Please advise a Laboratory Evidence Technician when submitting these items, so that they can be stored properly at the laboratory.
- **DO** submit known standards of a medication when tampering is suspected and clearly label as such.

■ *Clandestine Laboratory Samples*

Due to the hazardous nature of chemicals used in the manufacture of illicit drugs, safety precautions need to be taken when handling and packaging this type of evidence. Certain chemicals pose such a hazard that they will not be accepted into the laboratory under any circumstances.

Other chemicals and liquids are accepted only in smaller quantities and in approved containers. An example of an approved container consists of a one ounce glass vial with a Teflon liner and screw cap, stored in a plastic Nalgene bottle. Powders, solids, iodine, and items with residue (filters) that have a strong chemical odor should also be packaged in this manner. Suspected iodine samples should be packaged in a separate, external container.

Preferably, only the amount of liquid / powder needed to prove the offense should be submitted. Larger volumes of liquids can be submitted, however, representative sampling is encouraged. To submit a larger volume of liquid, divide the liquid into multiple approved containers. These should be labeled clearly as originating from the same container and the laboratory analysis request should reflect that the containers can be combined for analysis.

The Drug Chemistry Section does not test for Coleman Fuel, sulfuric acid, and various other chemicals related to drug manufacturing. The Drug Chemistry Section can test for ammonia, iodine, lithium, and red phosphorous.

The following items MAY NOT be submitted to laboratory:

- anhydrous ammonia,
- hydrogen chloride gas,
- sodium metal,
- compressed gas cylinders,
- samples not in approved containers, and
- bulk quantities of any liquid or solid chemical used to manufacture drugs.

■ *Syringes, Sharps, Glass*

Frequently, drug cases also contain various puncture, scratch, and cut hazards from objects such as syringes, razor blades, and broken glass. These types of hazards need to be packaged in a way that protects all of the individuals that handle that particular piece of evidence.

All syringe and sharp hazards should be packaged separate from other evidence. Syringes should be packaged individually in hard plastic tubes, boxes, or syringe safes. Sharps and glass should be packaged in hard-sided containers to protect from puncture and/or breakage. Glass that is already broken should be treated as a sharp hazard and packaged as such.

- **DO NOT** submit syringes and sharps if they are not essential to the case.
- **DO NOT** wrap evidence tape around syringes and sharps.
- **DO NOT** wrap syringes in plastic bags, cloths, etc., before placing in approved sharps containers.
- **DO NOT** submit syringes that do not have visible residue.

■ *Comparison Standards: Tampering Cases*

If available, 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. Also, collect known standards of tablets and capsules. Clearly mark these specimens as standards. **DO NOT REMOVE STANDARDS FROM THEIR ORIGINAL CONTAINER.**

DO NOT MIX SAMPLES. PACKAGE EACH SEPARATELY TO AVOID MIXING DURING TRANSPORT.

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 laboratory as soon as possible. With the assistance of the Automated Fingerprint Identification System (AFIS), we are 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. Also, homicide and sexual assault cases will be searched, without a request, through the FBI's Integrated Automated Fingerprint Identification System (IAFIS) if no candidate is generated through AFIS. All other types of crimes will be searched through IAFIS only upon request.

■ *Comparison Standard/Inked Prints*

Collect fingerprints and palmprints 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.

■ *Photographing Latent Prints*

A ruled scale should be used when photographing latent prints. Photographs to be used for comparison purposes should be 1:1 or natural size prior to submission to the laboratory.

■ *Latent Prints On 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.**

■ *Latent Prints On Surfaces*

Use fingerprint 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. Place the 3" x 5" cards in an envelope, label it appropriately, initial, date, and seal the envelope. **The use of black powder and white cards is recommended.** 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. 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.**

■ *Latent Prints On Wet Surfaces*

When fingerprint evidence found in a body of water is collected, it should remain in the original water. A watertight container should be

lowered into the water and allowed to fill. This allows the evidence to be placed in the container without exposing it to the air. If fingerprint evidence found in water is allowed to dry before processing, the likelihood of developing prints of value dramatically decreases.

■ *Packaging Fingerprint Evidence*

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. **Please do NOT circle, draw arrows, or further indicate location of latent prints.**

■ *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, & Impressions

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

■ *Handguns & 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 wrappers.

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, its 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, & 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 from 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 residue. Generally, the practical limit of distance determination is about three feet. Beyond three to four 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.

■ *Footwear & 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 residue (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 two 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 is "set", place your initials, date, case information, etc., into the backside of the cast. Dental and die stone casts generally become "set" in approximately one hour. Do not remove any dirt, mud, debris, etc., which has adhered to the cast. (Additional casting material will be needed for larger impressions, such as tire tread impressions.)

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

■ *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 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 cannot 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 20 years from now in a post conviction case.

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 be analyzed to interpret test results effectively. 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.

