



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

Handbook of Forensic Services

Revised 2003

Handbook of Forensic Services

(revised 2003)

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Table of Contents

Introduction	3
Submitting Evidence	7
Evidence Examinations	13
Crime Scene Safety	133
Crime Scene Search	155
Index	169

Introduction

The purpose of the *Handbook of Forensic Services* is to provide guidance and procedures for safe and efficient methods of collecting, preserving, packaging, and shipping evidence and to describe the forensic examinations performed by the FBI's Laboratory Division and Investigative Technology 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. The forensic services of the FBI Laboratory Division and the Investigative Technology 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.
- 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.
- 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 Assistant 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.

Violent Crime Versus Property Crime

The FBI accepts evidence related to all crimes under investigation by FBI field offices; however, it only accepts evidence related to violent crime investigations from state and local law enforcement agencies. The FBI does not routinely accept evidence in cases involving property crimes from state and local law enforcement agencies 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 Assistant 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.
- Explosive incidents and hoaxes targeting unoccupied residential and commercial buildings and property.
- Vandalism and malicious mischief directed toward residential or commercial buildings and property.
- Nonfatal traffic accidents involving speedometer and headlight examinations except in cases involving law enforcement and government officials.
- Hit-and-run automobile accidents not involving personal injury.
- Auto theft except auto theft rings or carjackings.
- Breaking and entering.
- Burglary.
- Minor theft (under \$100,000).
- Minor fraud (under \$100,000).

[*Back to the top*](#)

Submitting Evidence

Requesting Evidence Examinations

All requests for evidence examinations should be in writing, on agency letterhead, and addressed to the FBI Laboratory Evidence Control Unit, unless otherwise indicated in the Examinations section. The requests 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 concerning the case as they pertain to evidence examinations.
- The name(s) and descriptive data about the individual(s) involved (subject, suspect, victim, or a combination of those categories) and the agency-assigned case identification number.
- 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 or both. 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 is requested.
- Where the evidence should be returned and where the Laboratory report should be sent.
- A statement if the evidence was examined by another expert in the same field, if there is local controversy, or if other law enforcement agencies have an interest in the case.
- The reason(s) for an expeditious examination. Do not routinely request an expeditious examination.
- Submit separate communications for multiple cases.

Packaging and Shipping Evidence

- 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 the *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 to be 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.**

- 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 of the completed packages in grams.
- Unless otherwise indicated in the Examinations section, address the outer container as follows:

**FEDERAL BUREAU OF INVESTIGATION
LABORATORY DIVISION
ATTENTION: EVIDENCE CONTROL UNIT
2501 INVESTIGATION PARKWAY
QUANTICO VA 22135**

- Ship evidence by U.S. Postal Service Registered Mail, United Parcel Service, or Federal Express. Record the method of shipment and the tracking number(s) on the chain-of-custody form.

[*Back to the top*](#)

Evidence Examinations

Abrasives	14	Hairs	62
Adhesives	15	Image Analysis	63
Anthropology	15	Inks	69
Arson	17	Latent Prints	70
Audio	18	Lubricants	77
Bank Security Dyes	20	Metallurgy	78
Building Materials	21	Missing Persons	81
Bullet Jacket Alloys	22	Paints	88
Bullet Leads	23	Pepper Sprays	
Caulks	15	or Foams	90
Chemical Unknowns	25	Pharmaceuticals	91
Computers	26	Polymers	92
Controlled Substances	30	Product Tampering	94
Cords	105	Questioned Documents	95
Crime Scene Surveys,		Racketeering Records	31
Documentation, and		Ropes	105
Reconstruction	31	Safe Insulations	106
Cryptanalysis	31	Sealants	15
Disaster Squad	51	Serial Numbers	107
DNA	33	Shoeprints	109
Electronic Devices	45	Soils	119
Explosives	47	Tapes	121
Explosives Residue	49	Tire Treads	109
Facial Imaging	50	Toolmarks	122
Feathers	51	Toxicology	125
Fibers	62	Videos	128
Firearms	52	Weapons of Mass	
Glass	57	Destruction	131
Gunshot Residue	60	Woods	132

Abrasives Examinations

Examinations can determine what type of abrasive material was used to sabotage engines or machinery.

Questions concerning abrasives evidence should be directed to 703-632-8441. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Employ personnel familiar with engine and machinery operations and mechanics to recover abrasives.
- Abrasives settle in oil and fuel. Submit the oil and fuel from the engine sump and/or filters.
- Abrasives embed in bearings and other parts. Submit the bearings and other parts.
- Submit abrasives in heat-sealed or resealable plastic bags or paint cans. Do not use paper or glass containers.

Adhesives, Caulks, and Sealants Examinations

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

Questions concerning adhesives, caulks, and sealants evidence should be directed to 703-632-8441. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- 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 film canister or plastic pill bottle.
- If possible, submit a suspect source. Package separately.

Anthropological Examinations

Anthropological examinations can determine whether something is a bone and, if so, whether

it is human or animal in origin. Race, sex, approximate height and stature, and approximate age at death can be determined from human remains. Damage to bone such as cuts, blunt-force trauma, and bullet holes may also be examined. Personal identifications can be made by comparing X-rays of a known individual to skeletal remains.

Anthropological examinations are usually conducted on bones sent to the Laboratory for DNA analysis or for facial reproductions.

Questions concerning anthropological evidence should be directed to 703-632-7691.

Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Clean and air-dry bones, if possible. Pack in paper bags and wrap in protective material such as bubble wrap or paper. If tissue is present on the skeletal material, refrigerate until mailing, and then ship in a Styrofoam cooler.
- Collect insect samples found on the remains in leakproof containers such as film canisters or plastic pill bottles. Call the Laboratory at 703-632-7691 for additional instructions and a list of local entomologists.

- Submit medical records and X-rays, if possible.

[Back to the top](#)

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 speciality solvents. Examinations generally cannot identify specific brands.

Search for the following at questioned arson scenes: candles, cigarettes, matchbooks, Molotov cocktails, fused chemical masses, or any electronic or mechanical devices that may have been used to assist the arsonist. Also search for cloth- or paper-burn trails, burn trails on carpeted or hardwood floors, and the removal of personal property or commercial inventory.

Questions concerning arson evidence should be directed to 703-632-7641. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- 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 the containers to the top. Pack to prevent breakage.

[*Back to the top*](#)

Audio Examinations

Authenticity

Authenticity examinations are conducted to determine whether audio recordings are original, continuous, unaltered, and consistent with the operation of the recording device used to make the recording.

Enhancement

Enhancement examinations are conducted to selectively reduce interfering noise on audio recordings to improve the intelligibility.

Voice Comparisons

Spectrographic examinations compare an unknown recorded voice sample to a known verbatim voice exemplar produced on a similar transmission and recording device such as the telephone. Decisions regarding spectrographic voice comparisons are not conclusive. The results of voice comparisons are provided for investigative guidance only.

Signal Analysis

Signal analysis examinations are conducted to identify, compare, and interpret signals such as gunshots and telephone touch-tones.

Damaged Media

Audio recordings can be repaired, restored, or retrieved for playback and examination, if damage is not too extensive.

Questions concerning audio examinations should be directed to 703-632-6222. Questions concerning audio evidence should be directed to 703-632-6191. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Write-protect the original recording.
- Submit original audio recordings.
- Identify known and questioned voice samples.
- Label the outer container FRAGILE, SENSITIVE ELECTRONIC EQUIPMENT or FRAGILE, SENSITIVE AUDIO/VIDEO MEDIA and KEEP AWAY FROM MAGNETS OR MAGNETIC FIELDS.

- Address the outer container as follows:

**FEDERAL BUREAU OF INVESTIGATION
ENGINEERING RESEARCH FACILITY
ATTENTION: FORENSIC PROGRAM
BUILDING 27958A
QUANTICO VA 22135**

[Back to the top](#)

Bank Security Dyes 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 dye and tear gas.

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

Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- 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. Collect an unstained control sample, package separately, and submit it with the dye-stained evidence. 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.

[Back to the top](#)

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 703-632-7690.

Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- When building materials are penetrated or damaged, debris can adhere to people, clothing, tools, bags, and loot 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 separate paper bags. 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.

[Back to the top](#)

Bullet Jacket Alloy Examinations

Elemental analysis of bullet jackets can be done when a bullet has fragmented so that individual pieces cannot be used for comparison to test-fired ammunition from a firearm or in the absence of a firearm or the lead component of the bullet. This analysis may be helpful when there are multiple shooters and types of jacketed ammunition. Alloy classification can differentiate among bullet jacket alloys of different manufacturers or among the bullet jacket alloys in manufacturers' production lines.

Questions concerning bullet jacket alloy examinations should be directed to 703-632-8441. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Ammunition components such as bullets, cartridge cases, and shotshell casings can be sent via registered mail through the U.S. Postal Service. Evidence must be packaged

separately with the date, time, location, collector's name, case number, and evidence number written on the container.

- 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 package(s) and the gross weight of the completed package(s) in grams.
- Do not mark bullets, cartridges, cartridge cases, shotshells, or shotshell casings. The date, time, location, collector's name, case number, and evidence number must be on the container.

[*Back to the top*](#)

Bullet Lead Examinations

Elemental analysis of the lead component of a bullet may be done when the bullet lacks sufficient microscopic marks for association with a specific firearm or when no firearm is

recovered. The concentrations of selected elements in the lead portion of bullets or shot pellets can chemically characterize the source of the lead and determine if specimens could have originated from the same source of manufactured lead.

Questions concerning bullet lead examinations should be directed to

703-632-8441. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Ammunition components such as bullets, cartridge cases, and shotshell casings can be sent via registered mail through the U.S. Postal Service. Evidence must be packaged separately with the date, time, location, collector's name, case number, and evidence number written on the container.
- 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 package(s) and the gross weight of the completed package(s) in grams.
- Do not mark bullets, cartridges, cartridge cases, shotshells, or shotshell casings. The date, time, location, collector's name, case number, and evidence number must appear on the container.

[*Back to the top*](#)

Chemical Examinations of General Unknowns

General unknowns include powders, liquids, and stains which are of indeterminate origin or cannot be readily classified. Full identification of an unknown may not 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 with a known comparison sample.

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.

Questions concerning general unknown examinations should be directed to 703-632-8441. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Submit powder and liquid samples in leakproof containers.
- 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. Collect an unstained control sample, package separately, and submit it with the stained evidence. 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.

[Back to the top](#)

Computer Examinations

Content

Examinations can determine what type of data files are in a computer.

Comparison

Examinations can compare data files to known documents and data files.

Transaction

Examinations can determine the time and sequence that data files were created.

Extraction

Data files can be extracted from the computer or computer storage media.

Deleted Data Files

Deleted data files can be recovered from the computer or computer storage media.

Format Conversion

Data files can be converted from one format to another.

Keyword Searching

Data files can be searched for a word or phrase and all occurrences recorded.

Passwords

Passwords can be recovered and used to decrypt encoded files.

Limited Source Code

Source code can be analyzed and compared.

Call the Computer Analysis Response Team at 703-632-6872 to request a search or field examination. Submit requests at least one week in advance.

Obtain as much of the following information as possible prior to submitting a request.

- Determine the type of computers and operating systems.
- If applicable, determine the type of network software, the location of the network servers, and the number of computers on the network.
- Determine whether encryption and/or password protection is used.
- Specify whether a seizure of computers and media or an on-site examination is required.

Questions concerning computer evidence should be directed to 703-632-6872. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- For most examinations, submit only the central processing units and the internal and external storage media.
- Use a sturdy cardboard container when

shipping computer components. If possible, use the original packing case with the fitted padding. Use large, plastic bubble wrap or foam rubber pads as packing. Do not use loose Styrofoam because it lodges inside computers and/or components and creates static charges that can cause data loss or damage to circuit boards. Seal the container with a strong packing tape.

