U. S. Department of Justice
Federal Bureau of Investigation
Laboratory Division

HANDBOOK OF FORENSIC SERVICES

Handbook of Forensic Services

(revised 2013)

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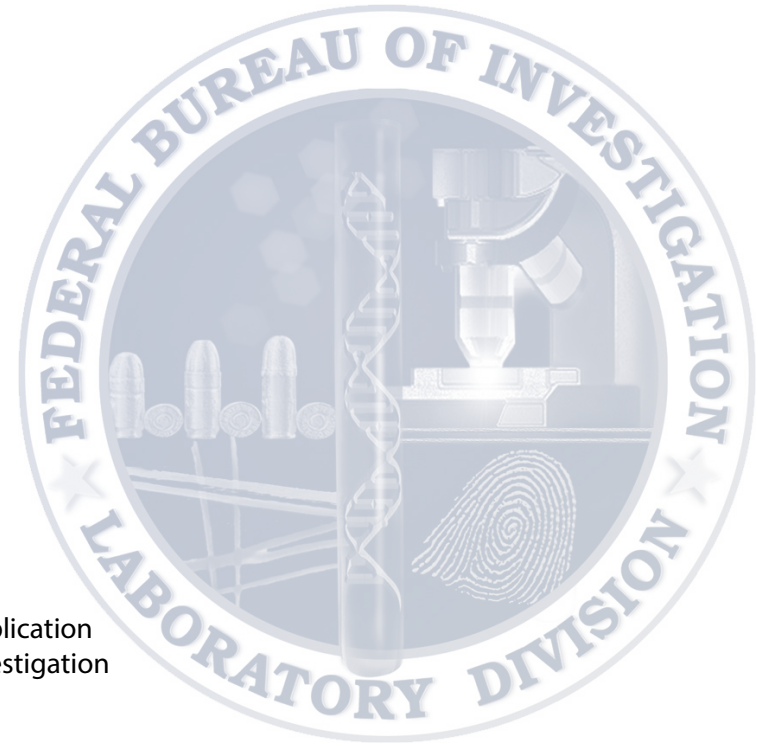

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INTRODUCTION

The Handbook of Forensic Services provides guidance and procedures for safe and efficient methods of collecting, preserving, packaging, and shipping evidence and describes the forensic examinations performed by the FBI's Laboratory Division.

FBI Forensic Services

The successful investigation and prosecution of crimes require, in most cases, the collection, preservation, and forensic analysis of evidence. Forensic analysis of evidence is often crucial to determinations of guilt or innocence.

The FBI has one of the largest and most comprehensive forensic laboratories in the world, and the FBI Laboratory is accredited by the American Society of Crime Laboratory Directors/Laboratory Accreditation Board. The forensic services of the FBI Laboratory Division are available to the following:

- FBI field offices and legal attachés;
- U.S. attorneys, military tribunals, and other federal agencies for civil and criminal matters; and
- State, county, and municipal law enforcement agencies in the United States and territorial possessions for criminal matters.

All forensic services, including expert witness testimonies, are rendered free of cost; however, the following limitations apply:

- No examination will be conducted on evidence that has been previously subjected to the same type of examination. Exceptions may be granted when there are reasons for a reexamination. These reasons should be explained in separate letters from the director of the laboratory that conducted the original examination, the prosecuting attorney, and the investigating agency. Exceptions require the approval of the Laboratory Director or a designee.
- No request for an examination will be accepted from laboratories having the capability of conducting the examination. Exceptions may be granted upon approval of the FBI Laboratory Director or a designee.
- No testimony will be furnished if testimony on the same subject and in the same case is provided for the prosecution by another expert.
- No request for an examination will be accepted from a nonfederal law enforcement agency in civil matters.
- No requests will be accepted from private individuals or agencies.

In addition, when submitting evidence to the FBI Laboratory, contributors acknowledge the following:

- FBI examiners will choose appropriate technical processes to address the contributor's request for examination, including additional testing as initial testing results warrant.
- Depending on the caseload of the Laboratory and the needs of the contributor, evidence examinations may be subcontracted at FBI expense.
- An FBI Laboratory Report of Examination may contain the opinions and/or interpretations of the examiner(s) who issued the report.

Additional Case Acceptance Guidelines

The FBI accepts evidence related to all crimes under investigation by FBI field offices; however, it accepts from other federal, state, and local law enforcement agencies only evidence related to violent crime investigations. The FBI does not routinely accept evidence from state and local law enforcement agencies in cases involving property crimes unless there was personal injury or intent to cause personal injury. These guidelines help to ensure that the FBI continues to provide timely forensic assistance to law enforcement agencies investigating crimes of violence or threatened violence. Additional restrictions may be imposed on case acceptance to achieve this goal.

At the discretion of the FBI Laboratory Director or a designee, the FBI may accept evidence from property crime cases. Such exceptions will be considered on a case-by-case basis and should not be regarded as setting a precedent for future case acceptance. All accepted cases will be afforded the full range of forensic services provided by the FBI.

The following are examples of property crimes that are not routinely accepted for examinations:

- Arson of unoccupied residential and commercial buildings and property (unless terrorism, such as an environmental terrorist attack, is suspected).
- Explosive incidents and hoaxes targeting unoccupied residential and commercial buildings and property (unless terrorism, such as an environmental terrorist attack, is suspected).
- Vandalism and malicious mischief directed toward residential or commercial buildings and property.
- Nonfatal traffic accidents involving headlight examinations except in cases involving law enforcement and government officials.
- Hit-and-run automobile accidents not involving personal injury.
- Automobile theft, except automobile theft rings or carjackings.
- Breaking and entering.
- Burglary.
- Minor theft (under $100,000).
- Minor fraud (under $100,000).

SUBMITTING EVIDENCE

Requesting Evidence Examinations

All requests for evidence examinations should be in writing, on agency letterhead, and addressed to the FBI Laboratory Evidence Management Program, unless otherwise indicated in the **Examinations** section.

Do not submit multiple cases under a single communication. Each case should be submitted with a separate communication and packaged separately.

All international law enforcement agency/police requests should be coordinated through the appropriate FBI legal attaché (LEGAT). LEGATs should fax the request to the Evidence Control Unit, 703-632-8334, prior to submitting any evidence to the Laboratory. Questions concerning international submissions should be directed to 703-632-8360.

Requests for evidence examinations must contain the following information:

- The submitting contact person's name, agency, address, and telephone number;
- Previous case-identification numbers, evidence submissions, and communications relating to the case;
- Description of the nature and the basic facts of the case as they pertain to evidence examinations;
- The name(s) of and descriptive data about the individual(s) involved (subject, suspect, victim, or a combination of those categories) and the agency-assigned, case-identification number;
- The violation;
- Reason for expedited examination, if requested;
- The name of the relevant prosecutor's office or prosecutor assigned, if available;
- A list of the evidence being submitted "herewith" (enclosed) or "under separate cover"
    - *Herewith* is limited to small items of evidence that are not endangered by transmitting in an envelope. Write on the envelope before placing evidence inside to avoid damaging or altering the evidence. The written communication should state: ***"Submitted herewith are the following items of evidence."***
    - Separate cover is used to ship numerous or bulky items of evidence. Include a copy of the communication requesting the examinations. The written communication should state: ***"Submitted under separate cover by [list the method of shipment] are the following items of evidence."***
- What type(s) of examination(s) is/are requested;
- Where the evidence should be returned and where the Laboratory report should be sent (a street address and phone number must be included); and
- A statement if there is local controversy or if other law enforcement agencies have an interest in the case.

Packaging and Shipping Evidence

Unless otherwise indicated in a specific Examination section, follow the below guidelines for packaging and shipping evidence. Please keep in mind the FBI case acceptance guidelines and limitations in the Introduction section.

- Prior to packaging and shipping evidence, call the pertinent unit for specific instructions.
- Take precautions to preserve the evidence.
- Wrap and seal each item of evidence separately to avoid contamination.
- Place the evidence in a clean, dry, and previously unused inner container.
- Seal the inner container with tamper-evident or filament tape.
- Affix EVIDENCE and BIOHAZARD labels, if appropriate, on the inner container. If any of the evidence needs to be examined for latent prints, affix a LATENT label on the inner container.
- Affix the evidence examination request and all case information between the inner and outer containers.
- Place the sealed inner container in a clean, dry, and previously unused outer container with clean packing materials. Do not use loose Styrofoam.
- Completely seal the outer container so that tampering with the container would be evident.
- All **shipments of suspected or confirmed hazardous materials** must comply with U.S. Department of Transportation and International Air Transport Association regulations. Title 49 of the Code of Federal Regulations (CFR) lists specific requirements that must be observed when preparing hazardous materials for shipment by air, land, or sea. In addition, the International Air Transport Association annually publishes Dangerous Goods Regulations detailing how to prepare and package shipments for air transportation.
- Title 49 CFR 172.101 provides a Hazardous Materials Table that identifies items considered hazardous for the purpose of transportation. Title 49 CFR 172.101 also addresses special provisions for certain materials, hazardous materials communications, emergency response information, and training requirements for shippers. A trained and qualified evidence technician must assist with the typing, labeling, packaging, and shipping of all hazardous materials.

Further information regarding shipping of Hazardous Materials or potential Chemical/Biological/Radiological/Nuclear (CBRN) Material can be found in WMD/CBRN Evidence Examinations.

- U.S. Department of Transportation regulations and the following guidelines must be followed when shipping live ammunition:
- Package and ship ammunition separately from firearm(s).
- The outside of the container must be labeled ***"ORM-D, CARTRIDGES, SMALL ARMS."***
- The Declaration of Dangerous Goods must include the number of packages and the gross weight in grams of the completed packages.

Unless otherwise indicated in the Examinations section, address the outer container as follows:

EVIDENCE MANAGEMENT PROGRAM
LABORATORY DIVISION
FEDERAL BUREAU OF INVESTIGATION
2501 INVESTIGATION PARKWAY
QUANTICO VA 22135

- Ship evidence by U.S. Postal Service Registered Mail, UPS, or FedEx.

EVIDENCE EXAMINATIONS

When submitting evidence for any of the following examinations and services, follow all instructions in the Introduction and Submitting Evidence sections of this Handbook in addition to any specific instructions provided in the examination and service descriptions.

Adhesive, Caulk, and Sealant Examinations

Adhesives, caulks, and sealants can be compared by color and chemical composition with suspected sources. The source and manufacturer of adhesives, caulks, and sealants cannot be determined by compositional analysis.

Questions concerning adhesive, caulk, and sealant evidence should be directed to 703-632-8441.

Collection and packaging considerations:

- When possible, submit the item to which the adhesive, caulk, or sealant is adhered. If this is not possible, remove a sample of the material with a clean, sharp instrument and transfer it to a resealable plastic bag or leakproof container such as a screw top vial or plastic pill box.
- Submit a suspected source. Package separately.

Advanced Photography

Highly skilled Scientific & Technical Photographers can provide detailed and accurate on-site documentation using oblique and vertical aerial photography (also see GIS Mapping and Aerial Photography), 360-degree spherical photography, 360-degree spherical video, and high-resolution imagery for special operations, crime scenes, and special events. All photographs can be geo-referenced, allowing imagery to be used by Visual Information Specialists to prepare crime scene diagrams, digitally interactive scenes, and scenario reconstructions (also see Demonstrative Evidence and Special Event and Situational Awareness Support).

Questions concerning advanced photography can be directed to your Field Photographer or be directed to 703-632-8194.

Age of Document Examination

The earliest date a document could have been prepared may be determined by examining various physical characteristics, including watermarks, indented writing, printing, typewriting, and inks.

Questions concerning age of document examinations should be directed to 703-632-8444.

Collection and packaging considerations:

- Documentary evidence must be preserved in the condition in which it was found. It must not be unnecessarily folded, torn, marked, soiled, stamped, or written on or handled excessively. Protect the evidence from inadvertent indented writing.
- Mark documents unobtrusively by writing the collector's initials, date, and other information in pencil.
- Whenever possible, submit the original evidence. The lack of detail in photocopies makes examinations difficult and often will result in inconclusive opinions.

Altered or Obliterated Writing Examinations

Documents can be examined for the presence of altered or obliterated writing, and the original writing may be deciphered.

Questions concerning altered or obliterated writing should be directed to 703-632-8444.

Collection and packaging considerations:

- Documentary evidence must be preserved in the condition in which it was found. It must not be unnecessarily folded, torn, marked, soiled, stamped, or written on or handled excessively. Protect the evidence from inadvertent indented writing.
- Mark documents unobtrusively by writing the collector's initials, date, and other information in pencil.
- Whenever possible, submit the original evidence. The lack of detail in photocopies makes examinations difficult and often will result in inconclusive opinions.

Anonymous Letter File

The Anonymous Letter File (ALF) contains images of anonymous and/or threatening communications submitted for examination. This file can be searched in an attempt to associate text from a communication in one case with text from communications in other cases.

Questions concerning the ALF should be directed to 703-632-8444.

Collection and packaging considerations:

- Documentary evidence must be preserved in the condition in which it was found. It must not be unnecessarily folded, torn, marked, soiled, stamped, or written on or handled excessively. Protect the evidence from inadvertent indented writing.
- Mark documents unobtrusively by writing the collector's initials, date, and other information in pencil.
- Whenever possible, submit the original evidence; however, photocopies are sufficient for reference file searches.

Anthropological Examinations

Anthropological examinations involve the analysis of skeletal remains (or potential skeletal remains). Examinations can result in the determination, interpretation, or estimation of:

- Whether material is skeletal (bone or tooth) versus some other material.
- Whether bones are human or nonhuman.
- Whether more than one individual is represented.
- Whether bones are modern or ancient.
- Biological information from certain bones (such as age, sex, ancestry, stature).
- Skeletal trauma type and timing (such as projectile, blunt, or sharp force trauma).
- Personal identification by comparison to known samples (such as medical records).
- Facial approximations, which are facilitated in conjunction with forensic imaging artists.

Forensic anthropologists are also available to assist in the detection and recovery of remains.

Questions concerning anthropological examinations should be directed to 703-632-8449. Case acceptance is based in part on the condition of the material; for cases with significant soft tissue remaining, please call 703-632-8449 for guidance prior to submission. In some cases, the determination of whether bones are human or nonhuman can be determined from submitted images (either by mail or by email). To submit images for analysis, please call 703-632-8449 for guidance.

Collection and packaging considerations:

- Collect bones (or small bone assemblages) individually in paper bags or other breathable material
- Tin foil may be formed around burned or very fragile bones.
- Sealed, plastic packaging may be acceptable for remains with fresh/wet tissue.
- As needed, include cold packs and/or 'BIOHAZARD' stickers.
- Minimize contact between bones and movement within the shipping container.
- If in doubt, please call for assistance.

Arson Examinations

Arson examinations can determine the presence of ignitable liquids introduced to a fire scene. Examinations of debris recovered from scenes can identify gasoline, fuel oils, and specialty solvents. Examinations generally cannot identify specific brands.

Questions concerning arson examinations should be directed to 703-632-7626.

Collection and packaging considerations:

- Search questioned arson scenes for candles, cigarettes, matchbooks, Molotov cocktails, fused chemical masses, or any electronic or mechanical devices an arsonist may have used.
- Search for burn trails on cloth or paper, burn trails on carpeted or hardwood floors, and the removal of personal property or commercial inventory.
- Ignitable liquids are volatile and easily lost through evaporation. Preserve evidence in airtight containers such as metal cans, glass jars, or heat-sealed plastic bags approved for fire debris. Do not fill containers to the top. Leave at least three inches of space between the evidence and top of the container. Pack to prevent breakage.

Bank Robbery Note File

The Bank Robbery Note File (BRNF) contains images of notes used in bank robberies. This file can be searched in an attempt to associate text from one bank robbery note with text from bank robbery notes in other cases. Digital submissions of demand notes for BRNF searches are accepted. FBI offices can attach the image(s) to their Electronic Communication/Lead Report via Sentinel. State and local law enforcement can submit the image(s) along with their request communication on agency letterhead to bankrobberysearch@ic.fbi.gov.

Questions concerning the BRNF should be directed to 703-632-8444.

Collection and packaging considerations:

- Documentary evidence must be preserved in the condition in which it was found. It must not be unnecessarily folded, torn, marked, soiled, stamped, or written on or handled excessively. Protect the evidence from inadvertent indented writing.
- Mark documents unobtrusively by writing the collector's initials, date, and other information in pencil
- Whenever possible, submit the original evidence; however, photocopies are sufficient for reference file searches.

