



Ada County Sheriff's Office

Forensic Lab

Crime Scene Analytical Method

Version 1.0

Ada County Sheriff's Office Forensic Lab

- 1.0 [Scope](#)
- 2.0 [References](#)
- 3.0 [Terms and definitions](#)
- 4.0 [Management requirements](#)
 - 4.1 Organization
 - 4.2 Management System
 - 4.3 Document control
 - 4.4 Review of requests, tenders, contracts
 - 4.5 Subcontracting tests
 - 4.6 Purchasing
 - 4.7 Service to customer
 - 4.8 Complaints
 - 4.9 Nonconforming work
 - 4.10 Improvement
 - 4.11 Corrective action
 - 4.12 Preventive action
 - 4.13 [Control of records/ Technical records](#)
 - 4.13.1 [Initial response request](#)
 - 4.13.2 [Note taking](#)
 - 4.13.3 [Diagramming](#)
 - 4.13.4 [Measurement methods](#)
- 5.0 [Technical requirements](#)
 - 5.1 General
 - 5.2 Personnel

Ada County Sheriff's Office Forensic Lab

- 5.3 [Accommodation and Environmental Conditions](#)
- 5.4 [Testing Methods](#)
 - 5.4.1 [Scene Assessment](#)
 - 5.4.2 [Biological Evidence](#)
 - 5.4.3 [Impression Evidence](#)
 - 5.4.4 [Trace Evidence](#)
 - 5.4.5 [Firearms/Toolmark Evidence](#)
 - 5.4.6 [Latent Friction Ridge Impression Evidence](#)
 - 5.4.7 [Living or Deceased Human Assessment](#)
- 5.5 [Equipment](#)
- 5.6 [Traceability](#)
- 5.7 [Sampling](#)
- 5.8 Handling of test items
- 5.9 Assuring the quality
- 5.10 Reporting

1.0 Scope

- 1.1 This analytical method specifies procedures to follow during crime scene investigation for the collection and preservation of evidence.
- 1.2 This analytical method is applicable to all forensic scientists responding to any type of crime scene investigation.
- 1.3 This analytical method is intended to be followed to ensure the highest level of quality and safety for crime scene investigation.

2.0 References

2.1 ACSO Policy Manual located at

<https://aces.ada.net.gov/sites/ADAPortal/departments/sheriff/policy/Documents/ACSO%20Policy%20Manual%20112414.pdf>

2.2 Ada County Forensic Crime Lab Quality Assurance Manual

2.3 Ada County Forensic Crime Lab Health and Safety Manual

3.0 Terms and Definitions

- 3.1 **ABFO scales:** (American Board of Forensic Odontology scales). An L-shaped piece of plastic used in photography that is marked with circles, black and white bars, and 18-percent gray bars to assist in distortion compensation and provide exposure determination. For measurement, the plastic piece is marked in millimeters.
- 3.2 **Adhesive Lifter:** Any of a variety of adhesive coated materials or tapes used for lifting evidence.
- 3.3 **Alternate light source:** Equipment used to produce visible and invisible light at various wavelengths to enhance or visualize potential items of evidence (fluids, fingerprints, clothing fibers, etc.).
- 3.4 **Ambient light:** The available or existing light that surrounds the object being photographed.
- 3.5 **Bindle paper:** Clean paper folded to contain trace evidence, sometimes included as part of the packaging for collecting trace evidence.
- 3.6 **Biohazard bag:** A container for materials that have been exposed to blood or other biological fluids and have the potential to be contaminated with hepatitis, AIDS, or other viruses.
- 3.7 **Biological fluids:** Fluids that have human or animal origin, most commonly encountered at crime scenes (e.g., blood, mucus, perspiration, saliva, semen, vaginal fluid, urine).
- 3.8 **Biological weapon:** Biological agents used to threaten human life (e.g., anthrax, smallpox, or any infectious disease).
- 3.9 **Bloodborne pathogen:** Infectious, disease-causing microorganisms that may be found or transported in biological fluids.
- 3.10 **Bloodstain Pattern Analysis:** The examination of the size, shape, distribution, and patterns of bloodstains.
- 3.11 **Body fluids:** Blood, semen, blood products, vaginal secretions, cerebrospinal fluid, synovial fluids, pleural fluid, peritoneal fluid, pericardial fluid, amniotic fluid, and concentrated HIV and HBV viruses. Care should also be taken with other biological materials such as body parts and tissues, saliva, urine, feces, and blood typing reagents.
- 3.12 **Boundaries:** The perimeter or border surrounding potential physical evidence related to the crime.
- 3.13 **Case file:** The collection of documents comprising information concerning a particular investigation. (This collection may be kept in case jackets, file folders, ring binders, boxes, file drawers, file cabinets, or digital files. Sub-files are often used within case files to segregate