- Pack and ship central processing units in the upright position. Label the outside container THIS END UP
- Disks, cartridges, tapes, and hard drives must be packed to avoid movement during shipping.
- Label the outer container FRAGILE, SENSITIVE ELECTRONIC EQUIPMENT and KEEP AWAY FROM MAGNETS OR MAGNETIC FIELDS.
- Address the outer container as follows:

**FEDERAL BUREAU OF INVESTIGATION
ENGINEERING RESEARCH FACILITY
ATTENTION: COMPUTER ANALYSIS
RESPONSE TEAM
BUILDING 27958A
QUANTICO VA 22135**

[*Back to the top*](#)

Controlled Substances Examinations

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

Bulk Drugs

The Laboratory limits the quantity of bulk drugs that it will analyze. Quantities exceeding 100 grams of marijuana or 10 grams of all other 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 only be accepted if the evidence is properly packaged to avoid contamination. Drug residue examinations of currency are performed only on a limited basis.

Call the Laboratory at 703-632-8441 prior to submitting drugs or currency to ensure that the evidence will be accepted for examination.

The communication accompanying the evidence must reference the telephone conversation accepting the evidence.

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

Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- 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.

[Back to the top](#)

Crime Scene Surveys, Documentation, and Reconstruction

Visual Information Specialists provide two- and three-dimensional victim and crime scene reconstructions and computer-animated modeling depicting bullet trajectory, line-of-sight analysis, and vehicular and human movement analysis.

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

Cryptanalysis and Racketeering Records Examinations

Cryptanalysis

Cryptanalysis examinations involve the analysis of encoded and enciphered documents used by

terrorists, foreign intelligence agents, violent criminals, street and prison gangs, and organized crime groups. Encrypted documents may be telefaxed or E-mailed for immediate decryption. Call 703-632-7333 for contact information.

Drug Records

Drug records are examined to determine the overall scope of the businesses including the hierarchy, type of drugs distributed, gross sales, gross or net weights or quantities, price structures, and other pertinent information.

Gambling

Gambling examinations include the interpretation of records from sports and horse bookmaking businesses, Internet gambling operations, numbers or lottery operations, and other gambling businesses.

Loan Sharking

Loan sharking records are examined to determine the amounts of the loans, amounts paid in interest and principal, number of loans, and interest rates.

Money Laundering

Money laundering records are examined to determine the scope of the operations, the amounts laundered, how the funds were laundered, and any other illegal activities.

Prostitution

Prostitution records are examined to determine the scope of the businesses including the number of employees, their roles, gross and net revenues, and other financial and organizational information.

Questions concerning evidence should be directed to 703-632-7333. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Documentary evidence must be preserved in the same condition it was found. It must not be folded, torn, marked, soiled, stamped, written on, or handled unnecessarily.

[Back to the top](#)

DNA Examinations

Deoxyribonucleic acid (DNA) is analyzed in body fluids, stains, and other biological tissues recovered from evidence. The results of DNA analysis of questioned biological samples are

compared with the results of DNA analysis of known samples. This analysis can associate victim(s) and/or suspect(s) with each other or with a crime scene.

There are two sources of DNA used in forensic analyses. Nuclear DNA (nDNA) is typically analyzed in evidence containing blood, semen, saliva, body tissues, and hairs that have tissue at their root ends. Mitochondrial DNA (mtDNA) is typically analyzed in evidence containing naturally shed hairs, hair fragments, bones, and teeth.

Questions concerning nuclear DNA evidence should be directed to 703-632-8446.

Questions concerning mitochondrial DNA evidence should be directed to 703-632-7572.

Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

Documenting, Collecting, Packaging, and Preserving DNA Evidence

If DNA evidence is not properly documented, collected, packaged, and preserved, it will not meet the legal and scientific requirements for admissibility in a court of law.

- If DNA evidence is not properly documented, its origin can be questioned.

- If it is not properly collected, biological activity can be lost.
- If it is not properly packaged, contamination can occur.
- If it is not properly preserved, decomposition and deterioration can occur.

When DNA evidence is transferred by direct or secondary (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 that 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.

Blood Examinations

Examinations can determine the presence or absence of blood in stains. Examinations can also determine whether blood is human or not. Blood examinations cannot determine the age or the race of a person. Conventional serological techniques

are not adequately informative to positively identify a person as the source of a stain.

Collecting Known 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 tubes with EDTA as an anticoagulant for DNA analysis. Collect drug- or alcohol-testing samples in gray-top tubes with NaF (sodium fluoride).
- Identify each tube with the date, time, subject's name, location, collector's name, case number, and evidence number.
- Refrigerate, do not freeze blood samples. Use cold packs, not dry ice, during shipping.
- Pack liquid blood tubes individually in Styrofoam or cylindrical tubes with absorbent material surrounding the tubes.
- Label the outer container KEEP IN A COOL DRY PLACE, REFRIGERATE ON ARRIVAL, and BIOHAZARD.
- Submit to the Laboratory as soon as possible.

Blood on a Person

- Absorb suspected **liquid blood** onto a clean cotton cloth or swab. Leave a portion of the cloth or swab unstained as a control. Air-dry the cloth or swab and pack in clean 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 distilled water. Leave a portion of the cloth or swab unstained as a control. 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. Leave a portion of the cloth or swab unstained as a control. 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 dilution. Eliminate as much snow as possible. Place

in a clean airtight container. Freeze the evidence and submit as soon as possible to the Laboratory.

Bloodstains

- Air-dry **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. Collect an unstained control sample. 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 distilled water. Leave a portion of the cloth or swab unstained as a control. Air-dry the cloth or swab and pack in clean paper or an envelope with sealed corners. Do not use plastic containers.

Blood Examination Request Letter

A blood examination request letter must contain the following information:

- A brief statement of facts relating to the case.
- Claims made by the suspect(s) regarding the source of the blood.
- Whether animal blood is present.
- Whether the stains were laundered or diluted with other body fluids.
- Information regarding the victim(s)' and suspect(s)' health such as AIDS, hepatitis, or tuberculosis.

Semen and Semen Stains

- Absorb suspected **liquid semen** onto a clean cotton cloth or swab. Leave a portion of the cloth or swab unstained as a control. 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. Collect an unstained control sample. 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 distilled water. Leave a portion of the cloth or swab unstained as a control. Air-dry the swab or cloth and place in clean paper or an envelope with sealed corners. Do not use plastic containers.

Seminal Evidence From Sexual Assault Victim(s)

- Sexual assault victim(s) 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 as soon as possible to the Laboratory.

Buccal (Oral) Swabs

- Use clean 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, subject's name, location, collector's name, case number, and evidence number.
- Buccal samples do not need to be refrigerated.

Saliva and Urine

- Absorb suspected **liquid saliva or urine** onto a clean cotton cloth or swab. Leave a

portion of the cloth unstained as a control. Air-dry the cloth or swab and pack in clean paper or an envelope with sealed corners. Do not use plastic containers.

- Submit suspected small, **dry saliva- or urine-stained objects** to the Laboratory. Pack to prevent stain removal by abrasive action during shipping. Pack in clean paper or an envelope with sealed corners. 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. Collect an unstained control sample. Pack to prevent stain removal by abrasive action during shipping. Pack in clean paper. Do not use plastic containers.
- 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.

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.
- Refrigerate and submit as soon as possible to the Laboratory.

Tissues, Bones, and Teeth

Call the Laboratory at 703-632-7572 prior to submitting suspected tissues, bones, or teeth to ensure that the evidence will be accepted for examination. The communication accompanying the evidence must reference the telephone conversation accepting the evidence.

- Pick up suspected tissues, bones, and teeth with gloved hands or clean forceps.

- Collect 1-2 cubic inches of red skeletal muscle.
- Collect 3-5 inches of long bone such as the fibula or femur.
- Collect teeth in the following order:
 1. nonrestored 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 tissue samples in a clean, airtight plastic container without formalin or formaldehyde. Place teeth and bone samples in clean paper or an envelope with sealed corners.
- Freeze the evidence, place in Styrofoam containers, and ship overnight on dry ice.

[*Back to the top*](#)

Electronic Devices Examinations

Commercial Electronic Devices

Examinations of commercial electronic devices including personal digital assistants (PDA), cellular telephones, pagers, and global positioning systems (GPS), can extract user and/or owner-entered data and other information. In some cases, it is necessary to disassemble the devices during examination.

Interception of Communication Devices

Interception of communication devices (IOC) are used to unlawfully intercept oral or wire communications. The devices consist of radio frequency transmitters and receivers. Examinations are conducted to identify operating characteristics (frequency of operation, range of operation). In some cases, it is necessary to disassemble the devices during examination.

Other Electronic Devices and/or Circuits

Examinations on other electronic devices and/or circuitry including facsimile machines, stun guns, and bomb detonators can extract user and/or owner-entered data, stored data, and other information. The examinations can identify operating characteristics and modifications

made to the devices. In some cases, it is necessary to disassemble the devices and/or circuits during examination.

Questions concerning electronic devices examinations should be directed to 703-632-6200. Questions concerning shipping electronic devices evidence should be directed to 703-632-6191. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Label the outer container FRAGILE, SENSITIVE ELECTRONIC EQUIPMENT and KEEP AWAY FROM MAGNETS OR MAGNETIC FIELDS.
- Address the outer container as follows:

**FEDERAL BUREAU OF INVESTIGATION
ENGINEERING RESEARCH FACILITY
ATTENTION: FORENSIC PROGRAM
BUILDING 27958A
QUANTICO VA 22135**

[Back to the top](#)

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 fuzing 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.

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.

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

Explosives are hazardous materials and must only be handled 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.

[Back to the top](#)

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.

Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- 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. Zip-lock storage bags are not suitable for shipping or storing explosives residue evidence. Do not fill the containers to the top. Pack to prevent breakage.

- 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.

[*Back to the top*](#)

Facial Imaging

Visual Information Specialists provide composite drawings, two- and three-dimensional facial reconstructions from skeletal remains, facial age progressions, postmortem reconstructions, and digital photographic manipulations and retouches.

Questions concerning facial imaging should be directed to 703-632-8194.

FBI Disaster Squad

- Assists in printing the deceased at disaster scenes.
- Assists in collecting antemortem fingerprints of victims.
- Assists in identifying friction ridge skin of the deceased.
- Deployment of the FBI's Disaster Squad requires consent from the disaster scene coroner or medical examiner, 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 Office of Strategic Information and Operations Center at 202-323-3300.**

See [*Latent Print Examinations*](#).

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 703-632-7690. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

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

[Back to the top](#)

Firearms Examinations

Firearms

Firearms examinations can determine the general condition of a firearm and whether the firearm is mechanically functional or in a condition that could contribute to an unintentional discharge. Trigger-pull examinations can determine the amount of pressure necessary to release the hammer or firing pin of a firearm. Examinations can determine whether a firearm was altered to fire in the full-automatic mode. Obliterated and/or altered firearm serial numbers can sometimes be restored. Firearms can be test-fired to obtain known specimens for comparison to evidence ammunition components such as bullets, cartridge cases, and shotshell casings.

Comparisons of suspect firearms can be made with firearms depicted in surveillance

images. Photogrammetry can determine the length of the weapon(s) used by the subject(s) depicted in the surveillance films. [See Image Analysis Examinations.](#)

Bullets

Fired bullets can be examined to determine the general rifling characteristics such as caliber and physical features of the rifling impressions and the manufacturer of the bullets. The microscopic characteristics on evidence bullets can be compared to test-fired bullets from a suspect firearm to determine whether the evidence bullet was fired from that firearm.