Bank Security Dye Examinations

Bank dye packs contain dye to stain money and clothing and tear gas to disorient a robber. Items such as money and clothing can be analyzed for the presence of bank security dye and tear gas.

Questions concerning bank security dye evidence should be directed to 703-632-8441.

Collection and packaging considerations:

- Only evidence with visible red or pink stains will be examined.
- Do not submit large stained evidence (e.g., car seats). When possible, cut a small sample of the stained area and submit in a heat-sealed or resealable plastic bag.
- When cutting is not possible, transfer questioned stains by rubbing with a clean (dry or wet with alcohol) cotton swab. Use an unstained swab as a control. Air-dry the swab and pack in a heat-sealed or resealable plastic bag.
- Collect an unstained control sample, package separately, and submit it with the dye-stained evidence.

Biological Material Examination

The FBI Laboratory can provide expertise for conducting examinations on a variety of biological samples and related bioinformatic data. These examinations can assist in determination of such things as speciation, identification, relatedness, and designed genetic modifications. These examinations are conducted at FBI-designated partner laboratories. Examples of biological materials that can be examined include:

- Pathogenic microbes (including select agents).
- Non-pathogenic microbes.
- Animals.
- Plants.
- Insects.
- Biological toxins.
- Genetically modified organisms.
- Synthetically produced organisms or biological materials.

Questions regarding biological materials examinations should be directed to 703-632-7726. Call 703-632-7726 prior to submitting evidence.

Building Materials Examinations

Examinations can compare building materials such as brick, mortar, plaster, stucco, cement, and concrete.

Questions concerning building materials evidence should be directed to 703-632-8449.

Collection and packaging considerations:

- When building materials are penetrated or damaged, debris can adhere to people, clothing, tools, bags, and stolen items and can transfer to vehicles. If possible, submit the evidence to the Laboratory for examiners to remove the debris. Package each item in a separate leakproof container. Do not process tools for latent prints.

- Collect known samples from the penetrated or damaged areas.
- Ship known and questioned debris separately to avoid contamination. Submit known and questioned debris in leakproof containers such as film canisters or plastic pill bottles. Do not use paper or glass containers. Pack to keep lumps intact.

Bullet Examinations

A fired bullet can be examined to determine physical characteristics, including weight, caliber, bullet design, and general rifling characteristics (GRCs). GRCs are the number, width, and direction of twist of the rifling grooves imparted on a fired bullet by the barrel of a firearm. A microscopic examination of the bullet is conducted to determine if any marks of value are present.

If a suspect firearm is submitted, a direct microscopic comparison is done between test-fired bullets and the submitted questioned bullet.

If a suspect firearm is not submitted, the submitted fired bullets are intercompared to determine if they were fired from the same barrel. Using the GRC measurements, a search of the FBI Laboratory's GRC database will be conducted to produce a list of firearms that could have fired the bullet(s).

Questions concerning bullet examinations should be directed to 703-632-8442.

Collection and packaging considerations:

- Package bullets to prevent contact with other bullets.
- Bullets can be sent via Registered Mail through the U.S. Postal Service. Evidence must be packaged separately and identified by date, time, location, collector's name, case number, and evidence number.
- Do not mark bullets or other firearm-related evidence. The date, time, location, collector's name, case number, and evidence number must be on the container.
- Follow the U.S. Department of Transportation regulations if shipping live ammunition as listed in the Submitting Evidence section.

Bullet Jacket Alloy Examinations

Alloy classification can often differentiate among the bullet jacket alloys used by manufacturers to produce different varieties of bullets. As such, it can be used to exclude a bullet fragment as having originated from a particular type of ammunition. This analysis is most often helpful when attempting to determine which of a group of shooters may have fired a particular round at a crime scene when the fragment is too mutilated for direct comparison to a firearm.

Questions concerning bullet jacket alloy examinations should be directed to 703-632-8441.

Collection and packaging considerations:

- Ammunition components such as bullets and cartridge cases can be sent via Registered Mail through the U.S. Postal Service. Evidence must be packaged separately and identified by date, time, location, collector's name, case number, and evidence number.
- Do not mark bullets, cartridges, or cartridge cases. The date, time, location, collector's name, case number, and evidence number must be on the container.
- Follow the U.S. Department of Transportation regulations if shipping live ammunition as listed in the Submitting Evidence section.

Burned or Charred Paper Examinations

Burned or charred documents (not completely reduced to ash) may be deciphered and stabilized.

Questions concerning burned or charred paper examinations should be directed to 703-632-8444.

Collection and packaging considerations:

- The document must be shipped in the container in which it was burned, in polyester film encapsulation or between layers of cotton in a rigid container.
- The document must be handled minimally.
- Documentary evidence must be preserved in the condition in which it was found. It must not be unnecessarily folded, torn, marked, soiled, stamped, or written on or handled excessively. Protect the evidence from inadvertent indented writing.

Carbon-14 Examinations

Carbon-14 is a radioactive form of carbon. Produced naturally when cosmic rays interact with the earth's atmosphere, carbon-14 is absorbed within all living matter and absorption stops upon death. Carbon-14 examinations can be used to determine the age of a once-living item (e.g., plant, animal, human). Typically, age dating based on carbon-14 analysis can produce ages within a 4-year uncertainty for items younger than 60 years. These exams are conducted at an FBI-designated partner laboratory.

Questions concerning Carbon-14 examinations should be directed to 703-898-7186. Call 703-898-7186 prior to submitting evidence.

Carbon Paper or Carbon-Film Ribbon Examinations

Used carbon paper or a carbon-film ribbon, such as a typewriter or a facsimile ribbon, can be examined to disclose the content of the text.

Questions concerning carbon paper or carbon-film ribbon should be directed to 703-632-8444.

Collection and packaging considerations:

- Documentary evidence must be preserved in the condition in which it was found. It must not be unnecessarily folded, torn, marked, soiled, stamped, or written on or handled excessively. Protect the evidence from inadvertent indented writing.
- Mark documents unobtrusively by writing the collector's initials, date, and other information in pencil.

Cartridge Case and Shotshell Casing (Fired) Examinations

A fired cartridge case or shotshell casing can be examined to determine physical characteristics, including caliber types or gauge, manufacturer, presence/type/extent of mechanism marks, and other properties. A microscopic examination of the cartridge case/shotshell casing is conducted to determine if any marks of value are present.

If a suspect firearm is submitted, a direct microscopic comparison is done between the test-fired cartridge case/shotshell casing and the questioned cartridge case/shotshell casing.

If a suspect firearm is not submitted, the submitted fired cartridge cases/shotshell casings are intercompared to determine if they were fired from the same barrel.

Questions concerning fired cartridge case and shotshell casings should be directed to 703-632-8442.

Collection and packaging considerations:

- Cartridge cases and shotshell casings can be sent via Registered Mail through the U.S. Postal Service. Evidence must be packaged separately and identified by date, time, location, collector's name, case number, and evidence number.
- Do not mark cartridge cases, shotshell casings, or other firearm-related evidence. The date, time, location, collector's name, case number, and evidence number must be on the container.
- Follow the U.S. Department of Transportation regulations if shipping live ammunition as listed in the Submitting Evidence section.

Cartridge/Shotshell and Ammunition Component (Unfired) Examinations

An examination of the submitted ammunition component can determine the physical characteristics of that item. Using the FBI Laboratory's Reference Ammunition File (RAF) and other reference materials, a list may be produced of specific manufacturers, products, or calibers from which the components may have originated.

An examination of the submitted unfired cartridge or shotshell can determine physical characteristics, including caliber or gauge, manufacturer, and presence/type/extent of mechanism marks. A microscopic examination of the cartridge case or shotshell casing is conducted to determine if any marks of value are present. The cartridges or shotshells are intercompared to determine if they were loaded in and extracted from the same firearm.

Questions concerning ammunition component, cartridge or shotshell examinations should be directed to 703-632-8442.

Collection and packaging considerations:

- Follow the U.S. Department of Transportation regulations when shipping live ammunition as listed in the Submitting Evidence section.
- Do not mark cartridges and cartridge cases, shotshells and shotshell casings or other firearm-related evidence. The date, time, location, collector's name, case number, and evidence number must be on the container.

Checkwriters Examinations

Checkwriters, also known as check embossers, are devices used to prepare checks and money orders to make it difficult for anyone to alter the monetary amount for which a check was written. A checkwriter impression can be compared with a known source. Examining checkwriter impressions may determine the brand or model of the checkwriter.

Questions concerning checkwriters examinations should be directed to 703-632-8444.

Collection and packaging considerations:

- Documentary evidence must be preserved in the condition in which it was found. It must not be unnecessarily folded, torn, marked, soiled, stamped, or written on or handled excessively. Protect the evidence from inadvertent indented writing.
- Mark documents unobtrusively by writing the collector's initials, date, and other information in pencil.
- Whenever possible, submit the original evidence. The lack of detail in photocopies makes examinations difficult and often will result in inconclusive opinions.

Controlled Substance Examinations

Controlled substance examinations can establish trace drug presence, identity, and quantity.

Bulk Drugs. The FBI Laboratory limits the quantity of bulk drugs that it will analyze. Quantities exceeding 100 grams of suspected marijuana or 10 grams of all other suspected drugs including cocaine, methamphetamine, and heroin will be returned unanalyzed. The Laboratory usually only analyzes drugs seized in federal investigations.

Drug Residue. Requests for drug residue examinations on evidence will be accepted only when the evidence is properly packaged to avoid contamination.

Questions concerning controlled substance evidence should be directed to 703-632-8441. Call the Laboratory at 703-632-8441 prior to submitting drugs to ensure that the evidence will be accepted for examination. The communication accompanying the evidence must reference the telephone conversation accepting the evidence.

Collection and packaging considerations:

- Submit evidence in separate heat-sealed or resealable plastic bags.
- Fold clothing to preserve trace evidence.
- Do not submit used drug field-test kits with evidence.

Crime Scene Surveys, Documentation, and Reconstruction

Crime Scene Surveys produce a more accurate representation of a scene than a sketch. Documentation methods include hand measurements, total station surveys, and laser scanning. This data may be obtained either by field personnel or by a team of Visual Information Specialists. Field-collected data should be submitted with the EC requesting services. Data is used to prepare two- and three-dimensional digital diagrams and/or physical models. Reconstructions can include computer simulations and may depict bullet trajectory data, line-of-sight analysis, and vehicular, human, or object movement analysis.

Questions concerning crime scene surveys, documentation, and reconstruction should be directed to 703-632-8194.

Cryptanalysis Examinations

Cryptanalysis is commonly known as code breaking. A cryptanalysis examination seeks to identify and "reverse engineer" manual codes and ciphers used by inmates, gangs, terrorists, and other criminals to protect communications and/or conceal information. Decrypted material has revealed murder hits, weapons stashes, planned criminal and terrorist activity, and admissions of guilt.

Digital images of suspected codes and ciphers may be e-mailed to codebreakers@ic.fbi.gov for immediate analysis and decryption. Results for items submitted electronically are provided for intelligence and lead generation purposes only. If testimony is required, the items must be resubmitted through routine submission procedures.

Questions concerning cryptanalysis evidence should be directed to 703-632-7334 or 703-632-7356.

Collection and packaging considerations:

- Submission of original evidence is preferred; however, contributors may submit high-quality images or photocopies with prior authorization.

Demonstrative Evidence

Visual Information Specialists prepare a wide array of demonstrative evidence for investigative and prosecutorial purposes. These items include charts, maps, diagrams, illustrations, and animated and digitally interactive presentations.

Questions concerning demonstrative evidence should be directed to 703-632-8194.

DNA Casework Examinations

Deoxyribonucleic acid (DNA) is analyzed in body-fluid stains and other biological tissues recovered from items of evidence. The results of DNA testing on evidence samples are compared with the results of DNA analysis of reference samples collected from known individuals. Such analyses can associate victims and suspects with each other, with evidence items, or with a crime scene. The FBI conducts nuclear and mitochondrial DNA testing on evidence samples as appropriate for the type of evidence. The type of evidence may also lend itself to additional testing such as Y-STR analysis.

Nuclear DNA Examinations

Nuclear DNA (nDNA) is the most discriminating and is typically analyzed in evidence containing blood, semen, saliva, body tissue, and hairs that have tissue at their root ends. The power of nDNA testing lies in the ability to identify an individual as being the source of the DNA obtained from an evidence item, as well as the definitive power of exclusion.

Y-chromosome DNA can be analyzed in sexual assaults, missing persons, and intelligence cases. The Y chromosome is passed down from father to son in a complete set, which means that anyone in the paternal lineage will have the same Y-DNA profile. Because multiple relatives can have the same Y-DNA profile, unique identifications are not possible from Y-STR analysis. However, in missing person cases, a known sample from a suitable male relative may suffice for comparison purposes in those cases in which a reference sample from a male victim or subject is not available (see also NMPDD).

Where appropriate, the DNA-typing results from evidence items (including items related to missing persons) may be uploaded into the National DNA Index System (see also NDIS/CODIS).

Known reference sample(s) from subjects and victims for comparison with evidence materials are required. DNA profiles located in the National DNA Index System (NDIS) cannot be used as reference samples.

While the Laboratory accepts cases for serological and nDNA analysis, the Laboratory does not conduct serological tests for the conclusive identification of saliva, urine, feces, or sweat.

The FBI Laboratory typically does not conduct low-copy-number (LCN) or "touch DNA" examinations (e.g., DNA from fingerprints, pieces of paper, handled objects), although items such as steering wheels and firearms may be appropriate for analysis.

Kinship analysis may be performed for cases involving unidentified human remains, criminal paternity, and missing persons only and not for routine evidence analysis.

Questions concerning nuclear DNA examinations should be directed to 703-632-8446. Please call 703-632-8446 for information on submission of appropriate family reference samples, kinship, and paternity/maternity comparisons.

Mitochondrial DNA Examinations

Mitochondrial DNA (mtDNA) is typically analyzed in evidence containing naturally shed hairs, hair fragments, bones, and teeth. The high sensitivity of mtDNA analysis allows scientists to obtain information from old items of evidence associated with cold cases, samples from mass disasters, and small pieces of evidence containing little biological material.

Regardless of the type of biological evidence, mtDNA analysis generally will not be performed when nDNA results exist on items of similar origin; however, mtDNA analysis is an excellent technique to use for obtaining information when nDNA analysis is not feasible.

The maternal inheritance of mtDNA allows scientists to compare a mtDNA profile to reference samples from that person's mother, brother(s), sister(s), or any other maternally related individuals. Because multiple individuals can have the same mtDNA profile, unique identifications are not possible from mtDNA analysis.

If several similar probative hair specimens are submitted from one source of evidence, mtDNA will be performed on only 1-2 hairs. Known victim hair samples (of all types) must be submitted to determine whether evidence hairs are similar or dissimilar to the victim's hair. If evidence includes specimens dissimilar to the victim, known suspect hair samples (of all types) should be obtained.

Approximately 2 cm of an evidentiary hair is required to conduct a mtDNA analysis, and this amount is consumed during testing. Any evidentiary hair approximately 3 cm or smaller submitted to the FBI Laboratory or located during evidence processing will require written permission from the prosecuting attorney and/or the investigating agency to consume the sample prior to the FBI beginning the mtDNA testing of this item.

The mtDNA typing results related to missing person cases may be uploaded into the CODIS database (see also NDIS/CODIS and NMPDD).

Prior to mtDNA analysis involving unidentified human remains, bone or teeth specimens should be examined by a forensic anthropologist, odontologist, or similarly qualified individual. Submissions of such items should be accompanied by a written report verifying human origin by a qualified expert.

Questions concerning mitochondrial DNA examinations should be directed to 703-632-7572. State and local law enforcement must contact 703-632-7572 prior to submitting evidence.

Collection and packaging considerations for DNA:

- When DNA evidence is transferred by direct or indirect means, it remains on surfaces by absorption or adherence. In general, liquid biological evidence is absorbed into surfaces, and solid biological evidence adheres to surfaces. Collecting, packaging, and preserving DNA evidence depends on the liquid or solid state and the condition of the evidence.
- The more evidence retains its original integrity until it reaches the Laboratory, the greater the possibility of conducting useful examinations. It may be necessary to use a variety of techniques to collect suspected body-fluid evidence.
- A written request from the contributor for evidence testing should contain the following information, if possible:
- A brief statement of facts relating to the case,
- Whether animal blood could reasonably be present,
- Whether the stains were laundered or diluted with other body fluids,
- Information regarding the health of the victim(s) and suspect(s), including the presence of such infections as AIDS, hepatitis, and tuberculosis, and
- Whether any presumptive chemical tests for the presence of blood were performed on the evidence and a description of the tests performed.