■ *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, or box), identify the contents, seal, initial, and date. Any debris that falls from the item onto the paper during the drying process should 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.** All DNA evidence should be placed in paper packaging; nothing air tight, such as plastic or glass. 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, etc.)— Cut the area believed to be stained.
- Nonporous material (glass, metal, etc.)— Remove stain with a cotton swab that has been moistened slightly with water. The sample must be well concentrated on the tip of the swab. Air dry the sample completely prior to packaging in paper.
- Liquid stains may be collected by soaking the sample onto clean cotton swabs. The 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. Dried specimens may be stored at room temperature in a paper container.

■ *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. Stains on nonporous material may be removed with a cotton swab, which has been moistened slightly with water. 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 and any suspects using the Missouri State Sexual Assault Evidence Kits. 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 should be collected at this time.

NOTE: Sexual Assault Kits can be obtained from any crime laboratory in the state.

■ *Other DNA Sources*

DNA may be obtained from items that do not contain blood or semen. This type of DNA is often referred to as touch or wearer DNA. Extreme caution should be taken when handling these items as contamination can easily occur. Touch DNA should not replace fingerprint examinations. Items submitted for touch DNA analysis should be items that were extensively handled by the suspect of the crime and not handled by multiple individuals.

■ *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 regarding 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 only to 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 genetic markers 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 100 times in every 100 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.

When obtaining comparison standards the buccal swab method is preferred.

- **Buccal (oral) Swabs:** See specific collection instructions below. **DO NOT USE THE MSHP OFFENDER DNA SAMPLE COLLECTION CARD/KIT.** This kit is not to be used for casework suspect standards. Use your agency's own swabs and packaging, with proper chain of custody.

- **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.)

■ *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 one 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, then placed into an envelope, sealed, initialed, and submitted to the laboratory in a timely manner. Submit at least two swabs from each individual (two to four preferred). Please label the package with the name of the individual from whom the sample was taken. (i.e. Collected from John Doe.)

In order to provide the best service to our submitting agencies, it is essential the laboratory knows how each piece of evidence is associated with the individuals involved in the case. These associations should be detailed on the Web LAR or your laboratory analysis request. (See Section II. p. 10) With this information, the laboratory can concentrate on the most productive evidence, properly interpret the results obtained, and provide a more comprehensive and informative report.

■ *CODIS (COmbined DNA Index System)*

The CODIS database is used to support law enforcement by providing investigative leads to cases. Even though the DNA sections of the laboratory are independent of each other, they complement each other through CODIS. The database relies upon properly collected offender and casework reference standards.

The FBI Laboratory's Combined DNA Index System blends forensic science and computer technology into an effective tool for solving crimes. CODIS enables federal, state, and local crime laboratories to exchange and compare DNA profiles electronically, thereby linking crimes to each other and to offenders.

The MSHP DNA casework sections in Jefferson City, Cape Girardeau, and Springfield are responsible for processing crime scene cases that agencies submit to the laboratory. Types of cases range from missing persons and burglaries to sexual assaults and homicides. The analyst's primary duties are stain identification and DNA typing of evidence from crime scenes, with subsequent comparison to known reference standards. Profiles generated from evidence may be entered into the CODIS for periodic searches against the database if they meet the eligibility criteria for entry.

The CODIS Section is responsible for generating profiles from offenders per Section 650.055 RSMo.

The Missouri State Highway Patrol is designated by Section 650.052 RSMo. to be the central repository for the DNA profiling (CODIS) system. This includes the management of the Offender DNA Profiling program in Missouri, as well as collaborating with the FBI and other Missouri CODIS laboratories. The state CODIS administrator is in the General Headquarters CODIS Section and is responsible for administering the CODIS program. DNA profiles generated by these samples will be entered into the CODIS database.

Offender samples are used for investigative purposes and are not considered evidence. Both DNA sections have access to the CODIS database. Eligible profiles from cases are searched weekly at the state and national level against each other as well as against the offenders, with the goal of possibly linking cases to each other and /or to an offender in Missouri or nationwide. When a match (hit) is made on a case, the submitting agency is notified.

The DNA Casework Section will request the agency to obtain a known reference standard, typically a mouth (buccal) swab, for comparison back to the case. When the casework laboratory completes the DNA comparisons, a supplemental report is issued.

Officers should be aware of the differences between the Casework and Offender CODIS sections, particularly when obtaining reference standards for a case. Reference standards from known suspects should be submitted if possible with the other evidentiary items in the case, as CODIS searching should not be routinely used in place of obtaining a reference standard, particularly if the suspect is known. When collecting standards for casework comparison, the standards should be collected under consent or warrant. The Missouri Offender DNA Collection Kits are not intended to be used to obtain a DNA sample for casework.