Ada County Sheriff's Office Forensic Lab

and group interviews, media coverage, laboratory requests and reports, evidence documentation, photographs, videotapes, audiotapes, and other documents.)

- 3.14 **Case identifiers:** The alphabetic and/or numeric characters assigned to identify a particular case.
- 3.15 **Casting:** The filling of a three-dimensional impression with material that takes on and retains the characteristics which were left in that impression.
- 3.16 **Chain of custody:** A process used to maintain and document the chronological history of the evidence. (Documents should include name or initials of the individual collecting the evidence, each person or entity subsequently having custody of it, dates the items were collected or transferred, agency and case number, victim's or suspect's name, and a brief description of the item.)
- 3.17 **Chemical enhancement:** The use of chemicals that react with specific types of evidence (e.g., blood, semen, lead, fingerprints) in order to aid in the detection and/or documentation of evidence that may be difficult to see.
- 3.18 **Chemical threat:** Compounds that may pose bodily harm if touched, ingested, inhaled, or ignited. These compounds may be encountered at a clandestine laboratory, or through a homemade bomb or tankard leakage (e.g., ether, alcohol, nitroglycerin, ammonium sulfate, red phosphorus, cleaning supplies, gasoline, or unlabeled chemicals).
- 3.19 **Clean/sanitize:** The process of removing biological and/or chemical contaminants from tools and/or equipment (e.g., using a mixture of 10-percent household bleach and water).
- 3.20 **Circumstantial (Indirect) Evidence:** Evidence which indirectly proves a fact in issue. Requires the fact finder to use inferences (a conclusion that can be drawn from a fact.)
- 3.21 **Collect/collection:** The process of detecting, documenting, or retaining physical evidence.
- 3.22 **Comparison samples:** A generic term used to describe physical material/ evidence discovered at crime scenes that may be compared with samples from persons, tools, and physical locations. Comparison samples may be from either an unknown/questioned or a known source.

Samples whose source is unknown/questioned are of three basic types:

1. **Recovered crime scene samples** whose source is in question (e.g., evidence left by suspects, victims).
2. **Questioned evidence** that may have been transferred to an offender during the commission of the crime and taken away by him or her. Such questioned evidence can be compared with evidence of a known source and can thereby be associated/linked to a person/vehicle/tool of a crime.

Ada County Sheriff's Office Forensic Lab

3. **Evidence of an unknown/questioned source** recovered from several crime scenes may also be used to associate multiple offenses that were committed by the same person and/or with the same tool or weapon.

Samples whose source is known are of three basic types:

1. **A standard/reference sample** is material of a verifiable/documented source which, when compared with evidence of an unknown source, shows an association or linkage between an offender, crime scene, and/or victim (e.g., a carpet cutting taken from a location suspected as the point of transfer for comparison with the fibers recovered from the suspect's shoes, a sample of paint removed from a suspect vehicle to be compared with paint found on a victim's vehicle following an accident, or a sample of the suspect's and/or victim's blood submitted for comparison with a bloodstained shirt recovered as evidence).

2. **A control/blank sample** is material of a known source that presumably was uncontaminated during the commission of the crime (e.g., a sample to be used in laboratory testing to ensure that the surface on which the sample is deposited does not interfere with testing. For example, when a bloodstain is collected from a carpet, a segment of unstained carpet must be collected for use as a blank or elimination sample).

3. **An elimination sample** is one of known source taken from a person who had lawful access to the scene (e.g., fingerprints from occupants, tire tread impressions from police vehicles, footwear impressions from emergency medical personnel) to be used for comparison with evidence of the same type.

3.23 **Contamination:** The unwanted transfer of material from another source to a piece of physical evidence.

3.24 **Control/blank sample:** See comparison samples.