Collecting DNA Known Reference Samples

- Blood:
  - Only qualified medical personnel should collect blood samples from a person.
  - Collect at least two 5-mL tubes of blood in purple-top (EDTA-containing) tubes for DNA analysis. Collect drug- or alcohol-testing samples in gray-top (sodium fluoride-containing) tubes.
  - Label each tube with the date, time, person's name, location, collector's name, case number, and evidence number.
  - Refrigerate, do not freeze, liquid blood samples (tubes may break if frozen). Use cold packs, not dry ice, during shipping.
  - Pack liquid blood tubes individually in Styrofoam or cylindrical tubes with absorbent material surrounding the tubes.
  - Package blood samples from different individuals separately.
  - Label the outer container, "KEEP IN A COOL DRY PLACE," "REFRIGERATE ON ARRIVAL", and "BIOHAZARD".
  - Submit to the Laboratory as soon as possible.
- Buccal (Oral) Swabs:
  - Use clean, sterile, cotton swabs to collect buccal (oral) samples. Rub the inside surfaces of the cheeks thoroughly.
  - Air-dry the swabs and place in clean paper or an envelope with sealed corners. Do not use plastic containers.
  - Identify each sample with the date, time, person's name, location, collector's name, case number, and evidence number.
  - Package buccal (oral) samples from different individuals separately.
  - Buccal (oral) samples do not need to be refrigerated.
  - Submit to the Laboratory as soon as possible.
  - If a reference blood or oral sample cannot be obtained, an alternate reference sample may be submitted (for nuclear examinations only). This may include such items as surgical samples, Pap smear slides, pulled teeth, toothbrush, or item of clothing known to be used solely by the individual of interest.

Collecting DNA Evidence with Blood

- Blood on a person:
  - Absorb suspected liquid blood onto a clean, sterile, cotton cloth or swab. Air-dry the cloth or swab and pack in clear paper or an envelope with sealed corners. Do not use plastic containers.
  - Absorb suspected dried blood onto a clean cotton cloth or swab moistened with sterile water. Air-dry the cloth or swab and pack in clean paper or an envelope with sealed corners. Do not use plastic containers.
- Blood on surfaces or in snow or water:
  - Absorb suspected liquid blood or blood clots onto a clean cotton cloth or swab. Air-dry the cloth or swab and pack in clean paper or an envelope with sealed corners. Do not use plastic containers.

  - Collect suspected blood in snow or water immediately to avoid further contamination. Eliminate as much snow as possible. Place in a clean, airtight container. Freeze the evidence and submit to the Laboratory as soon as possible.

- Bloodstains:
  - Air-dry suspected wet bloodstained garments. Wrap dried bloodstained garments in clean paper. Do not place wet or dried garments in plastic or airtight containers. Place all debris or residue from the garments in clean paper or an envelope with sealed corners.
  - Air-dry small suspected wet bloodstained objects and submit the objects to the Laboratory. Preserve bloodstain patterns. Avoid creating additional stain patterns during drying and packaging. Pack to prevent stain removal by abrasive action during shipping. Pack in clean paper. Do not use plastic containers.
  - When possible, cut a large sample of suspected bloodstains from immovable objects with a clean, sharp instrument. Pack to prevent stain removal by abrasive action during shipping. Pack in clean paper. Do not use plastic containers.
  - Absorb suspected dried bloodstains on immovable objects onto a clean cotton cloth or swab moistened with sterile water. Air-dry the cloth or swab and pack in clean paper or an envelope with sealed corners. Do not use plastic containers.

Collecting DNA Evidence with Semen

- Semen and semen stains:
  - Absorb suspected liquid semen onto a clean cotton cloth or swab. Air-dry the cloth or swab and pack in clean paper or an envelope with sealed corners. Do not use plastic containers.
  - Submit small suspected dry semen-stained objects to the Laboratory. Pack to prevent stain removal by abrasive action during shipping. Pack in clean paper. Do not use plastic containers
  - When possible, cut a large sample of suspected semen stains from immovable objects with a clean, sharp instrument. Pack to prevent stain removal by abrasive action during shipping. Pack in clean paper. Do not use plastic containers.
  - Absorb suspected dried semen stains on immovable objects onto a clean cotton cloth or swab moistened with sterile water. Air-dry the swab or cloth and place in clean paper or an envelope with sealed corners. Do not use plastic containers.
  - Note: It is not necessary to collect reference seminal fluid for comparison. Refer to the Collecting Known Reference Samples for more information.
- Seminal evidence from sexual assault victims:
  - Sexual assault victims must be medically examined in a hospital or a physician's office using a standard sexual assault evidence kit to collect vaginal, oral, and anal evidence.
  - Refrigerate and submit the evidence to the Laboratory as soon as possible.

Collecting DNA Evidence with Saliva, Urine, and Other Body Fluids

- Pick up cigarette butts with gloved hands or clean forceps. Do not submit ashes. Air-dry and place the cigarette butts from the same location (e.g., ashtray) in clean paper or an envelope with sealed corners. Do not submit the ashtray unless a latent print examination is requested. Package the ashtray separately. Do not use plastic containers.

- Pick up chewing gum with gloved hands or clean forceps. Air-dry and place in clean paper or an envelope with sealed corners. Do not use plastic containers.
- Pick up envelopes and stamps with gloved hands or clean forceps and place in a clean envelope. Do not use plastic containers.
- Absorb suspected liquid saliva or urine onto a clean cotton cloth or swab. Air-dry the cloth or swab and pack in clean paper or an envelope with sealed corners. Do not use plastic containers.
- Submit small suspected dry saliva- or urine-stained objects to the Laboratory. Pack to prevent stain removal by abrasive action during shipping. Pack in clean paper. Do not use plastic containers.
- When possible, cut a large sample of suspected saliva or urine stains from immovable objects with a clean, sharp instrument. Pack to prevent stain removal by abrasive action during shipping. Pack in clean paper. Do not use plastic containers.
- Note: No serological tests are currently available for the conclusive identification of saliva, urine, feces, or sweat.

Collecting DNA Evidence with Hair

- Pick up hair carefully with clean forceps to prevent damaging the root tissue.
- Air-dry hair mixed with suspected body fluids.
- Package each group of hair separately in clean paper or an envelope with sealed corners. Do not use plastic containers.
- Submit to the Laboratory as soon as possible.

Collecting DNA Evidence with Tissue, Bones, and Teeth

- Tissue:
  - Pick up suspected tissue with gloved hands or clean forceps.
  - Collect 1-2 cubic inches of red skeletal muscle.
  - Place tissue samples in a clean, airtight plastic container without formalin or formaldehyde.
  - Freeze the evidence, place in Styrofoam containers, and ship overnight on dry ice.
- Bones and teeth:
  - Pick up suspected bones and teeth with gloved hands and clean forceps.
  - Submit whole bones. Cutting bones increases the possibility of contamination.
  - Collect teeth in the following order of preference:
    1. Nonrestored (no dental work) molar.
    2. Nonrestored premolar.
    3. Nonrestored canine.
    4. Nonrestored front tooth.
    5. Restored molar.
    6. Restored premolar.

7. Restored canine.

8. Restored front tooth.

- Place teeth and bone samples in clear paper or an envelope with sealed corners.
- Bone and teeth evidence can remain at room temperature before shipping to the Laboratory for analysis.

Preserving DNA Evidence - Long Term Storage

- Blood/saliva (known reference samples):
  - Refrigerate, do not freeze, liquid blood samples.
  - Store all samples (refrigerated, frozen (if dried), or room temperature), away from light and humidity.
- Blood/semen (evidence samples):
  - Store all samples (refrigerated, frozen (if dried), or room temperature), away from light and humidity
- DNA tubes/tissue samples:
  - Store refrigerated or frozen if possible.
  - It is recommended that these samples be stored in a refrigerator/freezer and isolated from evidence that has not been examined.

Drug Records Examinations

A drug records examination may identify the type of drug(s) distributed and/or manufactured; details of the operational hierarchy, including suppliers and/or customers; weights and quantities associated with the activity; price structures and gross sales; and other pertinent information.

Questions concerning drug records examinations should be directed to 703-632-7334, or 703-632-7356.

Collection and packaging considerations:

- Submission of original evidence is preferred; however, contributors may submit high-quality images or photocopies with prior authorization.

Embossing and Seals Examinations

An embossed or seal impression can be compared with a known source. Submit the impression and the device to the Laboratory.

Questions concerning embossing and seals should be directed to 703-632-8444.

Collection and packaging considerations:

- Documentary evidence must be preserved in the condition in which it was found. It must not be unnecessarily folded, torn, marked, soiled, stamped, or written on or handled excessively. Protect the evidence from inadvertent indented writing.
- Mark documents unobtrusively by writing the collector's initials, date, and other information in pencil.
- Whenever possible, submit the original evidence. The lack of detail in photocopies makes examinations difficult and often will result in inconclusive opinions.

Evidence Response Team

Evidence Response Teams (ERTs) can provide assistance in evidence collection and management from traditional search warrants to complex crime scenes. ERTs are especially valuable on large or complicated scenes and cases that are multijurisdictional.

When legal authority and resources permit, ERTs may be requested to assist other agencies by processing crime scenes, conducting searches, and providing training courses and consultations. ERTs can coordinate with the FBI Laboratory on advanced forensic examinations.

The ERT Program offers:

- Evidence identification, collection, and preservation.
- Multiple crime scene coordination.
- Photography: basic, advanced, and latent print.
- Crime scene diagramming and scene surveys.
- On scene latent print detection, development, and collection.
- Impression evidence documentation and collection: footwear, tire track, and toolmark.
- DNA evidence collection.
- Blood detection, collection, and documentation.
- Forensic light source for latent prints, trace, body fluids, and chemical residue.
- Trace evidence collection.
- Explosive residue collection.
- Postblast scene management.
- Arson evidence documentation and collection.
- Human remains recovery, processing, and mapping.
- Digital evidence collection.
- Humanitarian and mass disaster assistance.
- Training on crime scene management and various forensic disciplines.

Specialty Programs:

Forensic Canine Program

- Human Scent Evidence Team
- Victim Recovery Team

Underwater Evidence Program

- Underwater Search Evidence Response Team (USERT)
- Technical Dive Team (TDT), which conducts evidence collection operations in contaminated and deep water environments.

Questions concerning the Evidence Response Team should be directed to 540-368-8200 or the ERT Senior Team Leader in your local FBI office.

Explosives Examinations

Evidence resulting from an apparent explosion and/or recovery of an explosive device can be examined. Examinations are based on the premise that components and accessories used to construct the devices survive the explosion, although disfigured. The examinations can accomplish the following:

- Identify the components used to construct the device, such as switches, batteries, detonators, tapes, wires, and fusing systems.
- Identify the explosive main charge.
- Determine the construction characteristics.
- Determine the manner in which the device functioned or was designed or intended to function.
- Determine the specific assembly techniques employed by the builder(s) of the device.
- Preserve the trace evidence potentially present in the devices so that it is not destroyed or damaged during the examinations.

Questions concerning explosives evidence should be directed to 703-632-7626. Call the Laboratory at 703-632-7626 each time an explosive device or a related explosive item needs to be shipped. The communication accompanying the evidence must reference the telephone conversation accepting the evidence.

Collection and packaging considerations:

- **Explosives are hazardous materials and must be handled only by qualified public safety personnel, military explosives ordnance disposal personnel, or certified bomb technicians**.
- **Special packaging is required**, and the amount to be shipped is regulated. An FD-861 form (Mail/Package Alert) is required for shipping bomb components to the FBI Laboratory.

Explosives Residue Examinations

Instrumental analyses of explosives residue can determine whether substances are high-explosive, low-explosive, or incendiary mixtures; whether the composition of the substances is consistent with known explosives products; and the type of explosives. Explosives residue can be deposited on metal, plastic, wood, paper, glass, cloth, and other surfaces. Residue may be deposited after handling, storing, or initiating an explosive.

Questions concerning explosives residue evidence should be directed to 703-632-7626.

Collection and packaging considerations:

- Some explosives residue is water soluble and must be protected from moisture. Other residue evaporates quickly and must be collected as soon as possible in airtight containers such as metal cans, glass jars, or heat-sealed or resealable nylon or Mylar bags. Do not fill containers to the top. Leave a minimum of three inches between packaged evidence and the top of the container. Pack to prevent breakage. Ziplock storage bags are not suitable for shipping or storing explosives residue evidence.
- Collect and preserve control samples from the blast site.
- Extreme care must be taken to avoid contaminating explosives residue evidence.

- Never store or ship explosives residue evidence with bulk explosive materials.
- Never store or ship explosives residue evidence from a crime scene with evidence from a search site.

Fabric Examinations

Fabric portions can be compared to determine if they physically match or exhibit the same construction and fiber composition. Fabric examinations can also determine whether a fabric has been damaged, the type of damage (e.g., cut, torn, punctured), and may determine the type of implement used. Impressions from fabric may be compared to known fabrics.

Questions concerning fabric evidence should be directed to 703-632-8449.

Collection and packaging considerations:

- When possible, submit the entire item of evidence.
- Examination-quality photographs, casts, and/or lifts of fabric impressions may be submitted when the substrate cannot be submitted.

FBI Disaster Squad

The FBI Disaster Squad consists of highly trained specialists from the FBI Laboratory Division. Upon official request, Disaster Squad assets are deployed to assist in the identification of casualties/victims through friction ridge analysis (fingerprints, palm prints, and footprints) at mass fatality incidents worldwide. Disaster Squad personnel use specialized postmortem fingerprint recovery techniques and equipment, including remote automated fingerprint search capabilities, to ensure precise and efficient forensic identification operations. The Disaster Squad also assists in printing the deceased at disaster scenes, collecting antemortem fingerprints of victims, and identifying friction ridge skin of the deceased.

Deployment of the FBI Disaster Squad requires consent from the disaster scene medical examiner or coroner, a ranking law enforcement or government official, a representative of the National Transportation Safety Board, or a representative of the U.S. Department of State. Requests for assistance must be made through the nearest FBI field office or the FBI's Strategic Information and Operations Center at **202-323-3300.**

Questions concerning the FBI Disaster Squad or postmortem fingerprint recovery techniques should be directed to 703-632-8443.

Feather Examinations

Feather examinations can determine bird species and can compare feathers found on clothing, vehicles, and other objects with feathers from the crime scene.

Questions concerning feather evidence should be directed to 703-632-8449.

Collection and packaging considerations:

- Submit feathers in heat-sealed or resealable plastic bags or paper bags.

Federal DNA Database (formerly Federal Convicted Offender) Examinations

The FBI Laboratory produces DNA profiles from buccal samples submitted by federal arresting and corrections agencies for comparison to DNA profiles from crime scene samples in the National DNA Index System (see also NDIS/CODIS).

DNA collection kits are provided at no charge to collection agencies, including Bureau of Prisons; federal probation districts; Court Services and Offender Supervision Agency, Washington, DC; and any federal agency that makes federal arrests or detains non-U.S. persons on immigration charges and is required by law to submit DNA samples.

- Samples from the following will be accepted:
  - Individuals identified in 42 U.S.C. 14135 (a)(1)(a).
  - Individuals required to register in a sex offender registry identified in the Sexual Offender Registration and Notification Act (SORNA).
- In accordance with Department of Justice legal direction, the following will **not** be accepted:
  - Samples given voluntarily by individuals not identified in 42 U.S.C. 14135 (a)(1)(a).
  - Samples used as reference specimens in criminal cases.

Questions concerning the Federal DNA Database should be directed to 703-632-7529. Current information on the Federal DNA Database is located at http://www.fbi.gov/about-us/lab/biometric-analysis/federal-dna-database.