Cartridge Cases or Shotshell Casings

Cartridge cases or shotshell casings examinations can determine the caliber or gauge, the manufacturer, and whether there are marks of value for comparison. The images of questioned cartridge cases and shotshell casings can be scanned into the National Integrated Ballistics Information Network to compare with evidence from other shooting incidents. The microscopic characteristics of evidence cartridge cases and shotshell casings can be examined to determine whether they were fired from a specific firearm.

Shot Pellets, Buckshot, or Slugs

Examinations of shot pellets, buckshot, or slugs can determine the size of the shot, the gauge of the slug, and the manufacturer.

Wadding

Examinations of wadding components can determine the gauge and the manufacturer.

Unfired Cartridges or Shotshells

Examinations of unfired cartridges or shotshells can determine the caliber or gauge and whether there are marks of value for comparison.

Examinations can also determine whether the ammunition was loaded in and extracted from a specific firearm. Unfired and fired cartridges or shotshells can be associated through manufacturing marks.

Gunshot Residue on Victim's Clothing

The deposition of gunshot residue on evidence such as clothing varies with the distance from the muzzle of the firearm to the target. Patterns of gunshot residue can be duplicated using a questioned firearm and ammunition combination fired into test materials at known distances. These patterns serve as a basis for estimating muzzle-to-garment distances.

Gun Parts

Gun parts examinations can determine the caliber and model of gun from which the parts originated.

Silencers

Muzzle attachments can reduce the noise of a firearm by suppressing sound during firing. Testing can determine whether a muzzle attachment can be classified as a silencer based on a measurable sound-reduction capability.

Questions concerning firearms evidence should be directed to 703-632-8442. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- All firearms must be unloaded.
- The firearm should be submitted.
If the firearm cannot be submitted, call 703-632-8442 for instructions.
- The firearm must be minimally handled 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 and ammunition components such as bullets, 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.
- 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 package(s) and the gross weight of the completed package(s) in grams.
- Do not mark the firearm. Firearms must be identified with a tag containing the caliber, make, model, and serial number. The date, time, owner(s)' name(s), location, collector's name, case number, and evidence number must be on the container.

- Do not mark bullets, cartridges and cartridge cases, shotshells and shotshell casings, and other firearms-related evidence. The date, time, location, collector's name, case number, and evidence number must be on the container.
- Clothing submitted for gunshot residue examination must be carefully handled, air-dried, and wrapped separately in paper. Clothing with blood must be air-dried and labeled BIOHAZARD on the inner and outer containers. The date, time, location, collector's name, case number, and evidence number must be on the container.

[Back to the top](#)

Glass Examinations

Glass comparison examinations can determine whether particles of glass originated from a broken source of glass. Glass fracture examinations can determine the direction and type of the breaking force and the sequencing of shots.

Questions concerning glass evidence should be directed to 703-632-7690. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

Comparison

- 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 victim(s)' and suspect(s)' air-dried clothing. Each item must be packaged separately in a paper bag.
- Search for particles in the victim(s)' and suspect(s)' hair, skin, and wounds. 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 and questioned debris separately to avoid contamination.
- Do not process evidence for latent prints.

Fracture

- 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 fitted 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 plywood or sturdy cardboard. Do not place any objects into the impact area.
- Do not process evidence for latent prints.

[Back to the top](#)

Gunshot Residue on Hands Examinations

For muzzle-to-target distance determinations involving gunshot residue, [see Firearms Examinations](#).

When a firearm is discharged, vaporous and particulate materials called gunshot residue (GSR) are expelled. After collecting gunshot residue from a suspected shooter's hands, the major elemental components of most cartridge primer mixtures can be analyzed to associate a suspect with the recent discharge of gunpowder from a firearm. This examination is used to determine if a person was in the presence of gunshot residue within a limited time period after a weapon discharge.

The Laboratory provides gunshot residue examinations to assist FBI field office investigations only.

Questions concerning gunshot residue evidence should be directed to 703-632-8441. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Only gunshot residue evidence obtained using a collection kit designed for scanning electron microscopy will be accepted. Call

the Laboratory at 703-632-8441 regarding the appropriate collection kits.

- Usually gunshot residue examinations will only be performed when samples are collected from living persons' hands.
- Gunshot residue evidence must be collected within five hours of exposure to the discharge of a firearm.
- Complete the information sheet included with the gunshot residue collection kit, and follow the instructions for collecting evidence.
- Collecting gunshot residue samples requires five adhesive lifts suitable for scanning electron microscopic analysis. Dab the adhesive side of the stub against the surface (right palm, back of right hand, left palm, back of left hand). Use one stub per sampling surface. The remaining stub will be used as a control. Label each sampling surface stub (e.g., RIGHT PALM, BACK OF RIGHT HAND). Cap and seal the stubs in separate, resealable plastic bags.

[*Back to the top*](#)

Hairs and Fibers Examinations

Hairs

Hair examinations can determine whether hairs are animal or human. Race, body area, method of removal, damage, and alteration (e.g., bleaching or dyeing) can be determined from human hair analysis. Examinations can associate a hair to a person on the basis of microscopic characteristics in the hair but cannot provide absolute personal identification. Hairs that are associated will be submitted for mitochondrial DNA analysis. The animal species and family can be determined from hair analysis.

Fibers

Fiber examinations can identify the type of fiber such as animal (wool), vegetable (cotton), mineral (glass), and synthetic (manufactured). Questioned fibers can be compared to fibers from victim(s)' and suspect(s)' clothing, carpeting, and other textiles. A questioned piece of fabric can be physically matched to known fabric. Fabric composition, construction, and color can be compared, and impressions on fabric and from fabric can be examined. Clothing manufacturers' information can be determined by label searches.

Questions concerning hairs and fibers evidence should be directed to 703-632-8449.

Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Collect at least 25 known hairs from different parts of the head and/or pubic region. Comb and pull out the hairs. Submit hairs in clean paper or an envelope with sealed corners.
- When possible, submit the entire garment or textile. Submit fibers in clean paper or an envelope with sealed corners.

[Back to the top](#)

Image Analysis Examinations

Photographic Comparisons

Examinations of film, negatives, digital images, photographic prints, and video recordings including surveillance images involve comparisons of subject(s) depicted in the questioned images with known images (e.g., photographs, videos) of suspect(s). Similar comparisons can be made between the subject(s)' clothing and clothing seized from the suspect(s). Comparisons can also be made with firearms, vehicles, and other objects depicted in surveillance images.

Photogrammetry

Dimensions can be derived from photographic images through the use of geometric formulae or on-site comparison. Examples of photogrammetry include determining the height of bank robbery subject(s) and the length of the weapon(s) used by the subject(s) depicted in the surveillance films.

Location, Time, and Date

Examinations of photographic evidence can determine the location, time, and date that an image was taken.

Authenticity and Image Manipulation Detection

Photographic evidence including film, video, and digital images can be examined to determine whether the image is the result of a composite, an alteration, or a copy.

Source and Age

Photographic products including film and prints can be dated, and the source can be established by examining manufacturing characteristics. This can establish the time frame during which a photograph was taken.

Cameras

Cameras seized as evidence can be examined to determine whether a specific camera exposed a specific image. Digital cameras, including digital-video cameras, can be compared with digital images and video clips to determine whether a specific camera captured a specific image or video clip.

Videos

Black-and-white and color photographic images can be produced from video images for enlargement and used in courtroom presentations.

Automobile Make and Model Identification

Vehicles depicted in surveillance images can be compared with the National Automotive Image File to determine make and model.

Child Pornography Examinations

The seized images of child pornography can be compared against images in the Child Exploitation and Obscenity Reference File to identify the source of the images. Video clips can be examined to determine if any of the people and scenes depicted in the video clips are also recorded as still images in the File. Video clips and still images can also be examined to

determine if they depict recordings or images of real people and events or whether they represent computer-generated subjects and events.

Questions concerning image analysis examinations should be directed to 703-632-6222. Questions concerning image analysis evidence should be directed to

703-632-6191. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Write-protect the original recording. Never use the Pause operation when viewing original video recordings.
- Submit original evidence (e.g., film or videotape) whenever possible because it contains the greatest level of detail. If the originals are unavailable, submit first generation photographic prints or videotapes.
- Process all film, including bank surveillance film, prior to submitting.
- When requesting forensic examinations based on video images, queue the original videotape to the approximate time of the pertinent area. State in a communication the date and time of the pertinent area and use the date-time stamp on the images or

the counter indicator (set from the beginning of the tape at 000). If prints from the relevant frames are available, submit them for reference.

- Arrest or known photographs of suspect(s) for comparison with questioned images must depict the suspect(s) from many angles similar to the questioned images. If a facial comparison is requested, ensure that the suspect(s)' face or head fills more than half of the frame. If questioned images show tattoos or marks, include photographs of the same areas on the known suspect(s)' body.
- When taking known photographs for comparison with questioned images, use 35mm black-and-white film. If color film is used, include a color chart in the photographs.
- Do not mark or cut items submitted for comparison (e.g., clothing or firearms) where they are visible in the questioned images.
- Physical items such as clothing and firearms must first be submitted to the Laboratory for other examinations before they are submitted for image comparison.

- If photogrammetry is requested, include the dimensions of the scene to the nearest 1/8 inch and include a diagram or print from the surveillance film indicating the location of the measurements. Include one diagram or print for every angle used in the scene. Do not touch or move surveillance cameras except to remove the film.
- Submissions for comparison with the Child Exploitation and Obscenity Reference File must be limited to no more than 30 images. Call 703-643-6222 for specific instructions.
- Address the outer container as follows:
**FEDERAL BUREAU OF INVESTIGATION
ENGINEERING RESEARCH FACILITY
ATTENTION: FORENSIC PROGRAM
BUILDING 27958A
QUANTICO VA 22135**

[*Back to the top*](#)

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 is usually limited to comparisons of the organic dye components. When ink formulations are the same, it is not possible to determine whether the ink originated from the same source to the exclusion of others. Examinations cannot determine how long ink has been on a document.

Questions concerning ink evidence should be directed to 703-632-8441. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

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

Latent Prints Examinations

Developing Latent Prints at Crime Scenes

The Laboratory is the best place to develop latent prints; however, it is sometimes necessary to develop latent prints at crime scenes. Caution should be taken to prevent destroying latent prints. The following are measures to ensure that crime scene latent prints are protected:

- Photograph latent prints prior to any processing.
- Examine all evidence visually and with a laser or an alternate light source before using any other latent print development process.
- When using latent print development processes, refer to the manufacturer's instructions and the Material Safety Data Sheets. Use personal protective equipment (e.g., safety glasses, masks, gloves, smocks).
- The *Processing Guide for Developing Latent Prints* is a comprehensive list of latent print processes and protocols. Refer to this document so that proper processes are applied in the recommended order. Following this guide will maximize the potential to

develop latent prints and will preserve evidence if other forensic examinations are required. The guide is available at www.fbi.gov/hq/lab/fsc/backissu/jan2001/lpu.pdf. Law enforcement personnel may request a field manual format of the *Processing Guide for Developing Latent Prints* by telefaxing a request on agency letterhead to 703-632-8374.

Photographing Latent Prints

- Use a tripod and cable release when photographing latent prints.
- Use a 35mm or medium-format camera with a macro lens capable of half-size to full-size reproduction.
- Photograph latent prints at each step in the processing sequence before moving to the next process.
- Photograph latent prints developed with fingerprint powders before lifting them.
- Use T-Max 400 film. Set the f-stop to f/11. Adjust the shutter speed setting to correspond with the f-stop setting by using the camera's metering system.