5. Toxicology

All biological fluids are biohazardous. Assume 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 drink. 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 tube which contains the additives sodium fluoride (NaF) and potassium oxalate (KOx). Samples which do not contain sodium fluoride will not be analyzed for alcohol. If your sample is needed also as a reference standard for DNA, collect a separate, duplicate sample in a purple capped tube.

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 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 15-20 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 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 from extreme heat, such as exists in a hot car during the summer. 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 U.S. 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 relating to 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" found on pages 26-27. Collect two tubes of blood (20 milliliters for drug testing).

Urine must be collected in a clean, dry, leakproof, plastic container. Urine collection must be observed to prevent the suspect from adulterating the sample. An observer of the same gender as the person should accompany the person 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 leakproof plastic bags. Zipper seal plastic bags work best. The double-bagged specimen may be placed in a paper bag or box, or submitted 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 should be frozen. Do not send urine samples through the U.S. Mail.

Please indicate on the Web LAR or 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" found on pages 26-27.

■ *Suspected Poisoning*

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 also may 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 "accelerant", the important concern is the type of container used for the preservation of the debris. Several containers are acceptable: glass jars, metal cans (epoxy-coated is preferred), nylon bags, and "Kapak" bags. Unacceptable contain-

ers include paper bags, cardboard boxes, and ordinary plastic bags. The use of an unacceptable container exposes the sample to possible contamination. The laboratory will analyze only properly packaged fire debris evidence.

Arson evidence should be submitted to the laboratory as soon as possible. Otherwise, the evidence should be stored in a freezer (ideally) until it can be submitted.

■ *Explosives*

Any explosive device must be rendered safe before submission to the laboratory. Then, explosive components and residue will 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, 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 isolating a single fiber.

■ *Filaments*

An ON or OFF condition of a vehicle lamp at the time of a crash frequently can be determined by examining the filaments of that lamp. When submitting vehicle lamps for filament examinations, submit the entire lamp housing, if possible. That way, the original orientation of the lamp 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 residue rapidly decreases in concentration through normal activity within about two hours and is 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.

Kits should be collected from living subjects within six hours of an incident. Kits collected after more than eight hours will not be analyzed routinely. Kits collected from shooting victims, whether suicide or homicide, will not be analyzed routinely.

■ *Hair*

Hair can be transferred readily from one person to another, especially in a physical altercation. Hair also is dropped randomly 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). On items that are too large for submission, such as car seats or furniture, hair collection techniques include tape lifting, vacuuming, or individual collection of single hairs. These may be placed on a Post-it note to prevent loss.

For microscopic comparison purposes, proper hair standards should be collected from all the individuals involved. A proper standard consists of 50 randomly pulled head hairs representing the entire scalp and 25 randomly pulled pubic hairs.

■ *Paint*

An available database system of automotive paints allows paint analysts the possibility of classifying a paint to a specific make and model vehicle. This degree of identification requires that the entire paint layer structure down to the metal or plastic be collected. Paint transfer in general, whether vehicular or architectural, provides good analytical data. Control paint samples should be collected from all vehicles involved and from an area close to the impact area. Clearly label control and transfer

samples and indicate from which vehicle they came. 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 samples 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 for comparison to questioned soils from the surface unless there is reason to believe the questioned soil was transferred from a dugout area. Collect a sample from several areas in the vicinity of interest. The equivalent of about one-half to one cup is sufficient. The samples should be dry or packaged in a container that does not trap moisture.

NOTE: Many trace evidence examinations require the comparison of a collected sample 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

■ *Cigarette Butts & Tobacco*

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 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 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

Anticoagulant – A chemical substance which retards the clotting of blood.

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.

CODIS – The COmbined DNA Index System administered by the FBI. CODIS links DNA evidence obtained from crime scenes, thereby identifying serial criminals. CODIS also compares crime scene evidence to DNA profiles obtained from offenders, thereby providing investigators with the identity of the putative perpetrator. In addition, CODIS contains profiles from missing persons, unidentified human remains, and relatives of missing persons.

- There are three levels of CODIS: the Local DNA Index System (LDIS), used by individual laboratories; the State DNA Index System (SDIS), used at the state level to serve as a state's DNA database containing DNA profiles from LDIS laboratories; and the National DNA Index System (NDIS), managed by the FBI as the nation's DNA database containing all DNA profiles uploaded by participating states.

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.

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. Lead, 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.

Ignitable Liquid – A combustible or flammable liquid that will ignite easily and sustain a fire; might be used criminally to increase the rate and intensity of an intentionally set fire.

LMG (Leucomalachite Green) Test – A screening test for blood.

Mass Spectrometry – A method by which a chemical compound is identified by ionization and a measurement of the mass/charge ratios of the charged and fragmented molecules that are produced by the breakdown of the molecule by this ionization.

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

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.

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.

Spectrographic 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. May be referred to as a "control" or "known".

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.