Collection and packaging considerations:

- A Request for National DNA Database Entry form (FD-936) must be submitted. When filling out the FD-936, use blue or black ink and write legibly or use a typewriter.
- Thoroughly complete the "Agency Contact Information" area on the FD-936. A sticker with the appropriate information is acceptable as long as it does not impede the box marked "For Official Use Only."
- At least one unique identifying number (Social Security Number, BOP Number, FBI Number, Alien number) for the subject must be present on the FD-936.
- Legible fingerprints must be present on the FD-936 and the fingerprint collector must sign at the bottom of the FD-936. Be sure that the appropriate index finger is printed in the assigned box.
- The offender's name written on the FD-936 must match that written on the FTA cards contained in the blue buccal collection devices.
- FD-936 forms have a barcode to match the barcode on the buccal collection devices in the kit. Because of this, FD-936 forms cannot be intermixed between buccal collection kits.
- Remember that the tamper evident seal should be secured by removing the backing and sealing it evenly. Do not moisten the envelope seal with saliva to close.
- Once the seal is closed, the kit should not be reopened. If the collector must open the kit after sealing, tape over the seal, and initial and date over the new seal.

Federal DNA Database Buccal DNA Collection Kit

- Complete instructions for the use of the Buccal DNA Collection Kits are located on the back of the FD-936 form. A separate sheet of paper directing proper sampling procedure is also included in the kit.
- When collecting a sample using the Buccal DNA Collection Kit:
  - Wear the gloves provided in the kit.
  - Using the fingerprint ink strip provided in the kit, ink the left and right index fingers of the individual and roll the appropriate index finger in the assigned box on the FD-936, starting with the inward edge of the finger and rolling away from the body.
  - Legibly write the offender's name on both of the FTA cards in the designated space.

- Swab one cheek for 15 seconds and then with the other collection device, swab the other cheek for 15 seconds. Remove the plastic covering over the sample collection card and press the swab onto the card for at least 10 seconds and then move the device into its resting position.
- Allow the samples to dry for 5 minutes.
- Individually, place each of the collection devices containing the sample card into the white envelopes provided in the kit.
- Place the white envelopes containing the collection devices and the FD-936 in the self-addressed envelope provided in the kit, seal it, and return this envelope via prepaid First Class Business Reply Mail.

Fiber Examinations

Fiber examinations can determine the type of fiber (e.g., carpet-type, wig-type, wool, cotton, acrylic). Questioned fibers can be compared to fibers from clothing, carpeting, and other textiles.

Questions concerning fiber evidence should be directed to 703-632-8449.

Collection and packaging considerations:

- When possible, submit the entire garment or textile.
- Submit fibers in a sealed paperfold or envelope as the inner packaging.

Firearms Examinations

A firearm function examination can determine if the firearm operates in the manner in which it was designed by the manufacturer or whether any modifications have been made. Additionally, firearms can be test fired to obtain known specimens for comparison with evidence ammunition, such as bullets, cartridge cases, and shotshell casings. When specifically requested by the contributor or when an examiner determines it to be probative, accidental discharge, ejection pattern, and silencer testing may be conducted.

An examination of the submitted firearm component can determine the physical characteristics of that item. Using the FBI Laboratory's Reference Firearms Collection (RFC) and other reference material, a list may be compiled of manufacturers, models, or calibers from which the components may have originated.

When specifically requested by the contributor, a serial number restoration is conducted on the obliterated or suspect areas on a submitted firearm or firearm component. Depending on the type of metal surface, a thermal or chemical method along with specialized techniques is used to assist in restoring and visualizing an obliterated stamping.

Questions concerning firearms examinations should be directed to 703-632-8442.

Collection and packaging considerations:

- All firearms must be unloaded.
- The firearm should be submitted, if collected. If the firearm cannot be submitted, call **703-632-8442** for instructions.
- The firearm must be handled minimally to avoid loss or destruction of evidence. Do not allow objects to enter or contact the firearm's barrel, chamber, or other operating surface.
- Firearms can be sent via Registered Mail through the U.S. Postal Service. Evidence must be packaged separately and identified by date, time, location, collector's name, case number, and evidence number.

- Do not mark the firearm. Firearms must be identified with a tag containing the caliber, make, model, and serial number. The date, time, name(s) of the owner(s), location, collector's name, case number, and evidence number must be written on the container.

Firearms Image Examinations

When specifically requested by the contributor, photographic images produced by the FBI's Operational Technology Division (OTD), Forensic Audio, Video, and Image Analysis Unit (FAVIAU) will be evaluated to determine the physical characteristics of suspect firearms or firearm-related items depicted in the images. The observed physical characteristics of the questioned items are compared to reference firearms or other information sources to determine if they are consistent. An association conclusion can be reached if observable physical characteristics are present and in agreement with a particular make and/or model of firearm.

Questions concerning firearms image examinations should be directed to 703-632-8442.

Forensic Facial Imaging

Facial composite drawings from eyewitness accounts can be prepared. Interviews required to prepare composite drawings may be conducted either by having a Visual Information Specialist (VIS) travel to the field or by using video teleconferencing.

Facial images can be age progressed or regressed.

Postmortem facial images can be enhanced for public viewing.

Questions concerning forensic facial imaging should be directed to 703-632-8212. Please call 703-632-8212 prior to submitting for information and submission requirements.

- For information on facial approximations (2D & 3D) from skeletal remains, please see Anthropological Examinations.
- Facial comparisons between known and questioned subjects are conducted by the FBI's Operational Technology Division (OTD), Digital Evidence Laboratory, Forensic Audio, Video, and Image Analysis Unit (FAVIAU). OTD has specific case acceptance criteria. Please contact 703-985-1393 for information on facial comparisons.

Gambling Device Examinations

A gambling device examination seeks to determine whether a particular device is a gambling machine based on analysis of the three principal characteristics associated with such devices—consideration, chance, and reward.

Questions concerning gambling device evidence should be directed to 703-632-7334 or 703-632-7356.

Gambling Records Examinations

A gambling records examination may identify activity associated with sports bookmaking, illegal lottery/numbers, illegal gambling machines, and/or internet gambling operations—such as the number and roles of participants, gambling revenues, and other pertinent information.

Questions concerning gambling records evidence should be directed to 703-632-7334 or 703-632-7356.

Collection and packaging considerations:

- Submission of original evidence is preferred; however, contributors may submit high-quality images or photocopies with prior authorization.

GIS Mapping and Aerial Photography

Up-to-date, high-resolution aerial imagery, oblique imagery, and mapping products can assist in crime scene documentation, tactical planning, special event mapping, construction planning and documentation, and geospatial intelligence (GEOINT) products.

Vertical photographs are taken by specially modified aircraft. Collected imagery is capable of a ground resolution measurement of 4 inches or less. The vertical aerials are georeferenced on capture and orthorectified in processing. This makes it possible to use the images in a Geographic Information System (GIS) for distance/area measurements, latitude/longitude location, and area-of-interest visualization. With GIS, the vertical imagery can be enhanced further with infrastructure data and intelligence information. Analysis of imagery and geospatial information can help visually depict geographically referenced activities on the earth. Spatial relationships are easier to understand with visual aids produced from the analysis.

Oblique photographs are taken at an angle to the surface of the earth from a plane or a helicopter. They can capture the topography of the land, sides of structures, and help give a better perception of the area. Points of interest can be captured in a rotational pattern for a 360-degree view.

Questions concerning GIS Mapping and Aerial Photography should be directed to 703-632-8194. Coordination is done with the GEOINT Program in the FBI's Intelligence Services Branch, Strategic Services Support Section, Standards and Practices Unit as needed on mapping requests.

Glass Examinations

Glass comparison examinations can determine whether particles of glass could have originated from a broken source of glass. Glass fracture examinations can determine the direction and type of the breaking force and the sequencing of blows which contributed to the glass fractures. When two pieces of glass fracture fit together, they were once part of the same object.

Questions concerning glass evidence should be directed to 703-632-8449.

Collection and packaging considerations:

Comparison Examinations

- Do not process evidence for latent prints.
- Submit samples of glass from each broken window or source in leakproof containers such as film canisters or plastic pill bottles. Do not use paper or glass containers.
- Submit samples of laminated glass (e.g., windshield) from each side of the glass. Label the samples "INSIDE" and "OUTSIDE" and package separately in leakproof containers such as film canisters or plastic pill bottles. Do not use paper or glass containers.
- Submit the air-dried clothing of the victim(s) and suspect(s). Package each item separately in a paper bag.
- Search for particles in the hair, skin, and wounds of the victim(s) and suspect(s). Submit particles in leakproof containers such as film canisters or plastic pill bottles. Do not use paper or glass containers.
- Search for particles in vehicles by vacuuming each section of the vehicle separately. Do not use tape for recovering glass particles. Submit vacuum sweepings in leakproof containers. Do not use paper or glass containers.
- Ship known samples and questioned debris separately to avoid contamination.

Fracture Examinations

- Do not process evidence for latent prints.
- Label the sides of the glass in the frame ("INSIDE" and "OUTSIDE"). Label the glass where it was removed in the frame ("TOP," "BOTTOM," "LEFT," and "RIGHT").
- Submit all glass pieces so that the pieces can be fit together to identify the radial cracks near and at the point(s) of impact and to increase the probability of matching edges. Pack all glass separately and securely to avoid shifting and breaking during shipping.
- Submit the entire piece of laminated glass, if possible. Secure the glass between sheets of plywood or sturdy cardboard. Do not place any objects into the impact area.

Graphic Arts (Commercial and Office Printing) Examinations

Printed documents can be associated with a common source or identified with known commercial printing paraphernalia such as artwork, negatives, and plates or office printing devices such as ink-jet or laser printers.

Questions concerning graphic arts examinations should be directed to 703-632-8444.

Collection and packaging considerations:

- Documentary evidence must be preserved in the condition in which it was found. It must not be unnecessarily folded, torn, marked, soiled, stamped, or written on or handled excessively. Protect the evidence from inadvertent indented writing.
- Mark documents unobtrusively by writing the collector's initials, date, and other information in pencil.
- Whenever possible, submit the original evidence. The lack of detail in photocopies makes examinations difficult and often will result in inconclusive opinions.
- Do not store or ship photocopies in plastic envelopes.

Hair Examinations

Hair examinations can determine whether hairs are animal or human. Characteristics of race, body area, damage, decomposition, alteration (e.g., bleaching, dyeing), and whether a hair has been forcibly removed or naturally shed can be determined through human hair analysis. Comparisons of the microscopic characteristics in hairs can determine if a person can be included as a possible source of a questioned hair but cannot provide personal identification. Human hairs that are determined by the examiner to be probative and suitable for additional testing may also be submitted for mitochondrial DNA analysis.

Animal hair examinations can determine the type of animal (e.g., cat, dog) and whether or not an animal can be included as a possible source of a questioned hair. Animal hairs do not typically possess sufficient characteristics to distinguish between members of similar breed and color.

Questions concerning hair evidence should be directed to 703-632-8449.

Collection and packaging considerations:

- Known human hair samples should consist of at least 25 combed and pulled hairs from all parts of the head and/or pubic region.
- Hair samples from different body areas should be packaged separately.
- Combed hairs should be collected first and packaged separately from pulled hairs.

- Known animal hair samples should consist of at least 50 hairs combed from all parts of the animal.
- Submit hairs in a sealed paperfold or envelope as the inner packaging and label to include the date of collection.

Handwriting and Hand Printing Examinations

The examination and comparison of handwriting characteristics can determine the origin or authenticity of questioned writing, although not all handwriting is identifiable with a specific writer. Intent and such traits as age, sex, and personality cannot be determined from handwriting examinations.

There are three common types of nongenuine signatures. Traced signatures are prepared by directly using a genuine signature as a template or pattern. Simulated signatures are prepared by copying or drawing a genuine signature. Freehand signatures are written in the forger's normal handwriting with no attempt to copy another's writing style; therefore, it may be possible to identify the writer(s) who prepared the signature(s) of this type.

Questions concerning handwriting and hand printing examinations should be directed to 703-632-8444.

Collection and packaging considerations:

- Documentary evidence must be preserved in the condition in which it was found. It must not be unnecessarily folded, torn, marked, soiled, stamped, or written on or handled excessively. Protect the evidence from inadvertent indented writing.
- Mark documents unobtrusively by writing the collector's initials, date, and other information in pencil.
- Whenever possible, submit the original evidence. The lack of detail in photocopies makes examinations difficult and often will result in qualified or inconclusive opinions.

Procedure for obtaining known writing exemplars

- Text, size of paper, space available for writing, writing instrument, and writing style (handwriting or hand printing) must be as close to the original writing as possible.
- Give verbal or typewritten instructions concerning the text to be written. Do not give instructions on spelling, punctuation, or arrangement of writing.
- All exemplars must be on separate pieces of paper.
- The writer and witness must initial and date each page of writing.
- Do not allow the writer to see the previous exemplars or the questioned writing. Remove each exemplar from the writer's sight as soon as it is completed.
- Numerous repetitions may be necessary to obtain naturally prepared writing.
- Obtain exemplars from the right and left hands.
- Obtain hand printing exemplars in upper- and lowercase letters.
- Obtain sufficient quantity of exemplars to account for natural variation in the writing.
- Obtain undictated writing such as business records, personal correspondence, cancelled checks, or other documents prepared during the normal course of business activity.

Human Smuggling Records Examinations

An examination of human smuggling records may identify details of the operational hierarchy, including the number and roles of participants as well as customer information; origin and destination locations; means of transportation; price structures and related revenues; and other pertinent information.

Questions concerning human smuggling records evidence should be directed to 703-632-7334 or 703-632-7356.

Collection and packaging considerations:

- Submission of original evidence is preferred; however, contributors may submit high-quality images or photocopies with prior authorization.

Ink Examinations

Examining inked writing in conjunction with other techniques (e.g., handwriting analysis, watermark identification) can provide details regarding document preparation. The composition of writing inks varies with the type of writing instrument (e.g., ballpoint pen, fountain pen, porous-tip pen) and the date of the ink manufacture. In general, inks are composed of dyes in solvents and other materials that impart selected characteristics. Ink analysis usually is limited to comparisons of the organic dye components. Examinations cannot determine how long ink has been on a document.

Questions concerning ink evidence should be directed to 703-632-8441.

Collection and packaging considerations:

- Pack ink evidence separately from any document or surface with ink marks.

Laboratory Shooting Reconstruction Team

The Laboratory Shooting Reconstruction Team (LSRT) performs Shooting Incident Reconstruction (SIR). LSRT can provide on-scene analysis and documentation of potential bullet holes and bullet impacts to assess and determine whether there are bullet trajectories that can provide information regarding the number of shots fired and the direction from which they originated. Additionally, gunshot residue within a vehicle may be detected through chemical processing of a surface (e.g., headrest, headliner, vehicle interior, windshield) that is suspected of having been in close proximity to a firearm discharge. Detecting and preserving patterns of gunshot residue can provide a basis for estimating muzzle-to-target distances.

Questions concerning the LSRT should be directed to 540-368-8200.

Latent Print (Friction Ridge) Examinations

A latent print is an impression that can be left when a person touches an object with the unique friction skin of their hands or feet. Physical items and latent lifts can be examined for the presence or detection of latent prints. Detected latent prints then can be compared to the known prints of an individual, to other latent prints, or searched through a computer database. Latent prints can be used to identify a specific individual as having touched an object or surface. It is also possible to exclude individuals as being the source of a particular latent print. The fingers and hands of an unknown deceased individual can also be examined in order to provide a positive identification.

Questions concerning latent prints should be directed to 703-632-8443. Because of the increasing casework demands of the FBI's mission, acceptance of any state and local cases generally will be based on the submitting agency's lack of access to the same techniques or services provided by the FBI Laboratory, the unusual technical nature of the case, or other circumstances.

Collection and packaging considerations:

Latent print evidence

- A latent print can potentially be developed on virtually any type of surface, with a greater likelihood on porous items, such as paper, and smooth, nonporous items made of plastic, metal, or glass; any item suspected of being handled should be submitted to the Laboratory for examination.
- Gloves should always be worn when items are being handled to eliminate the deposition of latent prints by the handler.
- Porous items can be submitted together, but can also be separated based on investigative or administrative requirements.
  - Porous items can be submitted in paper or plastic containers.
- Nonporous items need to be packaged individually and in a manner that restricts movement of the item within the packaging, for example:
  - Heat-sealable plastic bags, sealed around the item.
  - Shipping boxes utilizing zip ties to secure the item from moving.
- Nonporous items being submitted for latent print examinations only may be processed by cyanoacrylate (superglue) fuming by trained personnel prior to packaging and shipping to the Laboratory.
- No other processing should be performed on items that will be shipped to the Laboratory for latent print examination.
- Items that cannot be submitted to the Laboratory for latent print examinations due to their size or other investigative or administrative reasons should be processed in place by trained personnel, using approved methods. (Refer to The Processing Guide for Developing Latent Prints, http://www.fbi.gov/hq/lab/fsc/backissu/jan2001/lpu.pdf) In these instances, photographs of all friction ridge detail developed may be submitted, and if fingerprint powders are used, lifts may be taken and submitted.
- Any time evidence is submitted to the Laboratory for latent print examination and photographs have been taken of any latent prints on the items being submitted, the photographs must also be submitted.