- Take three exposures of each latent print by bracketing:
 - Original exposure.
 - One stop underexposed image.
 - One stop overexposed image.
- Photograph latent prints individually. This ensures that the target latent print is in focus.
- For reference purposes, photograph latent prints close to each other in one frame, if possible.
- Fill the frame completely.
- Photograph latent prints with an identification label that includes a scale, reference number, date, collector's initials, and location of the latent prints. The identification label should be placed on the same plane as the latent prints.
- Maintain a photographic log that records each shot, reference number, date, collector's initials, location of prints, and other pertinent information.

Lifting Latent Prints

- Photograph latent prints developed with fingerprint powders before lifting them.
- Apply black, gray, or white powder to the surface with a long hair brush. The color of the powder should contrast with the color of the surface (e.g., black for light surfaces or gray or white for dark surfaces).
- Use a short hair brush to remove excess powder. Use caution when powdering. Avoid overbrushing a latent print and losing clarity.
- Use transparent tape or black-and-white rubber lifts to lift latent prints.
- When transparent tape is used, the color of the backing card should contrast with the color of the powders (e.g., white backing card for black powder).

Questions concerning latent print evidence should be directed to 703-632-8443. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Stabilize the evidence to avoid movement or friction during shipping.

- Place nonporous evidence (e.g., nonabsorbent, hard surfaces) in separate protective coverings such as thick transparent envelopes or suspend in a container so that there is minimal surface contact. Friction will destroy latent prints on this type of surface.
- Place porous evidence (e.g., paper, cardboard) in separate protective coverings. Friction will not generally destroy latent prints on this type of surface.
- Submit known fingerprints and palm 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 biographical and/or demographical information.
- Palm prints should be taken on only one side of a separate card, not on the reverse side of a fingerprint card or on the reverse side of a card that has a recorded impression on the other side.
- Fingerprint cards and/or major case prints should include, at a minimum, the name of the person printed, the name of the person recording the prints, date, case identification

number, and a brief statement of facts relating to the case. The fingerprint card should bear an arrest offense.

- The notation “elimination prints” should be included if the person printed is not a suspect.
- When known prints are submitted separately from evidence, reference previous communications and case-identifying numbers and other pertinent information.

Submitting Hands and/or Fingers of an Unknown Deceased

- Pack each hand and/or finger in separate unbreakable, watertight, and airtight containers.
- Label each container (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) by the most expeditious means.
- Provide a complete physical description of the deceased, if possible.
- Affix a BIOHAZARD label on the outer container.

- All human remains will be returned to the contributor.
- Address the outer container as follows:

**FEDERAL BUREAU OF INVESTIGATION
LABORATORY DIVISION
ATTENTION: EVIDENCE CONTROL UNIT
2501 INVESTIGATION PARKWAY
QUANTICO VA 22135**

Legible, complete ten-print fingerprint cards not related to an ongoing Laboratory investigation should be sent to the FBI's Criminal Justice Information Services Division.

- Address the outer container as follows:
**FEDERAL BUREAU OF INVESTIGATION
CRIMINAL JUSTICE INFORMATION SERVICES
DIVISION
1000 CUSTER HOLLOW ROAD
CLARKSBURG WV 26306**
- Questions concerning ten-print fingerprint cards should be directed to 304-625-2360.

[*Back to the top*](#)

Lubricants 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. Lubricants examinations may be conducted in sexual assault, vehicular homicide, or heavy equipment sabotage cases.

Questions concerning lubricants evidence should be directed to 703-632-8441. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- 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

Comparison

Comparative examinations can determine whether two metals or metallic objects came 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 can also 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 can also be determined.

Specification Frauds 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. In some cases, the country of origin can be determined. Precious metal contents can also 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, it can be determined whether an explosive was detonated and the magnitude of the detonation velocity can be determined. The nature of the object that was the source of the fragments can also often be determined.

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 can often be determined.

Lamp Bulbs

Examinations can determine whether a lamp bulb was incandescent when its glass envelope was broken. Determinations can also be made whether a lamp bulb was incandescent when it was subjected to an impact force such as a vehicular collision. Such determinations can be made whether or not the glass was broken by the impact.

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 positions of on/off switches and other mechanical components can be determined.

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

Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

[*Back to the top*](#)

National Missing Persons DNA Database Examinations

Samples must be submitted through FBI field offices or resident agencies. All submissions must have an FBI Investigative Classification of 301 unless the samples are submitted under an existing FBI case identification number. Samples should also have a National Crime Information Center and/or a Violent Criminal Apprehension Program number.

Call the National Missing Persons DNA Database program manager at 703-632-7582 prior to submitting samples or for questions

concerning samples. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

Samples from Biological Relatives of Missing Persons

- Samples must be sent with a Consent and Information Form for the National Missing Persons DNA Database (FD-935 form).
- Collect samples in the following order of preference:
 1. dried bloodstains.
 2. liquid blood.
 3. buccal (oral) swabs.

Dried Bloodstains

- Collect dried bloodstains using a finger lancet (also used to collect samples for blood-glucose testing). Place 2-4 drops of blood on sterile cotton gauze.
- Air-dry the cotton gauze prior to packaging. It can be shipped without ice or refrigeration.
- Pack to prevent stain removal by abrasive

action during shipping. Pack in clean paper. Do not use plastic containers.

- Label the outer container KEEP IN A COOL DRY PLACE, REFRIGERATE ON ARRIVAL, and BIOHAZARD.

Liquid Blood

Only qualified medical personnel should collect liquid blood samples from a person.

- Collect at least two 5-mL tubes of blood in purple-top tubes with EDTA as an anticoagulant for DNA analysis.
- Identify each tube with the date, time, subject's name, location, collector's name, case number, and evidence number.
- Refrigerate, do not freeze blood samples. Use cold packs, not dry ice during shipping.
- Pack liquid blood tubes individually in Styrofoam or cylindrical tubes with absorbent material surrounding the tubes.
- 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 cotton swabs to collect two 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, subject's name, location, collector's name, case number, and evidence number.
- Buccal samples do not need to be refrigerated.

Samples from Unidentified Human Remains

Call the Laboratory at 703-632-7582 prior to submitting bones, teeth, or tissues to ensure that the missing person samples will be accepted by the Laboratory. The communication accompanying the evidence must reference the telephone conversation accepting the evidence.

Bones

Anthropological examinations can determine whether skeletal remains are human or animal. Race, sex, approximate height, and stature at death can be determined from human remains.

- Bones must be submitted with an anthropological report, preferably from an American Board of Forensic Anthropology-certified anthropologist, or a medical examiner's report.
- Pick up bones with gloved hands or clean forceps.
- If possible, three bones should be submitted.
- Send whole bones. Cutting the bones increases the possibility of contamination.
- Bones must be air-dried and placed in paper bags.
- Collect bones in the following order:
 1. femur.
 2. tibia.
 3. rib.
 4. humerus.
 5. lower arm bone.
 6. skull.
 7. vertebrae.
 8. hand and foot bones.

Teeth

Personal identifications can be made by comparing teeth with dental records and X-rays.

- Teeth must be submitted with an odontological report, preferably from an American Board of Forensic Odontology-certified odontologist, or a medical examiner's report.
- Pick up teeth with gloved hands or clean forceps.
- Teeth must be air-dried and placed in paper bags.
- Collect teeth in the following order:
 1. nonrestored molar.
 2. nonrestored premolar.
 3. nonrestored canine.
 4. nonrestored front tooth.
 5. restored molar.
 6. restored premolar.
 7. restored canine.
 8. restored front tooth.

Tissues

Tissue samples will usually provide sufficient quantities of DNA for testing.

- Pick up tissues with gloved hands or clean forceps.
- Collect 1-2 cubic inches of red skeletal muscle.
- Tissue samples must be placed in a clean, airtight plastic container without formalin or formaldehyde and kept refrigerated.
- Label the outer container KEEP IN A COOL DRY PLACE, REFRIGERATE ON ARRIVAL, and BIOHAZARD.
- Submit to the Laboratory as soon as possible.

[*Back to the top*](#)

Paint Examinations

A comparison of the layer structure of a questioned paint sample can be compared with known sources. 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 can 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 or architectural paints.

Questions concerning paint evidence should be directed to 703-632-8441. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Search the accident or crime scene and the victim(s)' personal effects to locate paint fragments. Paint fragments are often found in the clothing of a hit-and-run victim(s).

Submit the clothing. 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 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 vials or pillboxes. Do not stick paint particles on adhesive tape. Do not use plastic bags, cotton, or envelopes to package paint specimens.

[*Back to the top*](#)

Pepper Spray or Foam Examinations

Oleoresin capsicum is a resin in various peppers. It may be used in self-defense sprays or foams. Ultraviolet dye (orange) and/or tear gas may also 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.

Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- 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.

Pharmaceutical Examinations

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

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

Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

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

Polymers Examinations

Polymer evidence typically consists of pieces of plastic or other man-made materials. The source, use, or manufacturer of polymer evidence usually cannot be identified by composition 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 polymers evidence should be directed to 703-632-8441.

Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- 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 the victim(s)' personal effects to locate plastic fragments. Submit fragments in leakproof containers such as film canisters or plastic pill bottles. Do not use cotton or paper containers.
- Remove damaged suspect motor-vehicle parts and package separately in resealable plastic bags or boxes.
- 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 a section where the transfer is suspected with a clean, sharp instrument. Collect an unstained control sample. Pack to prevent stain removal by abrasive action during shipping. Pack in clean paper. Do not use plastic containers.

[Back to the top](#)

Product Tampering Examinations

Product tampering is when a commercial product is intentionally distorted to harm someone or for extortion purposes. 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 and product specifications in commercial products.

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

Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Submit control samples of the unadulterated product.
- Package and ship 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.
- Caution should be taken to prevent destroying latent prints.

Questioned Documents Examinations

Handwriting and Hand Printing

Although not all handwriting is identifiable to a specific writer, the examination of handwriting characteristics can sometimes determine the origin or authenticity of questioned writing. Traits such as age, sex, personality, or intent cannot be determined from handwriting examinations. Some reasons for inconclusive results include the following:

- Limited questioned and/or known writing.
- Lack of contemporaneous writing or lapse of time between execution of questioned and known writing.
- Distortion or disguise in the questioned and/or known writing.
- Lack of sufficient identifying characteristics.
- Submission of photocopied evidence instead of original evidence.

Procedures for Obtaining Known Writing

Exemplars

- The 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 in 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 exemplars from the writer's sight as soon as completed.
- Obtain exemplars from dictation until normal writing has been produced. Normal handwriting is assessed by determining whether the writing is too quickly or slowly executed and whether the handwriting is consistent.
- Obtain exemplars from the right and left hands.
- Obtain hand printing exemplars in upper- and lowercase letters.
- Obtain exemplars written rapidly, slowly, and at varied slants.

- Obtain a sufficient quantity of exemplars to account for natural variation in the writing.
- Obtain undictated writing such as business records, personal correspondence, and canceled checks.

Altered or Obliterated Writing

The presence of altered or obliterated writing can sometimes be determined, and the writing can sometimes be deciphered.

Common Types of Nongenuine Signatures

- Traced signatures are prepared by 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.

Typewriting

Questioned typewriting can occasionally be identified with the typewriter that produced it. This is most common when the typewriter is a typebar machine. The identification can sometimes be 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 elements and carbon film or correction ribbons can sometimes be associated with specific texts by examining individual characteristics of the elements and by correlating the text and ribbons.

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

Carbon film typewriter ribbons can sometimes be read for content or specific wording of questioned material. Carbon film ribbons can sometimes be identified with questioned typewritten impressions. Fabric ribbons cannot be read.

Procedures for Obtaining Known Typewriting Exemplars

- If the typewriter has a carbon film ribbon, remove it from the typewriter and submit it to the Laboratory. Also submit the correction tape. 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 strike and the carbon paper strike exemplars to the Laboratory.