Capturing latent print impressions/latent print photography

- Questions concerning latent print photography should be directed to **703-632-8135**. The publication Latent Impression Photography is available in PDF format upon request.
- A professional 12 MP (or higher) digital camera or 35 mm film camera body should be used. Use a macro lens with at least half-size capability. Use a tripod and a cable/electronic release to avoid vibration of the camera.
- RAW uncompressed, RAW lossless compression, TIFF lossless compression, and JPEG 2000 with additional documentation of no compression or lossless compression are the only acceptable file formats. Standard JPEG file format is not acceptable.
- Set the ISO to 400 ISO and select the proper White balance to capture the item in its correct color. The White balance selection is controlled by the lighting condition (daylight or tungsten lighting).
- Select either Aperture Priority or Manual mode to control depth of field. To obtain maximum depth of field and sharpness, select the f/stop setting that is two stops from the smallest f/stop setting.

- Determine the correct shutter speed setting through the camera's exposure system. Please note that over- or underexposure may be required to obtain maximum detail. Consideration of the reflectivity of the surface should be evaluated to determine the proper exposure.
- Evenly illuminate the surface of the latent print to provide maximum contrast using either an electronic flash or a floodlight.
- Adjust the focus of the macro lens in manual mode.
- Include required information (e.g., reference number, date, collector's initials) and a scale in each photograph. A metric scale is preferred and the scale must be on the same plane as the print.
- Fill the viewfinder with the latent print and scale in landscape orientation to get the highest resolution. The minimum acceptable resolution is 1000 ppi when calibrated to actual size.
- With multiple prints located together, photograph the prints collectively then, depending on the area of capture, it may be necessary to get closer to photograph each print separately to increase resolution.
- To determine the maximum area of capture for covering multiple prints or palm prints, divide the amount of horizontal and vertical pixels on the camera sensor by 1,000. For example, for a 12 MP sensor the pixel resolution is 4256 x 2832. This equates to a maximum area of capture of 4.256" x 2.832" or 108 mm x 71 mm.
- The proper sequence is to first photograph the visible impressions, then photograph after each sequential developmental process.
- Copy the image files from the camera storage media to a CPU hard drive, CD, or DVD and verify images were successfully saved before deleting from camera. Best practice when burning to CD or DVD is to make at least two copies marked as "original/master," stored separately. If possible, create two additional copies marked "original/master working copy," for viewing, processing, and printing.

Latent print images in digital format

- Digital images should include a scale or other measurable item. If a search of the FBI's friction ridge print database is requested, a scale or other measurable item is mandatory.
- Digital images, including digital photographs, must meet the following requirements:
  - Documentation of the image source (e.g., window, door frame)
  - Documentation of the capture device (e.g., flatbed scanner, digital camera)
  - Documentation indicating the image is an original capture
  - File properties for latent images:
  - A file format without compression or with lossless compression (e.g., RAW, TIFF, JPEG 2000 with appropriate documentation)
  - A minimum of 8 bits for grayscale images and 24 bits for color images
  - A resolution that meets or exceeds 1000 ppi when calibrated to actual size (1:1)
- Latent prints submitted as facsimiles or photocopies will not be examined in the FBI Laboratory.

Known or intentionally recorded prints (e.g., 10-print cards, palm print card, driver's license print(s), prints recorded on checks)

- Submit intentionally recorded prints of everyone who may have handled the evidence, including suspects, victims, those who had legitimate access, and investigative personnel. All fingerprint cards must include pertinent biographic and/or demographic information.

- Known prints should include, at a minimum, the name and signature of the person printed, the name and signature of the person who recorded the prints, and the date the prints were recorded.
- Only one side of a card should be used to record prints.
- When known recorded prints are submitted separately from evidence, reference previous communications and case-identifying numbers and other pertinent information.
- Nonoriginal (photocopy, digital printout) copies of intentionally recorded prints can be submitted; however, a determination of suitability for comparison will be made upon receipt.
- Intentionally recorded prints submitted as facsimiles will not be examined in the FBI Laboratory, except when:
- the known prints will be searched against the FBI's friction ridge print database in order to obtain FBI file prints, or
- the prints will be manually compared against other known prints.
- *Hands or Fingers of Unknown Deceased*
- Pack each hand or finger in a separate, unbreakable, watertight, and airtight container.
- Label each container as appropriate (e.g., "RIGHT HAND," "RIGHT THUMB," "RIGHT INDEX").
- Ship the remains in the condition in which they were found (e.g., in water, frozen, dried) and by the most expeditious means.
- Provide a complete physical description of the deceased, if possible.
- Label the outer container "KEEP IN A COOL, DRY PLACE," "REFRIGERATE ON ARRIVAL," and "BIOHAZARD."
- All human remains will be returned to the contributor.

Loan Records Examinations

Commonly known as loan sharking, an examination of usurious/extortionate loan records may identify the number and type of loans, amounts loaned to borrowers, amounts of interest and/or principal repaid, annualized interest rates, and other pertinent information.

Questions concerning loan records evidence should be directed to 703-632-7334 or 703-632-7356.

Collection and packaging considerations:

- Submission of original evidence is preferred; however, contributors may submit high-quality images or photocopies with prior authorization.

Lubricant Examinations

Lubricants encompass a range of substances, including petroleum products, natural fatty ester oils, and polyalkylene glycol oils. Automotive fluids (e.g., engine oil, brake fluid), certain cosmetics (e.g., bath oils, lotions), and some polishes contain lubricants. Lubricant examinations may also be conducted in sexual assault, vehicular homicide, or heavy-equipment sabotage cases.

Questions concerning lubricant evidence should be directed to 703-632-8441.

Collection and packaging considerations:

- Submit entire items (e.g., clothing) when possible. Air-dry the evidence and package separately in paper bags.
- Absorb suspected lubricants onto a clean cotton cloth or swab. Leave a portion of the cloth or swab unstained as a control. Air-dry the swab and pack in a heat-sealed or resealable plastic bag.
- Submit suspected sources of lubricants for comparison examinations.
- Package lubricants separately in leakproof containers.

Metallurgy Examinations

Comparisons. Comparative examinations can determine whether two metals or metallic objects may have come from the same source or from each other. Metal comparisons can identify various surface and microstructural characteristics—including fractured areas, accidental damage, and fabrication marks—to determine whether the objects share a common origin. Moreover, the manufacturing methods used to produce an object can be determined. These manufacturing techniques can include casting, forging, hot and cold rolling, extrusion, drawing, swaging, milling, grinding, spinning, blanking, ironing, deep drawing, and others. Examinations can determine mechanical properties, such as the response of a metal to an applied force or load. Examinations also can determine chemical composition, including alloying and trace elements.

Broken or Mechanically Damaged Metal. The causes of failure or damage—such as the application of stress exceeding the tensile strength or yield limit of the metal; a material or manufacturing defect; or corrosion, cracking, or excessive service usage (fatigue)—can be determined. The magnitude of the force or load that caused the failure, how the force or load was transmitted to the metal, and the direction it was transmitted also can be determined.

Burned, Heated, or Melted Metal. Examinations can determine the approximate temperature to which a metal was exposed, the nature of the heat source, and whether a metal was in an electrical short-circuit situation.

Cut or Severed Metal. Examinations can determine the method by which a metal was severed, such as sawing, shearing, milling, turning, or thermal cutting. The nature of the thermal source (e.g., burner bar, electric arc welder) used can sometimes be determined.

Metal Fragments. Examinations can determine how metal fragments were formed. If fragments were formed by impulsive (short-duration, high strain rate) loading, an examination can determine whether an explosive was detonated and the magnitude of the detonation velocity. The nature of the object that was the source of the fragments often can be determined as well.

Specification Fraud and Noncompliant Materials. Metallurgical testing of materials can determine whether inferior components were substituted in contracting frauds. The composition and mechanical properties of materials can be examined to determine if the components meet contractual obligations or appropriate regulatory codes. Precious-metal content also can be determined.

Lamp Bulbs. Examinations can determine whether a lamp bulb was incandescent when its glass envelope was broken. Determinations also can be made as to whether a lamp bulb was incandescent when it was subjected to an impact force such as a vehicular collision. Such determinations can be made even if the glass was broken by the impact.

Watches, Clocks, and Timers. The conditions causing a watch, clock, timer, or other mechanism to stop or malfunction and whether the time displayed represents a.m. or p.m. (calendar-type timing mechanisms only) can be determined. The on/off condition of appliance timers damaged by a fire or explosion often can be determined.

Objects with Questioned Internal Components. X-ray radiography can nondestructively reveal the interior construction and the presence or absence of defects, cavities, or foreign materials. The position of on/off switches and other mechanical components can be determined.

Questions concerning metallurgy evidence, including appropriate packaging, should be directed to 703-632-8441.

Muzzle-to-Target Distance Determination

Gunshot Residue Pattern. The deposition of gunshot residue on evidence such as clothing items, furniture, bedding, and wallboard varies with the distance from the muzzle of a firearm to the target. When reproducing residue patterns detected on evidentiary items, the suspect firearm and ammunition similar to the suspect ammunition will be used to produce known-distance test patterns. Detecting and preserving patterns of gunshot residue can be used as a basis for estimating muzzle-to-target distances.

Shot Pattern. A shot pattern produced by discharged shot pellets on evidence such as clothing items, furniture, bedding, and wallboard varies with the distance from the muzzle of a firearm to the target. When reproducing shot patterns detected on evidentiary items, the suspect firearm and ammunition similar to the suspect ammunition will be used to produce known-distance shot patterns. Shot patterns from known distances can be used as a basis for estimating muzzle-to-target distances.

Questions concerning muzzle-to-target distance determinations should be directed to 703-632-8442.

Collection and packaging considerations:

- All firearms must be unloaded.
- The firearm should be submitted, if collected. If the firearm cannot be submitted, call **703-632-8442** for instructions.
- The firearm must be handled minimally to avoid loss or destruction of evidence. Do not allow objects to enter or contact the firearm's barrel, chamber, or other operating surface.
- Firearms can be sent via Registered Mail through the U.S. Postal Service. Evidence must be packaged separately and identified by date, time, location, collector's name, case number, and evidence number.
- Do not mark the firearm. Firearms must be identified with a tag containing the caliber, make, model, and serial number. The date, time, name(s) of the owner(s), location, collector's name, case number, and evidence number must be on the container.

National DNA Index System/Combined DNA Index System

The FBI Laboratory manages the Combined DNA Index System (CODIS) and the National DNA Index System (NDIS) to foster the exchange and comparison of forensic DNA evidence from violent crime investigations. CODIS can be used to generate investigative leads in cases where biological evidence is recovered from the crime scene. Matches made among profiles in the Forensic Index can link crime scenes together, possibly identifying serial offenders. Matches made between the Forensic and Offender Indexes may provide investigators with the identity of a suspected perpetrator(s).

The CODIS database also contains DNA profiles to assist in the identification of missing persons. Relatives of missing persons may voluntarily submit DNA samples for comparison against the Unidentified Human (Remains) Index. Reference samples from personal effects of the missing person may also be used in the identification process.

Questions concerning the NDIS/CODIS should be directed to 703-632-8315. Current information on NDIS/CODIS is located at http://www.fbi.gov/about-us/lab/biometric-analysis/copy-of-codis.

National Integrated Ballistic Information Network (NIBIN)

The National Integrated Ballistic Information Network (NIBIN) database is used to discover potential links between unsolved crimes. When specifically requested by the contributor or at the examiner's discretion, a digital image of the test-fired cartridge case/shotshell casing or evidence cartridge case/shotshell casing is entered into the database and searched against earlier entries. Potential associations can be confirmed through a traditional microscopic comparison of the actual evidence items.

A test-fired specimen from a non-evidentiary firearm (e.g., from a Confidential Human Source) can be entered into the database and searched against earlier entries and multiple regions for intelligence and lead generation purposes only.

Questions concerning NIBIN should be directed to 703-632-8442.

National Missing Person DNA Database (NMPDD) Program

The FBI Laboratory supports the National Missing Person DNA Database (NMPDD) Program. Mitochondrial DNA and nuclear DNA (STR) analyses are conducted to support the NMPDD Program. Local, state, and federal law enforcement missing person cases can be submitted directly to the FBI Laboratory or through your local FBI Field Office.

All samples submitted to the FBI Laboratory must be accompanied by an incoming letter describing the samples submitted. Samples from biological relatives of missing persons must be sent with a Consent and Information Form for the NMPDD (FD-935) and a copy of the law enforcement report. A copy of the anthropology, odontology (dental), medical examiner and/or coroner, and law enforcement reports must be included with unidentified human remains samples submitted.

Questions concerning the NMPDD Program mitochondrial DNA analysis should be directed to 703-632-7582 or 703-632-7572. Questions concerning the NMPDD Program nuclear DNA analysis should be directed to 703-632-7514 or 703-632-8446. All agencies must contact an NMPDD Program Manager before submitting samples.

Collection and packaging considerations:

Samples from Biological Relatives of Missing Persons

- For dried bloodstains:
  - Blood cell collection kits are available by contacting the mitochondrial DNA NMPDD Program Manager at 703-632-7582.
- For buccal (oral) swabs:
  - Wear disposable gloves when collecting samples.
  - Use sterile, cotton-tipped applicator swabs to collect four buccal (oral) samples. Rub the inside surfaces of the cheeks thoroughly (use two swabs on each side).
  - Air-dry the swabs and place them back into the original packaging or an envelope with sealed corners. Do not use plastic containers.
  - Identify each sample with the date, time, subject's name, location, collector's name, and case number.
  - Buccal samples do not need to be refrigerated.

Samples from Unidentified Human Remains

Call the Laboratory prior to submitting bones, teeth, or tissue. The communication accompanying the evidence must reference the telephone conversation accepting the evidence.

- For skeletal samples:
  - Pick up samples with gloved hands or clean forceps.
  - Air-dry samples and place in paper bags.
  - Submit whole samples. Cutting skeletal samples increases the possibility of contamination.
  - If possible, submit three samples.
  - Submit skeletal samples with an anthropological report, preferably from an anthropologist certified by the American Board of Forensic Anthropology, or a medical examiner's/coroner's report.
  - Submit skeletal samples in the following order of preference:
    1. Femur
    2. Tibia
    3. Humerus
    4. Teeth, skull, and/or mandible
    5. Hand and foot bones
    6. Lower arm bone
    7. Vertebrae
    8. Ribs
- For teeth:
  - Pick up teeth with gloved hands or clean forceps.
  - Air-dry teeth and place in paper bag.
  - Submit teeth with an odontological report, preferably from an odontologist certified by the American Board of Forensic Odontology, or a medical examiner's/coroner's report.
- Submit teeth in the following order of preference:
  1. Nonrestored (no dental work) molar
  2. Nonrestored premolar
  3. Nonrestored canine
  4. Nonrestored front tooth
  5. Restored molar
  6. Restored premolar
  7. Restored canine
  8. Restored front tooth
- For tissue:
  - Tissue samples usually will provide sufficient quantities of DNA for testing.
  - Pick up tissue with gloved hands or clean forceps.

- Collect 1-2 cubic centimeters of red skeletal muscle.
- Place tissue samples in a clean, airtight plastic container without formalin or formaldehyde and keep refrigerated or frozen.
- Label the outer container "KEEP IN A COOL, DRY PLACE," "REFRIGERATE ON ARRIVAL," and "BIOHAZARD".
- Submit to Laboratory as soon as possible.

Packaging Examinations

Packaging can be examined to determine whether there has been tampering.

Questions concerning packaging examinations should be directed to 703-632-8444.

Collection and packaging considerations:

- Documentary evidence must be preserved in the condition in which it was found. It must not be unnecessarily folded, torn, marked, soiled, stamped, or written on or handled excessively. Protect the evidence from inadvertent indented writing.
- Mark documents unobtrusively by writing the collector's initials, date, and other information in pencil.

Paint Examinations

The layer structure of a questioned paint sample can be compared with a suspected source. The sequence, relative thickness, color, texture, number, and chemical composition of each of the layers can be compared.

The color, manufacturer, model, and model year of an automobile may be determined from a paint chip. Sourcing automotive paints is limited to factory-applied, original automotive paint. Paint on safes, vaults, windowsills, and door frames can be transferred to and from tools. A comparison can be made between the paint from an object and the paint on a tool.

The Laboratory will not examine evidence to authenticate fine art or historical artifacts or to source spray paint or architectural paints.

Questions concerning paint evidence should be directed to 703-632-8441.

Collection and packaging considerations:

- Paint fragments are often found in the clothing of hit-and-run victim(s). Submit the clothing and package them separately in paper bags.
- Paints can be transferred from one car to another, from car to object, or from object to car during an accident or a crime. Control paint chips must be collected from the suspected source of the evidentiary paint. Controls must be taken from an area close to, but not in, any damaged area. If no damage is obvious, controls should be taken from several areas of the suspect substrate. Each layer can be a point of comparison. Controls must have all of the layers of paint down to the substrate. This can be accomplished by the following:
  - Section an area of the painted surface.
  - Cut a paint sample from the surface using a clean, sharp instrument.
  - Lift or pry loosely attached chips or dislodge the paint by gently hitting the opposite side of the painted surface.
- Package paint specimens in leakproof containers such as screw top vials or pillboxes. Alternatively, paint specimens can be packaged in a pharmacy fold. Do not attach paint particles to adhesive tape. Do not use plastic bags, cotton, or envelopes to package paint specimens.

Paper Examinations

The following examinations can be conducted on paper evidence:

- Torn edges can be compared.
- The paper manufacturer can be determined if a watermark or other information is present.
- Paper can be examined for indented writing. Do not rub the indentations with a pencil. Do not add indentations by writing on top of the evidence.

Questions concerning paper examinations should be directed to 703-632-8444.

Collection and packaging considerations:

- Documentary evidence must be preserved in the condition in which it was found. It must not be unnecessarily folded, torn, marked, soiled, stamped, or written on or handled excessively. Protect the evidence from inadvertent indented writing.
- Mark documents unobtrusively by writing the collector's initials, date, and other information in pencil.
- Whenever possible, submit the original evidence. The lack of detail in photocopies makes examinations difficult and often will result in inconclusive opinions.

Pepper Spray and Pepper Foam Examinations

Oleoresin capsicum is a resin in various peppers. It may be used in self-defense sprays or foams. Ultraviolet dye and/or tear gas also may be in the sprays or foams. Items can be analyzed for the presence of oleoresin capsicum, dye, or tear gas.

Questions concerning pepper-spray evidence should be directed to 703-632-8441.

Collection and packaging considerations:

- Submit entire items (e.g., clothing) when possible. Air-dry the evidence and package separately in paper bags.
- Moisten a clean cotton cloth or swab with isopropanol (rubbing alcohol), and wipe over the suspected sprays or foams. Prepare a second moistened cloth or swab as a control. Air-dry the cloths or swabs and pack separately in heat-sealed or resealable plastic bags. Submit spray canisters when possible.
- Follow the guidelines for **Hazardous Materials Transportation** in the Submitting Evidence section when submitting pepper-spray canisters.

Pharmaceutical Examinations

Pharmaceutical examinations can identify constituents, active ingredients, quantity, and weight.

Questions concerning pharmaceutical evidence should be directed to 703-632-8441.

Collection and packaging considerations:

- List the names of the pharmaceuticals and information on their use.
- If possible, submit pharmaceuticals in original containers.

Photocopy or Facsimile Examinations

Photocopies or facsimiles of documents can be identified with the machine used to produce them if the exemplars and questioned documents are relatively contemporaneous. The possible make and model of the photocopier or facsimile machine may be determined.

Questions concerning photocopy and facsimile examinations should be directed to 703-632-8444.

Collection and packaging considerations:

- Documentary evidence must be preserved in the condition in which it was found. It must not be unnecessarily folded, torn, marked, soiled, stamped, or written on or handled excessively. Protect the evidence from inadvertent indented writing.
- Mark documents unobtrusively by writing the collector's initials, date, and other information in pencil.

Procedures for obtaining known photocopy exemplars

- Obtain at least 10 exemplars without a document on the glass plate and with the cover down.
- Obtain at least 10 exemplars without a document on the glass plate and with the cover up.
- Obtain at least 10 exemplars with a document on the glass plate and the cover down.
- Obtain at least 10 exemplars with a document through the automatic document feeder, if applicable.
- Record on each exemplar the date the exemplars were obtained, collector's name, and the conditions under which the exemplars were made.
- Record the make, model, and serial number of the photocopier; information about the toner supplies and components; whether the paper supply is sheet- or roll-fed; and options such as color, reduction, enlargement, zoom, mask, trim, and editor board.
- Do not store or ship photocopies in plastic envelopes.

Plastic Bag Examinations

Plastic bags (e.g., sandwich bags, garbage bags) can be compared with a roll or box of bags.

Questions concerning plastic bag examinations should be directed to 703-632-8444.

Collection and packaging considerations:

- Preserve the evidence in the condition it was found.
- Air-dry bags if necessary before packaging.
- If bag must be cut, avoid cutting on seams.
- Do not remove known specimens from box or roll.

Polymer Examinations

Polymer evidence typically consists of pieces of plastic or other manufactured materials. The source, use, or manufacturer of polymer evidence usually cannot be identified by compositional analysis. Motor vehicle trim can be compared with plastic remaining on property struck in a hit-and-run case. The manufacturer, make, model, and model year of a vehicle can be determined if a manufacturer's part number is on the trim. Plastics in wire insulation and miscellaneous plastics such as buttons can be compared with known sources.

Questions concerning polymer evidence should be directed to 703-632-8441.

Collection and packaging considerations:

- When a motor vehicle has been in an accident, fragments (e.g., plastic lens covers) can be left at the scene. These pieces can be physically reconstructed with the remnants of the fixture left on the car. Collect and package the fragments carefully to keep the edges intact.
- Search the accident or crime scene and personal effects of the victim(s) to locate plastic fragments. Submit fragments in leakproof containers such as screw top vials, plastic pill boxes or paper bags. Remove damaged suspect motor vehicle parts, and package separately in resealable plastic bags or a cardboard box.
- If possible, submit entire items (e.g., clothing) with potential or smeared polymeric transfers. Package separately in paper bags. If the entire item cannot be submitted, cut with a clean, sharp instrument a section where the transfer is suspected. Collect an unstained control sample. Pack to prevent stain removal by abrasive action during shipping. Pack in a paper bag. Do not use plastic containers.

Product Tampering Examinations

Product tampering is when a commercial product is intentionally adulterated to harm someone or to extort money or other thing of value. Examples range from drug tampering in medical environments, food adulteration in supermarkets, and the combination of tampering and altering in domestic settings.

The Laboratory will not assess manufacturing quality control or product specifications in commercial products.

Questions concerning product-tampering evidence should be directed to 703-632-8441.

Collection and packaging considerations:

- Submit control samples of the unadulterated product.
- Package and ship the control and suspect samples separately to avoid contamination. Submit samples in leakproof containers such as film canisters or plastic pill bottles. Do not use paper or glass containers.
- Use caution to prevent the destruction of latent prints.

Prostitution Records Examinations

An examination of prostitution records may identify details of the operational hierarchy, including customers as well as the number and roles of participants; price structures and related revenues; and other pertinent information.

Questions concerning prostitution records evidence should be directed to 703-632-7334 or 703-632-7356.

Collection and packaging considerations:

- Submission of original evidence is preferred; however, contributors may submit high-quality images or photocopies with prior authorization.

Radioactive Materials Examinations

Radioactive materials (e.g., materials which produce alpha particles, beta particles, gamma rays, neutrons) can be found in the medical sector, manufacturing, and in some older X-ray imaging systems. Examinations of radioactive materials are conducted at an FBI-designated partner laboratory.

Questions concerning radioactive materials evidence should be directed to 703-898-7186. Call 703-898-7186 prior to submitting evidence.

Rope or Cordage Examinations

Cordage examinations can determine if portions of rope/cord exhibit the same color, construction, and composition. The manufacturer of ropes/cords may also be determined.

Questions concerning rope or cordage evidence should be directed to 703-632-8449.

Collection and packaging concerns:

- When possible, submit the entire rope/cord.
- If the rope/cord must be cut, label which ends were cut during evidence collection.

Rubber Stamp Examinations

A rubber stamp impression can be compared with a known source.

Questions concerning rubber stamp examinations should be directed to 703-632-8444.

Collection and packaging considerations:

- Submit the rubber stamp to the Laboratory uncleaned.
- Documentary evidence must be preserved in the condition in which it was found. It must not be unnecessarily folded, torn, marked, soiled, stamped, or written on or handled excessively. Protect the evidence from inadvertent indented writing.

Safe Insulation Examinations

Safe insulation can be compared to a known source. Examinations of safe insulation sometimes can determine the manufacturer.

Questions concerning safe insulation evidence should be directed to 703-632-8449.

Collection and packaging considerations:

- Collect safe insulation samples from damaged areas. Safe insulation can adhere to people, clothing, tools, bags, and stolen items and can transfer to vehicles. If possible, submit the evidence to the Laboratory for examiners to remove the debris. Package each item of evidence in a separate leakproof container. Do not process tools for latent prints.
- Ship known and questioned debris separately to avoid contamination. Submit known and questioned debris in leakproof containers such as film canisters or plastic pill bottles. Do not use paper or glass containers. Pack to keep lumps intact.

Serial Number (Altered) Examinations

Altered or restamped serial or identification numbers, including markings on metal, wood, plastic, and fiberglass, may contain toolmarks of value. If toolmarks are present and no suspect tool is submitted, it may be possible to produce a list of possible tools. When toolmarks of value are present, a comparison can be made with suspect dies.

The Laboratory can provide on-scene serial number restoration of obliterated or suspect areas on stolen vehicles and heavy equipment. Depending on the type of metal surface, a thermal or chemical method, along with specialized techniques, is used to assist in restoring and visualizing an obliterated stamping.

Questions concerning serial number evidence should be directed to 703-632-8442.

Collection and packaging considerations:

- For bulky items, if possible, remove the section containing the serial number and submit to Laboratory.
- If it is not possible to remove the section containing the serial number, take several photographs and make several casts of the suspect area to submit to the Laboratory.
  - Take several photographs and document the location of the area that is being cast.
  - Use an acrylic-surface replica cast kit. Call the Laboratory at 703-632-8442 regarding the appropriate cast kit.
  - Prior to cleaning the surface, cast the surface in its original state. Allow cast to set and label appropriately.
  - Clean the area. Remove paint or dirt with a solvent such as acetone, gasoline, or paint remover. Use Naval Jelly to remove rust. Use a soft brush. Do not use a wire brush.
  - Build a dam around the stamped characters to retain the acrylic liquid while it sets. Use a soft and pliable dam material such as modeling clay. Ensure there are no voids in the dam.
  - The acrylic liquid will take several minutes to set. If paint, foreign debris, and/or rust are on the cast, make additional casts. These casts should be labeled sequentially and documented appropriately.
  - Pack the cast(s) to prevent any damage.

Shoe Print and Tire Tread Examinations

Shoe print or tire tread impressions are routinely left at crime scenes. These impressions are retained on surfaces in two- and three-dimensional forms. Almost all impressions, including partial impressions, have value for forensic comparisons. Examinations of shoe print and tire tread impressions could result in the positive identification of the shoes of the suspect(s) or tire(s) from the vehicle(s) of the suspect(s).

Whenever possible, submit the evidence bearing the original impression. If this evidence cannot be submitted to the Laboratory, see below for techniques on lifting two-dimensional and casting three-dimensional impressions.

A file of manufacturer's outsole designs and a file of tire tread patterns and other reference material can be searched to determine brand names and manufacturers. For shoe print and tire tread file searches, submit quality photographs of the impressions (see below for photography information). If photographs are not available, submit casts, lifts, or the original evidence.

Electronic images of shoe print or tire tread impressions may be submitted for file searches via email, along with a request letter on your agency's letterhead, to shoeprintsearch@ic.fbi.gov. The request letter should include suspect's name, victim's name, type of crime, date of crime, brief synopsis of crime, agency case number, and contact information. Email attachments are limited to 5 MB; therefore, it may be necessary to submit the request in multiple emails.

Questions concerning shoe print and tire tread evidence should be directed to 703-632-8444.

Collection and packaging considerations:

- For shoe print and tire tread comparisons, submit original evidence whenever possible (shoes, tires, photographic negatives, CDs with images, casts, lifts).
- Air-dry and package evidence separately in paper bags. Ensure the collector's initials, dates, and other relevant information is on the evidence container.

- Electrostatic lifts should be taped inside a clean, legal-size file folder or other laminated folder.
- Casts should be placed in paper bags and then covered with bubble wrap to minimize breakage when shipped to the Laboratory.

Capturing shoe print/tire tread images

- Questions concerning shoe print/tire tread photography should be directed to **703-632-8087**. Due to insufficient image detail, general crime scene photographs are not suitable for shoe print/tire tread impression examinations. Examination quality photographs require extreme close-up photographs.
- A SLR 12 MP (or higher) digital camera or 35 mm film camera body should be used. Use a tripod and a cable/electronic release to avoid vibration of the camera.
- RAW uncompressed, RAW lossless compression, and TIFF lossless compression are the only acceptable file formats. JPEG file format is not acceptable.
- Set the ISO to 400 ISO and select the proper White balance to capture the impression in its correct color. The White balance selection is controlled by the lighting condition (daylight or incandescent lighting).
- Select either Aperture Priority or Manual mode to control depth of field and select an f/stop setting of f/16 or f/22.
- If possible, use a fixed focal length lens that is double the normal focal length for your camera (e.g., use a 100 mm or 105 mm lens for 35 mm film or a 35 mm full frame sensor). If that lens is not available, use the normal lens for film or sensor size (e.g., use a 50 mm or 60 mm lens with 35 mm film or DSLR with a full frame sensor or a 35mm lens with DSLR with DX or APS-C sensor size). If neither option is available, use a zoom lens with the zoom set at double the normal focal length. Once the focal length and focus are selected, use a piece of tape to secure the lens barrel so the lens setting does not change due to the effects of gravity.
- Place a linear scale such as a ruler next to the full length of the impressions and on the same plane as the impression. If the impression is in a medium such as snow, sand, or soil, consider pressing the scale adjacent to the impression into the medium so that it is at the same plane as the bottom level of the impression. Also place a label in the photograph to correlate the impression with the crime scene notes and general crime scene photographs.
    - For tire treads, use a long tape measure as a scale and photograph the impression in overlapping segments to capture a full revolution (approximately 7 to 9 feet) of the tire.
- Fill the viewfinder with the impression and scale in landscape orientation. Position the camera directly over the impression with the film plane of the camera parallel to the surface of the impression.
- Adjust the focus of the macro lens in manual mode focusing on the bottom of the impression.
- Attach an electronic flash with long extension cord to the camera and position at a very low angle for oblique lighting, 10- to 15-degrees above the ground to enhance the detail of the impression. For consistent and even illumination, hold the flash at least 5 to 7 feet from the impression. Block out any bright ambient light with a sunscreen to maximize the lighting effect from the electronic flash unit for maximum detail.
- For shoe impressions, take a minimum of three images with oblique lighting at least 120-degree increments around the entire impression. For tire impressions, take four images, positioning the flash to illuminate the impression from all four sides.

- Copy the image files from the camera to a hard drive, CD, or DVD and verify images were successfully copied before deleting from camera. Best practice is to make at least two copies marked as "original/master," stored separately. If possible, create two additional copies marked "original/master working copy," for viewing, processing, and printing.

Capturing shoe print/tire tread images in snow

- First, attempt to photograph the impressions as if in soil.
- Impressions in snow are difficult to photograph because of lack of contrast. To increase contrast, lightly spray snow impressions with Snow Print Wax or with colored spray paint. Hold the spray can at least 2 to 3 feet from the impression so the force of the aerosol does not damage the impression.
- Direct a light application of the spray at a 30- to 45-degree angle so the colored paint strikes only the high points of the impression.
- Highlighted impressions will absorb heat from the sun and must be shielded until photographed and cast to prevent melting.
- After spraying, photograph impressions using above instructions.