- Obtain two full word-for-word texts of the questioned text and type the entire keyboard (all symbols, numbers, and upper- and lowercase letters) two times.
- 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 directed the exemplars.
- Obtain the typewriter service and/or repair history.
- It is not normally 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) must also be submitted to the Laboratory.

Photocopies

Photocopies can sometimes be identified with the machine producing them if the exemplars and questioned copies are relatively contemporaneous. The possible make and model of the photocopy machine can sometimes be determined by comparison with the Office Equipment File.

Procedures for Obtaining Known Photocopy Exemplars

- Obtain at least ten exemplars with no document on the glass plate, with the cover down.
- Obtain at least ten exemplars with no document on the glass plate, with the cover up.
- Obtain at least ten exemplars with a document on the glass plate, with the cover down.
- Record on each exemplar the date the exemplars were obtained, the name of the person who directed the exemplars, and the conditions under which the exemplars were made.
- Record the make, model, and serial number of the photocopy machine, 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, or editor board.

- Do not store or ship photocopies in plastic envelopes.

Graphic Arts (Printing)

Printed documents can sometimes be associated as originating from a common source or identified with known printing paraphernalia such as artwork, negatives, and plates.

Paper

Torn edges can sometimes be positively matched. The manufacturer can sometimes be determined if a watermark 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.

Burned or Charred Paper

Information on burned or charred documents can sometimes be deciphered. The document must be minimally handled. 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.

Age of a Document

The earliest date a document could have been prepared can sometimes be determined by examining watermarks, indented writing, printing, and typewriting.

Carbon Paper or Carbon Film Ribbon

Examination of used carbon paper or carbon film ribbon can sometimes disclose the content of the text.

Checkwriters

A checkwriter impression can sometimes be identified with the checkwriter that produced it. Examining a checkwriter impression can sometimes determine the brand of the checkwriter.

Embossings and Seals

An embossed or seal impression can sometimes be identified with the instrument that produced it.

Rubber Stamps

A rubber stamp impression can sometimes be identified with the rubber stamp that produced it. Submit the rubber stamp to the Laboratory uncleaned.

Plastic Bags

Plastic bags (e.g., sandwich and garbage bags) can sometimes be identified with a roll or a box from which it originated.

Bank Robbery Note File

The Bank Robbery Note File contains images of notes used in bank robberies. This file can be searched in an attempt to associate by text a note from one bank robbery to others.

Anonymous Letter File

The Anonymous Letter File contains images of anonymous letters submitted to the Questioned Documents Unit for examination. This file can be searched in an attempt to associate by text a letter from one case to letters from others.

Questions concerning documentary evidence should be directed to 703-632-7277.

Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

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

documents unobtrusively by writing the collector's initials, date, and other information with a pencil.

- Whenever possible, submit the original evidence to the Laboratory. The lack of detail in photocopies makes examinations difficult. Copies are sufficient for reference file searches.
- Do not store or ship photocopies in plastic envelopes.

[Back to the top](#)

Ropes and Cords Examinations

A piece of rope or cord can be compared with a questioned rope or cord. The composition, construction, color, and diameter can be determined. If a tracer is present, the manufacturer can be determined.

Questions concerning ropes and cords evidence should be directed to 703-632-8449.

Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Submit the entire rope or cord. If the rope or cord must be cut, specify which end was cut during evidence collection.
- Label the known and questioned samples.
- Handle the sections of rope or cord carefully to prevent loss of trace material or contamination.
- Submit in heat-sealed or resealable plastic or paper bags.

Safe Insulation Examinations

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

Questions concerning safe insulation evidence should be directed to 703-632-7690.

Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Collect safe insulation samples from damaged areas.
- Safe insulation can adhere to people, clothing, tools, bags, and loot 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 separate paper bags. 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 Examinations

Obliterated serial or identification numbers are often restorable including markings on metal, wood, plastic, and fiberglass. Comparisons can be made with suspect dies.

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

Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- If possible, remove the piece of frame rail containing the serial number, indicate where on the vehicle the cut was taken, and submit it to the Laboratory.
- If it is not possible to submit a piece of the frame rail, make a cast to submit to the Laboratory.
 1. Use an acrylic surface replica cast kit. Call the Laboratory at 703-632-8442 regarding the appropriate cast kit.
 2. Different formulas are used in different temperatures. If possible, move the evidence to a warm area.
 3. Casts will duplicate foreign material in the stamped characters. Clean the area

before proceeding. Remove paint and 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.

4. Build a dam around the stamped characters to retain the acrylic liquid while it hardens. The dam material must be soft and pliable such as modeling clay. Ensure there are no voids in the dam.
5. Following the instructions in the kit, mix the liquid and powder for one minute and pour it into the dam.
6. The acrylic liquid will take 30 minutes to harden. Remove the cast when it is hard. If paint and rust are on the cast, make additional casts and submit the cleanest cast to the Laboratory.
7. Indicate where on the vehicle the cast was taken.
8. Pack the cast to prevent breakage.

[*Back to the top*](#)

Shoeprint and Tire Tread Examinations

Shoeprint 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. The examination of detailed shoeprint and tire tread impressions often results in the positive identification of the suspect(s)' shoe(s) or tire(s) from the suspect(s)' vehicle(s).

Photographing Shoeprint and Tire Tread Impressions

General crime scene photographs must be taken to relate the impressions to the crime scene. Examination-quality photographs must then be taken to obtain maximum detail for forensic examination and include a scale. All impressions must be photographed using both methods.

General Crime Scene Photographs

General crime scene photographs of shoeprint or tire tread impressions must include close-range and long-range photographs. 400 ISO color film should be used. The photographs must show the relationship of the impressions to the surrounding area. General crime scene

photographs are not suitable for footwear or tire examinations.

Examination-Quality Photographs

Examination-quality photographs must be taken directly over the impressions using a tripod and lighting. A scale must be in every photograph. The purpose of these photographs is to produce a detailed negative that can be enlarged to natural size. Examination-quality photographs must be taken as follows:

1. Place a linear scale such as a ruler next to and on the same plane as the impression. Place a label in the picture to correlate the impression with crime scene notes and general photographs.
2. Images should be taken using a 35mm or medium-format film camera. Low-cost digital cameras do not provide sufficient image detail for examination-quality photographs. Use a manual focus camera. If the shoeprint is made from a colored substance (e.g., blood), color film may be preferable to black and white. In most ambient light situations, use 100 ISO film. Use 200 or 400 ISO film, if necessary.

3. Place the camera on a tripod and position it directly over the impression. Adjust the height of the camera and if possible use a normal lens (50mm for a 35mm camera). Fill the frame with the impression and scale. Position the camera so the film plane is parallel to the impression.
4. Set the f-stop on f/16 or f/22 for a greater depth of field.
5. Attach an electronic flash with a long extension cord to the camera.
6. Block out bright ambient light with a sunscreen to maximize the light from the flash.
7. Focus on the bottom of the impression, not on the scale. Take an existing or reflected light photograph.
8. Position the flash at a very low angle (10-15 degrees) to the impression. This will enhance the detail of the impression. For consistent exposure, hold the flash at least 5-7 feet from the impression. Shoot several exposures, bracketing toward overexposure to obtain maximum image detail. Move the flash two or more angles to the impression.

9. Take the exposures, move the light to another position, adjust the sunscreen, and repeat Steps 7 and 8.

Photographing Impressions in Snow

Impressions in snow are difficult to photograph because of lack of contrast. First, attempt to photograph the impressions as if in soil. To increase the contrast, snow impressions can be lightly sprayed with Snow Print Wax, a material used for casting snow impressions, or with colored spray paint. The spray can must be held at least 2-3 feet from the impression so the force of the aerosol does not damage the impression. A light application of spray must be directed at an angle of about 30-45 degrees so the colored paint only strikes 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.

Recovering the Original Evidence

Submit the evidence bearing the original impression to the Laboratory, whenever possible. If the evidence cannot be submitted to the Laboratory, use the following techniques to recover the evidence.

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.

Mixing Dental Stone in a Bag

Store dental stone in resealable plastic bags. An 8- by 12-inch resealable plastic bag can store two pounds 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 for 3-5 minutes through the bag. Ensure that the

material in the corners of the bag is also mixed. After mixing, the material should have the consistency of pancake batter or heavy cream.

Mixing Dental Stone in a Bucket or Bowl

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 slowly added to the water and continuously stirred for 3-5 minutes. After mixing, the material should have the consistency of pancake batter or heavy cream.

Pouring Dental Stone

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.

If the mixture is too viscous to flow into the impression, vibrate 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 completely hardens, write the date, collector's initials, and other identifying information onto it. The cast should be left undisturbed for at least 20-30 minutes in warm weather. 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. A 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 photography and examination.

Electrostatic Lifts

An electrostatic lifting device lifts footwear impressions from porous and nonporous surfaces without damaging the impressions. This device works on dry dust or residue impressions on clean surfaces but will not work if the impressions were wet or become wet. Electrostatic lifting devices have instructions regarding usage.

Storing Electrostatic Lifting Film

Lifted impressions are easily damaged if the film is not properly stored. The film has a residual charge that attracts dust and debris and causes the film to cling to another surface. To preserve and store the lifting film containing an impression, tape one edge of the film securely in a clean, smooth, quality paper file folder or tape the edges securely in a shallow, photographic paper box. Low-grade cardboard boxes such as pizza boxes must not be used, because the residual charge on the film will pull dust from the boxes 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 and Adhesive Lifts

Gelatin lifters can be used to lift impressions from porous and nonporous surfaces. Black gelatin lifters work well for lifting light-colored dry or wet impressions. White gelatin lifters can be used to lift impressions developed with fingerprint powders or impressions dark enough to contrast with a white background.

Adhesive lifters can only be used to lift impressions from smooth nonporous surfaces.

White adhesive lifters can be used to lift impressions developed with fingerprint powders. Transparent adhesive lifters can be used to lift impressions developed with black or fluorescent powders. Transparent tapes such as two-inch fingerprint lifting tape can also be used to lift powdered impressions if they are transferred to a white card.

Lifting Materials

- *Electrostatic:* Can be used on porous and nonporous dry surfaces. Nondestructive. Useful for searching for latent impressions.
- *White Adhesive:* Can be used on nonporous wet and dry surfaces. Also used with chemical-enhancement methods and dark fingerprint powder.
- *Transparent Adhesive:* Can be used on nonporous wet and dry surfaces which have been treated with black or fluorescent powder. Do not use on an original impression.
- *White Gelatin:* Can be used on all porous and nonporous wet and dry surfaces as long as it contrasts with an impression. Also used with some chemical methods and with fluorescent powder.

- *Black Gelatin:* Can be used on all porous and nonporous wet and dry surfaces. Offers good contact with most residue.

Shoeprint and Tire Tread Files

A file of shoe manufacturers' designs and a file of tire treads and other reference material can be searched to determine brand names and manufacturers.

Questions concerning shoeprint and tire tread evidence should be directed to 703-632-7288, 703-632-7314, or 703-632-7315.

Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- For shoeprint and tire tread comparisons, submit original evidence whenever possible (shoes, tires, photographic negatives, casts, lifts).
- For shoeprint and tire tread file searches, submit quality photographs of the impressions. If photographs are not available, submit casts, lifts, or the original evidence. Detailed sketches or photocopies are acceptable. Images of impression evidence may be submitted electronically. Call 703-632-7288 for the contact information.

- Unobtrusively write the collector's initials, dates, and other relevant information on the evidence.
- Air-dry and package evidence separately in bubble wrap; clean, smooth quality paper or laminated folders; or paper bags.

[Back to the top](#)

Soil Examinations

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

Questions concerning soil evidence should be directed to 703-632-7690. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Collect soil samples as soon as possible, because the soil at the crime scene can change dramatically.
- Collect soil samples from the immediate crime scene area and from the logical access and/or 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 paper bags.
- Carefully remove soil adhering to vehicles. Air-dry the soil and package separately in paper bags.
- 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.

[*Back to the top*](#)

Tape Examinations

Tape composition, construction, and color 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, and packaging tapes but will not examine cellulose acetate tape (e.g., Scotch tape).

Questions concerning tape evidence should be directed to 703-632-8441. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- 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).

[Back to the top](#)

Toolmark Examinations

Toolmarks

Tools can bear unique microscopic characteristics due to manufacturing processes and use. These characteristics can be transferred to surfaces that contacted the tools. Evidence toolmarks can be compared to recovered tools. In the absence of a questioned tool, toolmark examinations can determine the type of tool(s) that produced the toolmark and whether the toolmark is of value for comparison. Toolmark examinations also include lock and key examinations.

Fractures

Fracture examinations can be used to associate whether evidence was joined together and subsequently broken apart.

Questions concerning toolmark evidence should be directed to 703-632-8442. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- If possible, submit the toolmarked evidence.
- If it is not possible to submit the toolmarked evidence, make a cast to submit to the Laboratory.
 1. Use an acrylic surface replica cast kit. Call the Laboratory at 703-632-8442 regarding the appropriate cast kit.
 2. Different formulas are used in different temperatures. If possible, move the evidence to a warm area.
 3. Casts will duplicate foreign material in the stamped characters. Clean the area before proceeding. Remove paint and 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.
 4. Build a dam around the stamped characters to retain the acrylic liquid while it hardens. The dam material must be soft and pliable such as modeling clay. Ensure there are no voids in the dam.
 5. Following the instructions in the kit, mix the liquid and powder for one minute

and pour it into the dam.

6. The acrylic liquid will take 30 minutes to harden. Remove the cast when it is hard. If paint and rust are on the cast, make additional casts and submit the cleanest cast to the Laboratory.
 7. Indicate where on the vehicle the cast was taken.
 8. Pack the cast to prevent breakage.
- 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 toolmarked 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.

[*Back to the top*](#)

Toxicology Examinations

Toxicology examinations can disclose the presence of drugs and poisons in biological specimens and food products. The examinations can determine the circumstances surrounding drug- or poison-related homicides, suicides, and accidents.

Because of the large number of potentially toxic substances, it may be necessary to screen for classes of poisons. Examples are as follows:

- Volatile compounds (ethanol, methanol, isopropanol).
- Heavy metals (arsenic).
- Nonvolatile organic compounds (drugs of abuse, pharmaceuticals).
- Miscellaneous (strychnine, cyanide).

Questions concerning toxicology evidence should be directed to 703-632-8441. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Accepting evidence in alleged poison investigations will be based on whether the victim(s) sought medical attention or a suspicious death occurred. A doctor's

medical evaluation and report must be included with the evidence.

- Biological evidence in drug-facilitated assaults must include a urine sample. The urine must be collected as soon as possible after the assault but must not have been collected more than 96 hours after the alleged drugging.
- Toxicological analysis of hair specimens will only be performed for specific drugs or poisons. **Call the Laboratory at 703-632-8441 prior to submitting hair to ensure that the evidence will be accepted for examination.** The communication accompanying the evidence must reference the telephone conversation accepting the evidence.
- The quantity of biological specimens submitted depends on whether the identity of a toxic substance is known, the route of administration, the time after exposure that biological specimens are collected, and whether subjects(s) or victim(s) are living or deceased. **Call the Laboratory at 703-632-8441 prior to submitting the specimens to ensure that the correct quantity is submitted.** The communication accompanying the evidence must reference

the telephone conversation accepting the evidence.

- Each biological specimen must be placed in separate, labeled, sealed glass tubes, plastic cups, or heat-sealed or resealable plastic bags. Affix BIOHAZARD labels to the inside and outside containers. To avoid deterioration, biological specimens must be refrigerated or frozen during storage and shipping. Pack so that no breakage, leakage, or contamination occurs.
- Submit a copy of the autopsy or incident report.
- Describe the symptoms of the suspect(s) or victim(s) at the time of the crime or prior to the death.
- List any known or questioned drugs consumed by or prescribed for the suspect(s) or victim(s).
- Describe any known or questioned environmental exposure to toxic substances by the suspect(s) or victim(s).

[Back to the top](#)

Video Examinations

Authenticity

Authenticity examinations are conducted to determine whether video recordings are original, continuous, unaltered, and consistent with the operation of the recording device used to make the recording.

Enhancement

Enhancement examinations are conducted to maximize the clarity of the video signal through video processors and time-base correctors.

Video Image Processing

Enhanced prints can be produced from images depicted on videotapes.

Standards Conversion

Videotapes can be converted from one standard to another (e.g., PAL to NTSC or SECAM).

Format Conversion

Videotapes can be converted from one format to another (e.g., Beta to VHS).

Synchronization

Audio and video signals can be combined to produce one composite recording.

Special Effects

Special effects such as a mosaic can be added to video recordings to protect a person's identity.

Damaged Media Repair

Video recordings can be repaired, restored, or retrieved for playback and examination, if damage is not too extensive.

Questions concerning video examinations should be directed to 703-632-6222. Questions concerning video evidence should be directed to 703-632-6191. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Write-protect the original recording. Never use the Pause operation when viewing original video recordings.
- Submit original video recordings.
- Identify the location(s) of the image(s) on the video recordings and describe the image(s).
- Label the outer container FRAGILE, SENSITIVE ELECTRONIC EQUIPMENT or FRAGILE, SENSITIVE AUDIO/VIDEO MEDIA and KEEP AWAY FROM MAGNETS OR MAGNETIC FIELDS.

- Address the outer container as follows:

**FEDERAL BUREAU OF INVESTIGATION
ENGINEERING RESEARCH FACILITY
ATTENTION: FORENSIC PROGRAM
BUILDING 27958A
QUANTICO VA 22135**

[*Back to the top*](#)

Weapons of Mass Destruction Examinations

A weapon of mass destruction is typically associated with nuclear and/or radiological, biological, or chemical agents; however, it may also be an explosive. Weapons of mass destruction are designed to cause a large amount of destruction or disruption to people and infrastructures.

Suspected or confirmed weapons of mass destruction crime scenes should only be handled by qualified personnel. Upon notification or suspicion of a possible weapon of mass destruction incident, contact the FBI's Weapons of Mass Destruction Operations Unit duty officer at 202-323-3300.

Prior to suspected or confirmed weapons of mass destruction evidence being analyzed by the Laboratory and partner laboratories, it must be properly field screened by qualified personnel to determine the absence or presence of hazardous materials. **Questions concerning weapons of mass destruction evidence examinations should be directed to 703-632-7766.**

Wood Examinations

Wood examinations can match sides, ends, and fractures; can determine wood species; and can compare wood particles found on clothing, vehicles, and other objects with wood from the crime scene.

Questions concerning wood evidence should be directed to 703-632-7690. Follow the Evidence Submission directions including [Requesting Evidence Examinations](#) and [Packaging and Shipping Evidence](#).

- Submit wood in plastic or paper bags.

Crime Scene Safety

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 forensic evidence. All shipping of forensic evidence must comply with U.S. Department of Transportation and International Air Transport Association regulations.

This section provides a familiarity of the hazards, safety precautions, safe work practices, and personal protective equipment recommended for personnel processing routine crime scenes. This section also describes the importance of compliance 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 a 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, respiratory protection must be worn. Only certified personnel are allowed to wear respiratory protection.

Skin Contact

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. Do not bring food, drink, or cigarettes into areas where contamination can occur regardless of personal protection that may be worn.

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, the Occupational Safety and Health Administration 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 Universal Precautions. This concept is the primary mechanism for infection control. It requires employees to treat all blood, body fluids, or other potentially infectious materials as if infected with bloodborne diseases, such as hepatitis B virus (HBV), hepatitis C virus (HCV), and 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 may occur with potentially infectious materials. Change gloves when torn, 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 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.
- Decontaminate equipment after use with a daily prepared solution of household bleach diluted 1:10 or 70 percent 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. Some examples of engineering controls include puncture-resistant containers used for storage and disposal of sharps and paint stirrers and long-handled mirrors for use in locating and retrieving evidence in confined or hidden spaces.

Chemical Safety

Depending on the type of material encountered, a variety of health and safety hazards can exist. Some of those 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 in air temperatures less than 130 degrees Fahrenheit (540 degrees Celsius) without an external ignition source.
- Oxidizers, such as nitrates, hydrogen peroxide, and concentrated sulfuric acid, are a class of chemical compounds that readily yield oxygen to promote combustion. Avoid storage with flammable and combustible materials or substances that could rapidly accelerate its decomposition.
- Corrosive materials can cause destruction to living tissue or objects, such as wood and steel. The amount of damage is dependent upon 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 the information in a Material Safety Data Sheet and appropriate training. The Material Safety Data Sheet 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, the eyes must be protected 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 should also be avoided.

Protective eyewear appropriate for the light source should be worn by all personnel in the vicinity of 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) mark denoting eye-protection compliance. Laser protective eyewear must be made 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 are not designed for

continuous occupancy (e.g., sewers, open pits, tank cars, and vats). 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 may not be entered until a confined-space permit has been issued. The atmosphere must be continuously monitored 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 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 Occupational Safety and Health Administration (OSHA) Title 29 CFR 1910.147, *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.
- Back-up communication must be in place prior to entry.
- Wear appropriate personal protective equipment, such as self-contained breathing apparatus (SCBA), full-body harness, head protection, and other necessary equipment.
- Never attempt a rescue unless part of a designated rescue team.
- Personnel certified in first aid and cardiopulmonary resuscitation (CPR) must be on-site.
- For additional information, refer to the Occupational Safety and Health Administration standard for *Permit Required Confined Spaces*, 29 CFR Section 1910.146.⁷

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.

[Back to the top](#)

Personal Protective Equipment

In 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.

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.^{8,9}

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 materials to lose their integrity.

- Powder-free gloves with reduced protein content will lower the risk of developing latex allergies. Personnel allergic to latex can usually wear nitrile or neoprene.

Guidelines for glove use include the following:

- Prior to donning, inspect the gloves 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 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

Appropriate eye protection, such as safety glasses and goggles, should be worn when handling biological, chemical, and radioactive materials.^{1,10} 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 should be worn over prescription glasses. Safety glasses may be made to the wearer's eyeglass prescription.

Foot Protection

Shoes that completely cover and protect the foot are essential.^{8,11} Protective footwear should be used at crime scenes when there is a danger of foot injuries from falling or rolling objects, from objects piercing the sole, and when feet are exposed to electrical hazards. The standard recognized by the Occupational Safety and

Health Administration for protective footwear is the American National Standard for Personal Protection-Protective Footwear, ANSI Z41-1991. In some situations, nonpermeable shoe covers can provide barrier protection to shoes and prevent the transfer of contamination outside of the crime scene.

Respiratory Protection

Certain crime scenes, such as bombings and clandestine laboratories, can produce noxious fumes and other airborne contaminants in which responders must use respiratory protection.^{1,8,12}

Compliance with Title 29 CFR 1910.134, *Respiratory Protection*,¹³ 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

In certain crime scenes where structural damage has or can occur, protective helmets should be worn. The standard recognized by the Occupational Safety and Health Administration for protective helmets is ANSI's Requirements for Industrial Head Protection, Z89.1-1997.¹⁴

[*Back to the top*](#)

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 Code of Federal Regulations (CFR)¹⁵ 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 the *Dangerous Goods Regulations*¹⁶ detailing how to prepare and package shipments for air transportation.