Casting three-dimensional impressions

- Casting a three-dimensional impression in soil, sand, or snow is necessary to capture detail for examination. Dental stone, with a compressive strength of 8,000 psi or greater, must be used for casting all impressions. The compressive strength is listed on the container along with the proper ratio of powder to water used for mixing. Dental stone is available through local dental supply houses. Colored dental stone is preferred.
- Plaster of paris, modeling plasters, and dental plasters are not sufficiently hard, do not resist abrasion when cleaned, and must not be used.
- The average footwear impression requires about 2 lbs of dental stone and approximately 10 oz of water. The average tire impression (about 18 to 24 inches in length) requires about 7 lbs of dental stone and about 35 oz water. Tire impressions can be cast up to 36 inches in length.
- After the dental stone and water have been mixed, the material should have the consistency of pancake batter or heavy cream. It may be necessary to adjust the amounts of dental stone and water used to obtain the desired consistency.
- Store dental stone in resealable plastic bags. An 8- by 12-inch resealable plastic bag can store 2 lbs of dental stone powder. With premeasured bags, casting impressions at the crime scene involves only adding water. The bag containing the dental stone powder can be used to mix and pour the dental stone. To make a cast, add the appropriate amount of water to the bag and close the top. Mix the casting material by vigorously massaging it through the bag for 3 to 5 minutes. Ensure that the material in the corners of the bag is also mixed.
- If the impressions are numerous or large, it may be necessary to mix larger quantities of dental stone in a bucket or bowl. The dental stone should be added slowly to the water and stirred continuously for 3 to 5 minutes.
- Casting material has sufficient weight and volume to erode and destroy detail if it is poured directly on top of the impression. The casting material should be poured on the ground next to the impression, allowing it to flow into the impression. The impression should be filled with casting material until it has overflowed. Once dried, the resulting cast should be ½ to 1 inch in thickness to minimize breakage when being transported to the Laboratory.

- For fragile impressions or impressions in fine sand/soil it may be necessary to mix the dental stone to a more watery consistency. Once dried, the resulting cast will be very thin and additional dental stone should be mixed and poured on top of the dried cast while it is still in the ground. This is necessary in order to obtain a cast that is ½ to 1 inch in thickness. Ensure the cast is thoroughly dried on the surface before adding the additional dental stone.
- If the mixture does not flow easily into all areas of the impression, use a finger or a small stick on the surface to cause the dental stone to flow into the impression. Do not put the stick or finger more than 1/4 inch below the surface of the casting material because it can damage the impression.
- Before the cast hardens completely, write the date, collector's initials, and other identifying information on it. In warm weather, the cast should be left undisturbed for at least 20 to 30 minutes. In cold weather, the cast should be left undisturbed longer. Casts have been destroyed or damaged when lifted too soon. If the cast is in sand or loose soil, it should lift easily. Casts in mud or clay may require careful treatment and excavation when being removed.
- Allow the cast to air-dry for at least 48 hours. Package the cast in paper, not in plastic. An FBI Laboratory examiner must clean the cast.

Lifting two-dimensional impressions

- Lifting an impression allows for the transfer of a two-dimensional residue or dust impression to a lifting film. It also allows the impression to be shipped to the Laboratory for photographing and examination.
- ***Electrostatic lifting devices*** lift footwear impressions from porous and nonporous surfaces without damaging the impressions. These devices work on dry dust or residue impressions on clean surfaces but will not work if the impressions were wet or have become wet. Electrostatic lifting devices come with instructions for use. This method is useful for searching for latent impressions.
    - Lifted impressions are damaged easily if the film is not stored properly because the film has a residual charge that attracts dust and debris and causes the film to cling to other surfaces. To preserve and store the lifting film containing an impression, tape one edge of the film securely in a clean, smooth, high-quality paper file folder. Low-grade cardboard boxes such as pizza boxes must not be used because the residual charge on the film will pull dust from the box and contaminate the impression.
    - Items that contain a dry residue footwear impression must not be wrapped or stored in plastic because a partial transfer of the impression to the plastic will occur.
- ***Gelatin lifters*** can be used to lift wet or dry impressions from porous and nonporous surfaces. Gelatin lifts should be allowed to sit on the impression for approximately 20 to 25 minutes before being removed. This allows sufficient time for the impression to be absorbed by the gelatin.
    - Black gelatin lifters work well for lifting light-colored dry or wet origin impressions.
    - White gelatin lifters can be used to lift impressions developed with black fingerprint powder or impressions dark enough to contrast with a white background.
- ***Adhesive lifters*** can be used only to lift impressions from smooth, nonporous surfaces.
    - White adhesive lifters can be used to lift dry impressions developed with black fingerprint powder.

- Transparent adhesive lifters can be used to lift dry impressions developed with black powders. Transparent lifts should be placed on a white card or white sheet of paper for maximum contrast.

Soil Examinations

Soil examinations can determine whether soils could share a common origin by comparing color, texture, and composition.

Questions concerning soil evidence should be directed to 703-632-8449.

Collection and packaging considerations:

- Collect soil samples as soon as possible because the soil at the crime scene can change dramatically over time.
- Collect soil samples from the immediate crime scene area and from the logical access and escape route(s).
- Collect soil samples where there are noticeable changes in color, texture, and composition.
- Collect soil samples at a depth that is consistent with the depth from which the questioned soil may have originated.
- If possible, collect soil samples from alibi areas such as the yard or work area of the suspect(s). Submit a map identifying soil sample locations.
- Do not remove soil adhering to shoes, clothing, and tools. Do not process tools for latent prints. Air-dry the soil and the clothing, and package separately in leakproof containers.
- Carefully remove soil adhering to vehicles. Air-dry the soil, and package separately in leakproof containers.
- Ship known and questioned debris separately to avoid contamination. Submit known and questioned soil in leakproof containers such as film canisters or plastic pill bottles. Do not use paper envelopes or glass containers. Pack to keep lumps intact.

Special Event and Situational Awareness Support

Teams of Scientific and Technical Photographers and Visual Information Specialists can travel to the field and conduct digital image and mapping surveys of venues as they relate to an operation or special event. This survey provides two- and three-dimensional visual mapping of a main venue and possible secondary venues. This documentation includes 360-degree spherical photography, still photography, 360-degree spherical video capture, three-dimensional laser scanning and documentation of physical structures and objects, aerial photography, and geospatial (GIS) mapping.

Questions concerning Special Event and Situational Awareness Support should be directed to 703-632-8194.

Symbol Examinations

The Laboratory maintains a database of cryptic symbols, such as those found in graffiti and tattoos. A symbol examination involves correlating cryptic symbols to previously observed symbols. Symbol examinations are provided for intelligence and lead generation purposes only. No expert testimony is provided. Digital images of symbols may be sent to tag@ic.fbi.gov.

Questions concerning symbol evidence should be directed to 703-632-7334 or 703-632-7356.

Tape Examinations

Tape composition and construction can be compared with known sources. Comparisons can be made with the torn end of tape and a suspect roll of tape. The Laboratory will examine duct, vinyl electrical, packaging, masking, and cellulose acetate (e.g., Scotch) tapes. For duct tapes, the Laboratory is also able to identify the manufacturer and product line represented by the tape.

Questions concerning tape evidence should be directed to 703-632-8441.

Collection and packaging considerations:

- Whenever possible, submit tape still adhered to the substrate. This minimizes the loss of trace evidence, latent fingerprints, or contact impressions.
- If it is not possible to submit the substrate, the tape may be manually removed and placed adhesive side down on a clean, colorless piece of plastic sheeting (e.g., transparency film or Kapak tubular rollstock), not on cardboard, paper, or vinyl document protectors. Do not distort or tear the tape during removal.
- If the tape is cut during removal, document and initial each cut. Use a method that produces a unique cutting pattern (e.g., pinking shears).

Toolmark Examinations

An examination of the questioned item is conducted to determine if toolmarks are present, what types of tool may have caused them, and whether there are toolmarks of value for comparison purposes.

If a suspect tool is submitted, a comparison is done of the toolmarks on the questioned items with those in the test toolmarks.

If a suspect tool is not submitted, an intercomparison is done of the toolmarks on the questioned items.

Questions concerning toolmark evidence should be directed to 703-632-8442.

Collection and packaging considerations:

- Photographs locate toolmarks but are of no value for identification purposes.
- Obtain samples of any material deposited on the tools. Submit samples in leakproof containers such as film canisters or plastic pill bottles.
- To avoid contamination, do not place the tool against the tool-marked evidence.
- Submit the tool rather than making test cuts or impressions.
- Mark the ends of the evidence and specify which end was cut during evidence collection.
- If it is not possible to submit the tool-marked evidence, make a cast to submit to the Laboratory.
    - Use an acrylic-surface replica cast kit. Call the Laboratory at 703-632-8442 regarding the appropriate cast kit.
    - Clean the area. Remove paint or dirt with a solvent such as acetone, gasoline, or paint remover. Use Naval Jelly to remove rust. Use a soft brush. Do not use a wire brush.
    - Build a dam around the stamped characters to retain the acrylic liquid while it sets. Use a soft and pliable dam material such as modeling clay. Ensure there are no voids in the dam.

- The acrylic liquid will take several minutes to set. If paint, foreign debris, and/or rust are on the cast, make additional casts. These casts should be labeled sequentially and documented appropriately.
- Pack the cast(s) to prevent any damage.

Toxicology Examinations

Toxicology examinations may be performed to measure alcohol, drugs, and/or poisons in biological samples. For living subjects, testing may disclose what substances an individual was under the influence of at the time of the incident being investigated. When the subject is deceased, testing may aid in determining the individual's cause of death, if it was substance related. Typically, blood and urine are collected from living individuals. For deceased individuals, additional samples such as vitreous fluid and tissue samples are collected at their autopsies. Hair testing may be performed for a limited range of target analytes.

Questions concerning toxicology evidence should be directed to 703-632-8441. Call 703-632-8441 prior to submitting hair for testing.

Collection and packaging considerations:

Specimens from Living Subjects

- *Blood*. Collect at least 10 mL in 1-2 gray-top test tubes (containing sodium fluoride and potassium oxalate) from the individual if 24 hours or less have elapsed since the incident under investigation.
- *Urine*. Collect at least 30 mL from the individual in a leakproof specimen cup if 120 hours or less have elapsed since the incident under investigation.
- *Hair*. Call the Laboratory for specimen collection guidance and for permission to submit the evidence for testing.
- All samples from living subjects should be marked with the name of the donor and the date and time of collection. Refrigerated storage is recommended for blood and urine samples.
- In cases of suspected drug-facilitated sexual assault, a copy of the sexual assault examination record should be submitted with the specimen(s). A list of any drugs the individual is known to have taken during the 24 hours prior to the alleged assault through the time of collection of the biological specimens should also be included.

Autopsy Specimens

- *Blood*. Collect central (at least 10 mL) and peripheral blood (at least 5 mL) and mark with collection site. Preserve with sodium fluoride (a gray-top tube or other leakproof containers are acceptable).
- *Urine*. Collect all available in a leakproof container.
- *Vitreous fluid*. Collect from both eyes and combine in a leakproof container. Vitreous fluid is especially important for ethanol measurements.
- *Stomach contents*. Collect all available in a leakproof container in cases of suspected oral overdose or oral poisonings.
- *Liver, brain, kidney, and other organs*. Submit portions of each organ(s) to be tested in a separate container. Tissue slices and samples in paraffin are not suitable for toxicological testing. If embalming has been performed, please call the Laboratory for guidance.
- All autopsy samples should be marked with the name of the donor. Specimens may be stored refrigerated or frozen. Frozen storage is preferred for tissue samples.
- Medical records related to a poisoning incident should be submitted with the specimen(s).

- If available, a list of any drugs the decedent has been prescribed should accompany autopsy samples.

Typewriting Examinations

Questioned typewriting may be identified with the typewriter that produced it. This is most common when the typewriter is a typebar machine. The identification is based on individual characteristics that develop during the manufacturing process and through use and abuse of the typewriter.

Typewriters with interchangeable elements (e.g., ball, printwheel, or thimble) are less likely to be associated with questioned typewriting; however, these typing elements may be positively identified with specific texts by examining individual characteristics of the elements.

Comparison of questioned typewriting with reference standards can determine a possible make and model of the typewriter and/or the typewriter elements.

Carbon-film typewriter ribbons and correction ribbons may contain readable text. These ribbons can be compared with questioned typewritten impressions. Generally, fabric ribbons cannot be read or identified.

Questions concerning typewriting evidence should be directed to 703-632-8444.

Collection and packaging considerations:

- Documentary evidence must be preserved in the condition in which it was found. It must not be unnecessarily folded, torn, marked, soiled, stamped, or written on or handled excessively. Protect the evidence from inadvertent indented writing.
- Mark documents unobtrusively by writing the collector's initials, date, and other information in pencil.
- Whenever possible, submit the original evidence. The lack of detail in photocopies makes examinations difficult and often will result in inconclusive opinions.

Procedure for obtaining known typewriting exemplars

- If the typewriter has a carbon-film ribbon or correction ribbon, remove it from the typewriter and submit the ribbon to the Laboratory. Insert a new ribbon in the typewriter prior to obtaining exemplars.
- If the typewriter has a fabric ribbon, remove it from the typewriter and put the typewriter in the stencil position. Place a sheet of carbon paper over a sheet of blank paper and insert both into the typewriter. Allow the typeface to strike the carbon paper. Submit the fabric ribbon and the exemplars typed on the carbon paper to the Laboratory.
- Obtain two word-for-word typed exemplars of the questioned text and two typed exemplars of the entire keyboard (all symbols, numbers, and upper- and lowercase letters).
- Record the make, model, and serial number of the typewriter on the exemplars. Also record the date the exemplars were obtained and the name of the person who typed the exemplars.
- Obtain the typewriter service and repair history, if available.
- Normally it is not necessary to send the typewriter to the Laboratory; however, in some cases, the examiner will request the typewriter. It must be packed securely to prevent damage during shipment. Typewriter elements (e.g., ball, printwheel, or thimble) also must be submitted to the Laboratory.

Unknowns (General Chemical) Examinations

General unknowns include powders, liquids, and stains that are of indeterminate origin or cannot be readily classified. Full identification of an unknown may not always be possible; however, general classification of a substance is usually achievable. When comparison samples are available, it may be possible to comment regarding the consistency of the unknown substance compared with a known sample.

Questions concerning examinations of general unknowns should be directed to 703-632-8441. Call the Laboratory at 703-632-8441 prior to submitting general unknowns to ensure that the evidence will be accepted for examination. The communication accompanying the evidence must reference the telephone conversation accepting the evidence.

Collection and packaging considerations:

- Submit powder and liquid samples in leakproof containers.
- Do not submit large stained evidence. When possible, cut a small sample of the stained area and submit in a heat-sealed or resealable plastic bag. When cutting is not possible, transfer questioned stains by rubbing with a clean (dry or wet with alcohol) cotton swab. Use an unstained swab as a control. Air-dry the swab and pack in a heat-sealed or resealable plastic bag.
- Collect an unstained control sample, package separately, and submit it with the stained evidence.

Weapons of Mass Destruction/CBRN Evidence Examinations

Incidents involving chemical, biological, radiological and nuclear (CBRN) materials are deliberate, malicious acts intended to kill, sicken, terrorize, or disrupt society. The term CBRN is used in situations where any of these four hazards are present. These same hazardous materials are often referred to as Weapons of Mass Destruction (WMD).

Depending on the nature of the threat material (i.e., chemical, biological, radiological or nuclear) and the examinations requested, WMD/CBRN examinations may be conducted by the FBI Laboratory at an FBI Laboratory-designated partner laboratory (i.e., other government, commercial, or academic laboratories) specially equipped to analyze CBRN materials on behalf of the FBI.

The FBI's Hazardous Evidence Analysis Team (HEAT) provides traditional forensic examinations (e.g., latent print, trace evidence, photographic) on evidence contaminated with or containing CBRN materials. HEAT members are specially trained to safely conduct examinations of CBRN containing/contaminated evidence at FBI Laboratory-designated partner laboratories.

Upon determination or suspicion of a possible WMD/CBRN incident, a contributor must contact the FBI WMD Coordinator through their local FBI office or the FBI's Strategic Information and Operations Center at **202-323-3300** and ask for the **WMD Operations Response Unit Duty Officer.**

Questions concerning WMD/CBRN evidence examinations should be directed to 703-632-7726.

Collection and packaging considerations:

- Before evidence believed to contain CBRN material is shipped to the FBI Laboratory or FBI-designated partner laboratories, appropriate FBI personnel will develop a plan to include field screening, packaging, transportation, and laboratory destination.
- **Suspected or confirmed WMD/CBRN crime scenes should only be handled by qualified FBI personnel.**

CRIME SCENE SAFETY

Law enforcement personnel have the ultimate responsibility to recognize chemical, biological, and physical hazards when processing a crime scene. However, it is the responsibility of each agency responding to and providing support at the crime scene to develop policies, programs, and training on health and safety practices.