Title 49 CFR 172.101 provides a *Hazardous Materials Table* that identifies items considered to be hazardous for the purpose of transportation.¹⁷ 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 specified training prior to shipping any materials by commercial transportation.

Hazardous Waste Regulations

The U.S. Environmental Protection Agency's Resource Conservation and Recovery Act¹⁸ (RCRA), 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 once a material is determined to be hazardous, it is the generator's complete responsibility.

The process for determining whether a material is a hazardous waste should be done by qualified personnel. Even new material in its original container may be a 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 the material for other reasons is not needed, the immediate assistance of a qualified contractor knowledgeable about local regulations must be sought. Clandestine drug laboratories and environmental crimes are examples of scenes that may require the removal of waste.

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Back to the top

Crime Scene Search

Suspected or confirmed weapons of mass destruction (nuclear and/or radiological, biological, chemical, or explosive agents) crime scenes should only be handled by qualified personnel. Upon notification or suspicion of a possible weapon of mass destruction incident, contact the FBI's Weapons of Mass Destruction Operations Unit duty officer at 202-323-3300.

A crime scene search is planned, coordinated, and executed by law enforcement officials to locate physical evidence.

Basic Premises

- The best search options are usually the most difficult and time-consuming.
- Physical evidence cannot be overdocumented.
- There are two search approaches.
 - A cautious search of visible areas, avoiding evidence loss or contamination.
 - A vigorous search of concealed areas.

Preparation

- Obtain a search warrant, if necessary.
- Discuss the search with involved personnel before arriving at the scene, if possible.
- Establish a command headquarters for communication and decision making in major or complicated crime scene searches.
- Ensure that personnel are aware of the types of evidence usually encountered and the proper handling of the evidence.
- Make preliminary personnel assignments before arriving at the scene, if possible.
- Ensure that assignments are in keeping with the attitude, aptitude, training, and experience of search personnel. Personnel may be assigned two or more responsibilities:

Person in Charge

- Ensure scene security.
- Prepare administrative log.
- Conduct preliminary survey (initial walk-through).
- Prepare narrative description.

- Resolve problems.
- Make final decisions.

Photographer

- Photograph and log evidence and scene.

Sketch Preparer

- Sketch and log scene.

Evidence Recorder

- Evidence custodian and log evidence.
- Establish communication among the medical examiner, laboratory personnel, and prosecuting attorneys so that questions arising during the crime scene search can be resolved.
- Coordinate agreements with all agencies in multijurisdictional crime scene searches.
- Accumulate evidence collection and packaging materials and equipment.
- Prepare the paperwork to document the search.
- Provide protective clothing, communication, lighting, shelter, transportation, equipment,

food, water, medical assistance, and security for search personnel.

- In prolonged searches, use shifts of two or more teams. Transfer paperwork and responsibility in a preplanned manner from one team to the next.

Approach

- Be alert for evidence.
- Take extensive notes.
- Consider the safety of all personnel.

Secure and Protect

- Take control of the scene immediately.
- Determine the extent to which the scene has been protected. Obtain information from personnel who have knowledge of the original condition.
- Designate one person in charge for final decision making and problem resolution.
- Continue to take extensive notes.
- Keep out unauthorized personnel.
- Record who enters and leaves.

Preliminary Survey

The preliminary survey is an organizational stage to plan for the search.

- Cautiously walk through the scene.
- Maintain administrative and emotional control.
- Select a narrative technique (written, audio, or video).
- Take preliminary photographs.
- Delineate the extent of the search area. Usually expand the initial perimeter.
- Organize methods and procedures.
- Recognize special problem areas.
- Identify and protect transient physical evidence.
- Determine personnel and equipment needs. Make specific assignments.
- Develop a general theory of the crime.
- Take extensive notes to document the scene, physical and environmental conditions, and personnel movements.

Evaluate Physical Evidence Possibilities

This evaluation begins upon arriving at the scene and becomes detailed in the preliminary survey stage.

- Ensure that the collection and packaging materials and equipment are sufficient.
- Focus first on evidence that could be lost. Leave the least transient evidence last.
- Ensure all personnel consider the variety of possible evidence, not only evidence within their specialties.
- Search the easily accessible areas and progress to out-of-view locations. Look for hidden items.
- Evaluate whether evidence appears to have been moved inadvertently.
- Evaluate whether the scene appears contrived.

Narrative

The narrative is a running description of the crime scene.

- Use a systematic approach in the narrative.
- Nothing is insignificant to record if it catches one's attention.
- Under most circumstances, do not collect evidence during the narrative.
- Use photographs and sketches to supplement, not substitute for, the narrative.
- The narrative should include the following:
 - Case identifier.
 - Date, time, and location.
 - Weather and lighting conditions.
 - Identity and assignments of personnel.
 - Condition and position of evidence.

Photography

- Photograph the crime scene as soon as possible.
- Prepare a photographic log that records all photographs and a description and location of evidence.
- Establish a progression of overall, medium, and close-up views of the crime scene.
- Photograph from eye level to represent the normal view.
- Photograph the most fragile areas of the crime scene first.
- Photograph all stages of the crime scene investigation, including discoveries.
- Photograph the condition of evidence before recovery.
- Photograph the evidence in detail and include a scale, the photographer's name, and the date.
- Take all photographs intended for examination purposes with a scale. When a scale is used, first take a photograph without the scale.

- Photograph the interior crime scene in an overlapping series using a normal lens, if possible. Overall photographs may be taken using a wide-angle lens.
- Photograph the exterior crime scene, establishing the location of the scene by a series of overall photographs including a landmark. Photographs should have 360 degrees of coverage. Consider using aerial photography, when possible.
- Photograph entrances and exits from the inside and the outside.
- Photograph important evidence twice.
 - A medium-distance photograph that shows the evidence and its position to other evidence.
 - A close-up photograph that includes a scale and fills the frame.
- Prior to entering the scene, acquire, if possible, prior photographs, blueprints, or maps of the scene.

Sketch

The sketch establishes a permanent record of items, conditions, and distance and size relationships.

- Sketches supplement photographs.
- Sketch number designations should coordinate with the evidence log number designations.
- Sketches are normally not drawn to scale. However, the sketch should have measurements and details for a drawn-to-scale diagram, if necessary.
- The sketch should include the following:
 - Case identifier.
 - Date, time, and location.
 - Weather and lighting conditions.
 - Identity and assignments of personnel.

- Dimensions of rooms, furniture, doors, and windows.
- Distances among objects, persons, bodies, entrances, and exits.
- Measurements showing the location of evidence. Each object should be located by two measurements from nonmovable items (e.g., doors or walls).
- Key, legend, compass orientation, scale, scale disclaimer, or a combination of these features.

Crime Scene Search, Record, and Physical Evidence Collection

- Use a search pattern (grid, strip or lane, or spiral).
- Search from the general to the specific for evidence.
- Be alert for all evidence.
- Search entrances and exits.
- Photograph all items before collection and notate the photographic log.
- Mark evidence locations on the sketch.
- Complete the evidence log with notations for each item of evidence. If possible, have one person serve as evidence custodian.
- Two persons should observe evidence in place, during recovery, and being marked for identification. Mark directly on the evidence when necessary, but first attempt to place identifying marks on evidence containers.
- Wear latex or cotton gloves to avoid leaving fingerprints.
- Do not excessively handle the evidence after recovery.

- Seal all evidence packages at the crime scene.
- Obtain known standards (e.g., fiber samples from a known carpet).
- Make a complete evaluation of the crime scene.
- Constantly check paperwork, packaging, and other information for errors.

Final Survey

The final survey is a review of all aspects of the search.

- Discuss the search with all personnel.
- Ensure all documentation is correct and complete.
- Photograph the scene showing the final condition.
- Ensure all evidence is secured.
- Ensure all equipment is retrieved.
- Ensure hiding places or difficult access areas have not been overlooked.

Release

- Release the crime scene after the final survey.
- Crime scene release documentation should include the time and date of release, to whom released, and by whom released.
- Ensure that the evidence is collected according to legal requirements, documented, and marked for identification.
- Consider the need for specialists (e.g., a blood-pattern analyst or a medical examiner) to observe the scene before it is released.
- Once the scene has been released, reentry may require a warrant.
- The scene should be released only when all personnel are satisfied that the scene was searched correctly and completely.
- Only the person in charge should release the scene.

[*Back to the top*](#)

Index

A

Abrasives, 14
Acrylic surface replica cast kit, 107-108, 123-124
Adhesives, 15. *See also*
Tapes
for collecting gunshot residue samples, 61
for lifting impressions, 116-117
Airborne contaminants, 134
Ammunition. *See also* Bullets; Firearms
cartridge cases or shotshell casings, 53
packaging, shipping, labeling, 11, 56
shot pellets, buckshot, or slugs, 54
unfired cartridges or shotshells, 54
wadding, 54
Anonymous Letter File, 103
Anthropological examinations, 15-17
Arrest photos, 67
Arson, 17-18
limitations, 6

Audio, 18-20
Authenticity/manipulation detection, 18, 64, 128
Automobiles
accidents, 6, 88-89
auto theft, 6
glass samples from, 57-59
make and model identification, 65
paint samples from, 88-89
theft rings, 6
tire tread examinations, 109-119

B

Bank robbery, surveillance films, 64, 66-68
Bank Robbery Note File, 103
Bank security dyes, 20-21
Biohazardous materials
bloodborne-pathogen safety, 136-138
packaging, shipping, and labeling, 9, 57, 75, 83, 127, 137
routes of exposure in contaminated environments, 134-135

- Biological relatives, missing persons and samples from, 82
- Biological tissue sample examination. *See* DNA examinations
- Blood
- blood examination request letter, 39
 - on clothing submitted for gunshot residue examination, 57
 - collecting from a person, 36
 - collecting known samples, 36-39
 - collection, missing persons and, 82
 - dried, 37, 39, 82-83
 - examinations, 35-36
 - liquid, 37
 - on a person, 37
 - stains, 38-39
 - on surfaces, in snow or water, 37-38
 - wet bloodstained garments and objects, 38-39
- Bloodborne-pathogen safety, 136-138
- Body fluids. *See also* DNA examinations; *specific fluids*, e.g., Blood, Saliva
- Universal Precautions, 136-138
- Bones. *See* Anthropological examinations; Tissues, bones, and teeth
- Buccal (oral) swab samples, 41, 84
- Buckshot, 54
- Building materials, 21-22
- Bulk drugs, 30
- Bullets. *See also* Ammunition; Firearms
- bullet jacket alloys, 22-23
 - bullet leads, 23-25
 - fired, 53
 - packaging, shipping, and labeling, 56-57
- Burglary, 6
- C**
- Cameras, image analysis and, 65, 68. *See also* Photographs/photography; Surveillance images
- Carbon paper or carbon film ribbon, 102
- Carjacking, 6
- Cartridge cases, 53, 54
- Casting. *See* Impressions and casts

- Caulks, 15
- Cellular phones, 45
- Checkwriters, 102
- Chemical safety, 138-140
- Chemical unknowns, 25-26
- Child Exploitation and Obscenity Reference File, 65, 68
- Child pornography
 - examinations, image analysis, 65-66, 68
- Clocks, 80
- Clothing, fabrics, and textiles
 - blood on, 57
 - building material debris, 21
 - for comparisons, 63
 - controlled substances on, 30
 - glass samples on, 58
 - gunshot residue on, 54, 56, 57
 - hair/fibers on, 62
 - image analysis, 63, 67
 - paint on, 88-89
 - protective. *See* Personal protective equipment
 - safe insulation on, 106
 - wood particles on, 132
- Commercial electronic devices, 45-46
- Communication devices, interception of, 45
- Computer Analysis Response Team, 28
- Computers
 - comparison, 27
 - computer-animated modeling, 31
 - content, 26-27
 - deleted data files, 27
 - extraction, 27
 - format conversion, 27
 - keyword searching, 27
 - labeling and shipping, 28-29
 - limited source code, 28
 - passwords, 27
 - procedures for examination, 28-29
 - search or field examination, 28
 - transactions, 27
- Confined-space safety, 140-142
- Contaminated environments, routes of exposure in, 134-135
- Controlled substances, 30-31
- Cords, 105
- Crime scene safety. *See also* Biohazardous materials

- about, 133
 - bloodborne-pathogen
 - safety, 136-138
 - chemical safety, 138-140
 - confined-space safety,
 - 140-142
 - hazardous materials
 - transportation, 148
 - hazardous waste
 - regulations, 149
 - light-source safety, 140
 - personal protective
 - equipment, 143-147
 - routes of exposure in
 - contaminated
 - environments, 134-135
 - X-ray safety, 143
 - Crime scene search
 - procedures
 - approach, 158
 - basic premises, 155
 - final survey, 167
 - latent prints, 70-76
 - narrative, 161
 - photography, 71-72, 109-112, 162-163
 - physical evidence
 - possibilities evaluation, 160
 - preliminary survey, 159
 - preparations, 156-158
 - release, 168
 - search, record, and
 - collection, 166-167
 - search personnel, 156-158
 - secure and protect, 158
 - sketches, 164-165
 - weapons of mass
 - destruction and, 155
 - Crime scene surveys,
 - documentation, and
 - reconstruction, 31
 - Cryptanalysis, 31
- D**
- Damaged media restoration
 - audio recordings, 19-20
 - video, 129
 - Debris
 - arson and, 17
 - building materials, 21-22
 - glass samples, 59
 - paint, 88-89
 - safe insulation and, 106
 - soil examinations and, 120
 - Decontamination/disinfection
 - of equipment, 137-138
 - Dental stone, mixing and
 - pouring, 113-115
 - Digital cameras and film. See
 - Cameras; Film

DNA examinations

- about, 33-34
- anthropological
 - examinations of bone, 15-17
- blood examinations, 35-39
- buccal (oral) swabs, 41
- documenting, collecting, packaging, and preserving, 34-35
- hair, 43, 62-63
- mtDNA, 34
- nDNA, 34
- saliva, 41-43
- semen and semen stain examinations, 40
- seminal evidence from sexual assault victims, 41
- sources for analysis, 34
- tissues, bones, teeth, 43-45
- urine, 41-42, 126

Document age, 102

Drug records, 32

Drug residue, 30

Dyes, bank security, 20-21

E

Electronic devices, 45-46

Electrostatic lifts, 115-116,

117

Elimination prints, 75

Embossings, 102

Enhancement examinations

audio recordings, 18-20

video, 128-130

Evidence

packaging and shipping, 9-11

submission, 7-11

Evidence examinations,

requesting, 7-8. *See also specific items, e.g.,*

Abrasives, DNA, Explosives

Expert witness testimony, 4

Explosive incidents and

hoaxes, 6

Explosives, 47-48. *See also*

Chemical safety

Explosives residue, 49-50

Eye protection, 146

F

Fabrics and textiles. *See*

Clothing, fabrics, and textiles

Facial imaging/reproduction, 16, 50

FBI Disaster Squad, 51

FBI Investigative Technology Division, 3-4

FBI Laboratory Division, 3-4
FBI Laboratory Evidence
 Control Unit, 7, 11
Feathers, 51-52
Fibers, 62-63
Film, image analysis, 63-68
Fingerprinting human
 remains, 75-76. *See also*
 Latent prints
Fire. *See* Arson
Firearms, 52-57. *See also*
 Ammunition; Bullets
 cartridge cases or
 shotshell casings, 53
 gun parts, 55
 gunshot residue on
 victim's clothing, 54, 57
 image analysis, 67
 packaging, shipping, and
 labeling, 55-57
 shot pellets, buckshot, or
 slugs, 54
 silencers, 55
 unfired cartridges or
 shotshells, 54
 wadding, 54
Foot protection, 146-147
Footprints. *See* Shoeprints
Forensic services
 about, 3-4
 limitations, 4, 6

G

Gambling, 32
Gelatin lifts, 116-118
General unknowns (powders,
 liquids, stains), 25-26
Glass, 57-59
Global positioning systems
 (GPS), 45
Graphic arts (printing), 101
Guns. *See* Firearms
Gunshot residue
 on clothing, 54, 57
 on hands, 60-61

H

Hair, 43, 62-63
 toxicology screening, 126
Hand protection, 144-145
Handwriting and hand
 printing, 69, 95-97
Hazard-risk assessment,
 personal protective
 equipment and, 143-144
Hazardous materials handling
 and transportation, 10-11,
 148. *See also*
 Biohazardous materials;
 Chemical safety; *specific*
 hazardous materials, e.g.,
 Ammunition, Explosives

- Hazardous waste regulations, 149
- Head protection, 147
- Hepatitis B and C viruses, 136
- Hit-and-run (automobile)
 - cases, 6, 88-89, 92-93
- Human immunodeficiency virus (HIV), 136
- Human remains
 - anthropological examinations, 15-17
 - hands/fingers for latent prints, 75-76
 - samples from unidentified, 84-87
- I**
- Ignitable materials. See Arson
- Image analysis
 - authenticity and image manipulation detection, 64
 - automobile make and model identification, 65
 - cameras, 65, 68
 - child pornography
 - examinations, 65-66, 68
 - clothing, 63, 67
 - film, 63-64, 66-68
 - firearms, 67
 - location, time, and date of photographic evidence, 64
 - packaging, shipping, and labeling for, 66-68
 - photogrammetry, 64, 68
 - photographic comparisons, 63
 - photographs, 63, 64, 67
 - procedures for
 - submission, 66-68
 - providing originals, 66
 - source and age, 64
 - videos, 63, 65-67
- Impressions and casts
 - of serial/identification numbers, 107-108
 - three-dimensional
 - impression casts, 113 - 115
 - for toolmark examinations, 123-124
 - two-dimensional
 - impressions, 115-117
- Infectious materials, 136-138
- Ingestion of contaminants, 135
- Inhalation exposure, 134
- Injection of contaminants, 135

Inks, 69

Insect samples,
anthropological
examinations of bone and,
16

Interception of
communication devices
(IOC), 45

L

Labels and labeling, shipping,
9-11. *See also specific
items*

Lamp bulbs, 80

Latent labels, 9

Latent prints
developing at crime scene,
70-71
glass samples and, 59
lifting, 73
packaging, shipping, and
labeling, 73-76
photographing, 70-72
submitting hands/fingers
of deceased for, 75-76

Lifting materials, 73, 115-
118

Light-source safety, 140

Loan sharking, 32

Lubricants, 77

M

Malicious mischief, 6

Metallurgy
broken or mechanically
damaged metal, 78-79
burned, heated, or melted
metal, 79
comparative examinations,
78
cut or severed metal, 79
lamp bulbs, 80
metal fragments, 80
objects with questioned
internal components, 81
specification frauds and
noncompliant materials,
79
watches, clocks, and
timers, 80

Minor theft and fraud, 6

Missing persons
about samples, 81-82
blood collection and, 82-
83
bone submissions, 84-85
buccal (oral) swabs, 84
dried blood stains, 82-83
samples from biological
relatives, 82
teeth and, 86
tissue samples, 87

Mitochondrial DNA (mtDNA).

See DNA examinations

Money laundering, 33

N

National Automotive Image
File, 65

National Missing Persons
DNA Database, 81-87

Nonfatal traffic accidents, 6

Nuclear DNA (nDNA). See
DNA examinations

O

Oleoresin capsicum. See

Pepper sprays or foams

Oral swab samples, 41, 84

P

Packaging and shipping
evidence, 9-11

Pagers, 45

Paints, 88-89

Paper, 101-102

Pepper sprays or foams, 90

Personal digital assistants
(PDAs), 45

Personal protective

equipment

eye protection, 146

foot protection, 146-147

hand protection, 144-145

hazard-risk assessment

and, 143-144

head protection, 147

respiratory protection, 147

Pharmaceuticals, 91. See
also Toxicology

Photocopies, 100-101, 104,
118

Photogrammetry, 64, 68

Photographs/photography
crime scene search
procedures, 71-72, 162-
163

examination-quality, 110-
112

image analysis, 63, 64, 67

impressions in snow, 112

latent prints, 70, 71-72

location, time, and date
determinations and, 64
photographic comparisons,
63

shoe prints and tire
treads, 109-112

of suspects, 67

toolmarks, 124

Plastic bags, 103

Poisons. See Crime scene
safety; Toxicology

Polymers, 92-93

Pornography examinations,
image analysis, 65-66, 68
Printing and printed matter,
101
Product tampering, 94
Property crime, 5-6
Prostitution, 33
Protective clothing and
equipment, 143-147

Q

Questioned documents
altered or obliterated
writing, 97
Anonymous Letter File,
103
Bank Robbery Note File,
103
burned or charred paper,
101
carbon paper or carbon
film ribbon, 102
checkwriters, 102
document age, 102
embossings and seals,
102
graphic arts (printing), 101
handwriting and hand
printing, 95-97
inks and, 69
nongenuine signatures, 97

packaging, shipping, and
labeling, 103-104
paper, 101
photocopies, 100-101
plastic bags, 103
rubber stamps, 102
typewriting, 97-99

R

Racketeering records, 31-33
Respiratory protection, 147
Ropes, 105
Routes of exposure in
contaminated
environments, 134-135
Rubber stamps, 102

S

Safe insulations, 106
Safety. See Crime scene
safety
Saliva, 41-43
Sealants, 15
Seals, 102
Search pattern, 166
Search warrants, 156
Semen and semen stain
examinations, 40
Seminal evidence from
sexual assault victims, 41
Serial numbers, 107-108

Serology. See DNA examinations
Sexual assault, seminal evidence from, 41
Shipping of evidence. See Packaging and shipping evidence; *specific items*
Shoeprints, 109-119
Shot pellets, 54
Shotshells and shotshell casings, 53, 54
Signal analysis, audio recordings, 19
Signatures, 97
Silencers, 55
Skeletal remains. See Human remains
Skin contamination/contact, 134-135
Slugs, 54
Snow
 blood in, 37-38
 impressions in, 112
Soils, 119-120
Submitting evidence, 7-11
Substances unknown (powders, liquids, stains), 25-26
Surveillance images, 63-68
Suspects, arrest or known photographs of, 67

T

Tapes, 121-122
 for lifting impressions, 117
 for lifting latent prints, 73
Teeth. See Tissues, bones, and teeth
Timers, 80
Tire treads, 109-119
Tissues, bones, and teeth anthropological examinations of bone, 15-17
 DNA examinations, 43-44
 unidentified human remains, 84-87
Toolmarks, 122-124
Toxicology, 125-127
Traffic accidents, 6
Typewriting, 97-99

U

Universal Precautions, 136-138
Urine, 41-43, 126

V

Vandalism, 6
Videos, 128-130
 image analysis, 63, 65-67
Violent crime, 5-6
Visual Information

Specialists, 31, 50
Voice comparisons, 18

W

Wadding, ammunition, 54
Watches, 80
Watermark identification, 69
Weapons of mass
 destruction, 131
 crime scene search
 procedures and, 155
Woods, 132
Writing examinations. *See*
 Handwriting and hand
 printing; Questioned
 documents

X

X-ray safety, 143
X-rays, known individual
 comparison to skeletal
 remains, 16, 17

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