Always consult local, state, and federal environmental and occupational health and safety laws when working with potentially hazardous forensic evidence. All shipping of forensic evidence must comply with U.S. Department of Transportation and International Air Transport Association regulations.

This section describes the hazards, safety precautions, safe work practices, and personal protective equipment recommended for personnel processing routine crime scenes. This section also explains the importance of complying with waste-disposal regulations.

Routes of Exposure

Personnel operating in or around contaminated environments must be aware of the various ways in which hazards may enter and harm the body.[1]

Inhalation

Inhalation is the introduction of a toxic product by the respiratory system. Airborne contaminants may be in the form of dust, aerosol, smoke, vapor, gas, or fume. Materials may be in a solid or liquid form and still represent an inhalation hazard because they produce vapors, mists, and fumes.

Proper work practices and adequate ventilation can minimize the risk of airborne-contaminant inhalation. When working in areas with airborne contaminants present, personnel must wear respiratory protection. Personnel must be certified to wear respiratory protection and work in areas containing airborne contaminants.

Absorption

Contamination through the skin can result from direct contact or by absorption. The severity of the injury can depend on the concentration of the contaminant and the amount of exposure time. Systemic effects—such as dizziness, tremors, nausea, blurred vision, liver and kidney damage, shock, or collapse—can occur when the substances are absorbed through the skin and circulated throughout the body. Exposure can be prevented by using personal protective equipment (e.g., gloves, safety glasses, goggles, face shields, and protective clothing).

Ingestion

Ingestion involves introducing contaminants into the body through the mouth. Ingestion can cause severe damage to the mouth, throat, and digestive tract. To prevent entry of contaminants into the mouth, safe work practices—such as washing hands before eating, smoking, or applying cosmetics—must always be used. Personnel should not bring food, drinks, or cigarettes into areas where contamination can occur, regardless of any personal protection they may be wearing.

Injection

The direct injection of contaminants into the body—either by needle sticks or mechanical injuries from contaminated glass, metal, or other sharp objects—can cause severe complications. Contaminants enter directly into the bloodstream and can spread rapidly. Extreme caution should be exercised when handling objects with sharp or jagged edges. Work gloves must be worn at all times.

Safety

Bloodborne Pathogen Safety

On December 6, 1991, OSHA issued Title 29, Section 1910.1030, of the Code of Federal Regulations (CFR), *Bloodborne Pathogens*.[2] Occupations at risk for exposure to bloodborne pathogens include law enforcement, emergency response, and forensic laboratory personnel.

Fundamental to the bloodborne pathogens standard is the concept of following universal precautions. This concept is the primary mechanism for infection control. It requires that employees treat all blood, body fluids, or other potentially infectious materials as if infected with bloodborne diseases, such as the hepatitis B virus (HBV), the hepatitis C virus (HCV), and the human immunodeficiency virus (HIV). The following protective measures should be taken to avoid direct contact with potentially infectious materials:

- Use barrier protection—such as disposable gloves, coveralls, and shoe covers—if contact with potentially infectious materials may occur. Change gloves when torn or punctured or when their ability to function as a barrier is compromised. Wear appropriate eye and face protection to protect against splashes, sprays, and spatters of potentially infectious materials.
- Wash hands after removing gloves or other personal protective equipment. Remove gloves and other personal protective equipment in a manner that will not result in contaminating unprotected skin or clothing.
- Prohibit eating, drinking, smoking, or applying cosmetics where human blood, body fluids, or other potentially infectious materials are present, regardless of any personal protection that may be worn.
- Place contaminated sharps in appropriate closable, leakproof, puncture-resistant containers when transported or discarded. Label the containers with a BIOHAZARD warning label.
- Do not bend, recap, remove, or otherwise handle contaminated needles or other sharps.
- After use, decontaminate equipment with a daily prepared solution of household bleach diluted 1:10 or with 70% isopropyl alcohol or other appropriate disinfectant. Noncorrosive disinfectants are commercially available. It is important to allow sufficient contact time for complete disinfection.
- In addition to universal precautions, engineering controls and prudent work practices can reduce or eliminate exposure to potentially infectious materials. Examples of engineering controls include long-handled mirrors used to locate and retrieve evidence in confined or hidden spaces and puncture-resistant containers used to store and dispose of sharps and paint stirrers.

Chemical Safety

Depending on the type of material encountered, a variety of health and safety hazards can exist. Some of these hazards are identified by the following categories:[1, 3]

Flammable or combustible materials—such as gasoline, acetone, and ether—ignite easily when exposed to air and an ignition source, such as a spark or flame.

Over time, some explosive materials, such as nitroglycerine and nitroglycerine-based dynamite, deteriorate to become chemically unstable. In particular, ether will form peroxides around the mouth of the vessel in which it is stored. All explosive materials are sensitive to heat, shock, and friction.

Pyrophoric materials—such as phosphorus, sodium, and barium—can be liquid or solid and can ignite without an external ignition source in air temperatures less than 130 °F (54 °C).

Oxidizers—such as nitrates, hydrogen peroxide, and concentrated sulfuric acid—are chemical compounds that readily yield oxygen to promote combustion. Avoid storage with flammable and combustible materials or substances that could rapidly accelerate their decomposition.

Corrosive materials can cause destruction to living tissue or objects such as wood and steel. The amount of damage depends on the concentration and duration of contact.

When working with chemicals, be aware of hazardous properties, disposal techniques, personal protection, packaging and shipping procedures, and emergency preparedness. This awareness comes from appropriate training and the information in a Material Safety Data Sheet (MSDS). The MSDS provides information on the hazards of a particular material so that personnel can work safely and responsibly with hazardous materials.

Light-Source Safety

When using ultraviolet lights, lasers, and other light sources, personnel must protect their eyes from direct and indirect exposure.[4] Not all laser beams are visible, and irreversible eye damage can result from exposure to direct or indirect light from reflected beams. Prolonged exposure to the skin also should be avoided.

All personnel in the vicinity of the light source should wear protective eyewear appropriate for the light source. Goggles must have sufficient protective material and fit snugly to prevent light from entering at any angle. The goggles must display the American National Standards Institute's (ANSI's) mark denoting eye-protection compliance. Laser-protective eyewear must be of the appropriate optical density to protect against the maximum operating wavelength of the laser source.

Confined-Space Safety

A confined space is an enclosed area large enough for personnel to enter and work, but it has limited or restricted means for entry and exit. Confined spaces (e.g., sewers, open pits, tank cars, and vats) are not designed for continuous occupancy. Confined spaces can expose personnel to hazards including toxic gases, explosive or oxygen-deficient atmospheres, electrical dangers, or materials that can engulf personnel entering the space.[5]

Conditions in a confined space must be considered dangerous, and personnel may not enter the space until the space is assessed for hazards by a trained, competent person and, if necessary, a confined-space permit has been issued. The atmosphere must be monitored continuously with a calibrated, direct-reading instrument for oxygen, carbon monoxide, flammable gases and vapors, and toxic air contaminants. Periodic readings from these monitors should be documented. Only certified confined-space personnel may operate in permit-required confined spaces. Rescue services must be immediately available to the site.

The following practices must be followed when working in a confined space:

- Never enter before all atmospheric, engulfment, mechanical, and electrical hazards have been identified and documented. Isolating hazards must be performed in accordance with OSHA 29 CFR 1910.147, *The Control of Hazardous Energy (Lockout/Tagout).*[6]
- Provide ventilation. Ensure that ventilation equipment does not interfere with entry, exit, or rescue procedures.
- Provide barriers to warn unauthorized personnel and to keep entrants safe from external hazards.
- Provide constant communication between personnel entering the confined space and attendants.
- Ensure that backup communication is in place prior to entry.
- Wear appropriate personal protective equipment, such as self-contained breathing apparatus (SCBA), a full-body harness, head protection, and other necessary equipment.
- Never attempt a rescue unless part of a designated rescue team. Rescue services must be

immediately available to the site.

- Ensure that personnel certified in first aid and cardiopulmonary resuscitation (CPR) are on-site.
- For additional information, refer to the OSHA standard for *Permit-Required Confined Spaces*, 29 CFR 1910.146.[7]

Excavation Safety

All excavations must meet the requirements set forth in OSHA's standards for excavations, 29 CFR 1926.650,[8] 1926.651,[9] and 1926.652.[10] Each employee in an excavation shall be protected from cave-ins by an adequate protective system designed in accordance with 29 CFR 1926.652(b) or 29 CFR 1926.652(c),[10] unless excavations are less than five feet in depth and examination of the ground is made by a competent person to prevent cave-ins. A competent person is someone capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees and who has the authorization to take prompt corrective action to eliminate those hazards. No employee should enter an excavation that has been identified as a trench prior to either placement of shoring/protection systems or widening of the trench to safe dimensions as defined by OSHA.

As with all excavations, personnel should be aware of buried utilities and control standing water, hazardous environments, confined spaces, and oxygen-deficient atmospheres.

X-Ray Safety

Portable, handheld X-ray machines, often used to identify the contents of unknown packages, pose a risk for exposure to X-ray radiation at crime scenes.

Keep X-ray exposure as low as reasonably achievable by adhering to the following:

- Shield the X-ray device, the questionable object, and the operator.
- Remove all nonessential personnel from the X-ray field.
- Limit the time that personnel must be in the area of operation.
- Always wear assigned monitoring devices appropriate for X-ray radiation.
- Ensure that standard X-ray operating procedures are in place and followed and that adequate training has been provided in accordance with federal and state regulations.

Personal Protective Equipment

At all crime scenes, the selection of personal protective equipment must be done in coordination with a hazard risk assessment completed by trained and qualified personnel. The hazard risk assessment should identify the possible contaminants as well as the hazards associated with each product. Entry into these types of scenes will depend on each law enforcement organization's available equipment, situational training, and qualified personnel.

Hand Protection

Hand protection should be selected on the basis of the type of material being handled and the hazard(s) associated with the material.[11, 12] Detailed information can be obtained from the manufacturer. The following list provides information about glove material types and functions:

- Nitrile provides protection from acids, alkaline solutions, hydraulic fluid, photographic solutions, fuels, lubricants, aromatics, petroleum, and chlorinated solvents. It also offers some resistance to cuts and snags.
- Neoprene offers resistance to oil, grease, acids, solvents, alkalies, bases, and most refrigerants.

- Polyvinyl chloride (PVC) is resistant to alkalies, oils, and limited concentrations of nitric and chromic acids.
- Latex (natural rubber) resists mild acids, caustics, detergents, germicides, and ketonic solutions. Latex will swell and degrade if exposed to gasoline or kerosene. When exposed to prolonged, excessive heat or direct sunlight, latex gloves can degrade, causing the glove material to lose its integrity.
- Using powder-free gloves with reduced protein content reduces the risk of developing latex allergies. Personnel allergic to latex usually can wear nitrile or neoprene.

Guidelines for glove use include the following:

- Prior to donning gloves, inspect them for holes, punctures, and tears. Remove rings or other sharp objects that can cause punctures.
- When working with heavily contaminated materials, wear a double layer of gloves.
- Change gloves when they become torn or punctured or when their ability to function as a barrier is compromised.
- To avoid contaminating unprotected skin or clothing, remove disposable gloves by grasping the cuffs and pulling them off inside out. Discard disposable gloves in designated containers. Do not reuse.

Eye Protection

Personnel handling chemical, biological, and radioactive materials should wear appropriate eye protection, such as safety glasses and goggles.[1, 13] Face shields offer better protection when there is a potential for splashing or flying debris. Face shields must be worn in combination with safety glasses or goggles because face shields alone are not considered appropriate eye protection.

Contact lens users must wear safety glasses or goggles to protect the eyes. In the event of a chemical splash into the eye, it can be difficult to remove the contact lens to irrigate the eye, and contaminants can be trapped behind the contact lens.

Protective eyewear also should be worn over prescription glasses. Alternately, safety glasses may be made to the wearer's eyeglass prescription.

Foot Protection

Shoes that completely cover and protect the foot are essential.[11,14] Protective footwear should be worn at crime scenes when there is a danger of foot injuries from falling or rolling objects, from objects piercing the sole, or from exposure to electrical hazards. The standard recognized by OSHA for protective footwear is the *American National Standard for Personal Protection—Protective Footwear*, ANSI Z41-1991.[15] In some situations, nonpermeable shoe covers can provide barrier protection to shoes and prevent the transfer of contamination outside the crime scene.

Respiratory Protection

Certain crime scenes, such as bombings and clandestine laboratories, can produce noxious fumes and other airborne contaminants for which responders must use respiratory protection.[1, 11, 16]

Compliance with 29 CFR 1910.134, *Respiratory Protection*,[17] is mandatory whenever respirators are used. Critical elements for the safe use of respirators include a written program, training, medical evaluation, fit testing, and a respirator maintenance program. Without these elements, the wearer is not guaranteed protection.

Head Protection

At certain crime scenes where structural damage has occurred or may occur, protective helmets should be worn. The standard recognized by OSHA for protective helmets is ANSI's requirements for industrial head protection, Z89.1-2003.[18]

Hazardous Materials Transportation

All shipments of suspected or confirmed hazardous materials must comply with U.S. Department of Transportation and International Air Transport Association regulations. Title 49 of the CFR lists specific requirements that must be observed when preparing hazardous materials for shipment by air, land, or sea.[19] In addition, the International Air Transport Association annually publishes *Dangerous Goods Regulations*,[20] which details how to prepare and package shipments for air transportation.

Title 49 CFR 172.101 provides a Hazardous Materials Table[21] that identifies items considered hazardous for the purpose of transportation. Title 49 CFR 172.101 also addresses special provisions for certain materials, hazardous materials communications, emergency response information, and training requirements for shippers. Personnel who serve any function in the shipment of hazardous materials must receive the specified training prior to shipping any materials by commercial transportation.

Hazardous Waste Regulations

The U.S. Environmental Protection Agency's Resource Conservation and Recovery Act (RCRA),[22] commonly referred to as the "cradle-to-grave" regulation, was established to track chemicals from "cradle," or generation, to "grave," or disposal. This system imposes requirements on both generators and transporters, as well as on transport, storage, and disposal facilities. RCRA specifies that once a material is determined to be hazardous, it becomes the generator's complete responsibility.

The process for determining whether a material is a hazardous waste should be completed by qualified personnel. Even new material in its original container may be considered waste if there is no use for it. The services of a hazardous waste contractor and transporter can be used to help remove materials from scenes. Hazardous materials that are removed from crime scenes are considered evidence and would not fall under RCRA waste provisions. However, when a case has been adjudicated or, for other reasons, the material is not needed, the immediate assistance of a qualified contractor knowledgeable about local regulations must be sought. Clandestine drug laboratories and environmental crime scenes are examples of situations that may require the removal of waste.

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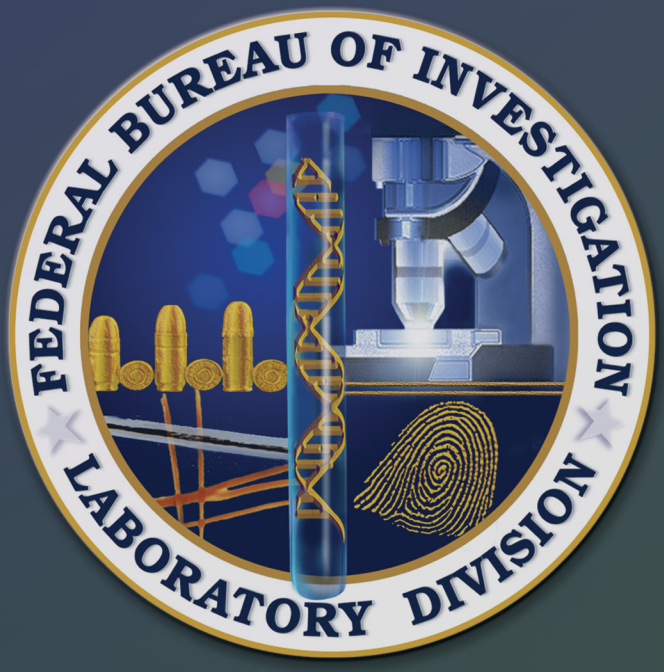
The Handbook of Forensic Services is available online at **http://www.fbi.gov/about-us/lab/handbook-of-forensic-services-pdf**.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