3.25 **Crime Scene Reconstruction:** The process of determining the nature and/or sequence of events that occurred at a scene from an evaluation of physical evidence and other relevant information observed at the scene.

3.26 **Cross-contamination:** The unwanted transfer of material between two or more sources of physical evidence.

3.27 **Documentation:** Written notes, audio/videotapes, printed forms, sketches and/or photographs that form a detailed record of the scene, evidence recovered, and actions taken during the search of the crime scene.

3.28 **Dying declaration:** Statements made by a person who believes he or she is about to die, concerning the cause or circumstance surrounding his or her impending death.

Ada County Sheriff's Office Forensic Lab

- 3.29 **Elimination sample:** See comparison samples.
- 3.30 **Evidence identifiers:** Tape, labels, containers, and string tags used to identify the evidence, the person collecting the evidence, the date the evidence was gathered, basic criminal offense information, and a brief description of the pertinent evidence.
- 3.31 **First responder(s):** The initial responding law enforcement officer(s) and/or other public safety official(s) or service provider(s) arriving at the scene prior to the arrival of the investigator(s) in charge.
- 3.32 **Fixative:** A spray or powder applied to an impression prior to chemical enhancement or casting.
- 3.33 **Impression evidence:** Objects or materials that have retained the characteristics of other objects that have been physically pressed against them.
- 3.34 **Initial responding officer(s):** The first law enforcement officer(s) to arrive at the scene.
- 3.35 **Investigator(s) in charge:** The official(s) responsible for the crime scene investigation.
- 3.36 **Known:** See comparison samples.
- 3.37 **Latent print:** A print impression not readily visible, made by contact of the hands or feet with a surface resulting in the transfer of materials from the skin to that surface.
- 3.38 **Measurement scale:** An object showing standard units of length (e.g., ruler) used in photographic documentation of an item of evidence.
- 3.39 **Metal Detector:** A device used to detect metallic objects within a solid matrix.
- 3.40 **Multiple scenes:** Two or more physical locations of evidence associated with a crime (e.g., in a crime of personal violence, evidence may be found at the location of the assault and also on the person and clothing of the victim/assailant, the victim's/assailant's vehicle, and locations the victim/assailant frequents and resides).
- 3.41 **Nonporous container:** Packaging through which liquids or vapors cannot pass (e.g., glass jars or metal cans).
- 3.42 **Oblique light:** Light that is positioned at a low angle of incidence relative to the surface being photographed or visualized. It is also referred to as side lighting.
- 3.43 **Other responders:** Individuals who are involved in an aspect of the crime scene, such as perimeter security, traffic control, media management, scene processing, and technical support, as well as prosecutors, medical personnel, medical examiners, coroners, forensic examiners, evidence technicians, and fire and rescue officers.

Ada County Sheriff's Office Forensic Lab

- 3.44 **Personal protective equipment (PPE):** Articles such as disposable gloves, masks, and eye protection that are utilized to provide a barrier to keep biological or chemical hazards from contacting the skin, eyes, and mucous membranes and to avoid contamination of the crime scene.
- 3.45 **Porous container:** Packaging through which liquids or vapors may pass (e.g., paper bags, cloth bags).
- 3.46 **Presumptive test:** A non-confirmatory test used to screen for the presence of a substance.
- 3.47 **Probable Cause:** Reasonable grounds or a substantial objective basis for believing that more likely than not an offense has been committed and a person to be arrested has committed it.
- 3.48 **Projectile trajectory analysis:** The method for determining the path of a high-speed object through space (e.g., a bullet emanating from a firearm).
- 3.49 **Radiological threat:** The pending exposure to radiation energy. (This energy can be produced by shortwave x-rays or through unstable isotopes.)
- 3.50 **Single-use equipment:** Items that will be used only once to collect evidence, such as biological samples, then discarded to minimize contamination (e.g., tweezers, scalpel blades, droppers).
- 3.51 **Standard/reference sample:** See comparison samples.
- 3.52 **Taphonomy:** The study of processes which modify biological tissue within a forensic context. These include the contextual conditions in which remains are discovered, decomposition rates, environmental patterns, disarticulation and dispersion of human tissues, and the postmortem interval (time since death).
- 3.53 **Team members:** Individuals who are called to the scene to assist in investigation or processing of the scene (e.g., scientific personnel from the crime laboratory or medical examiner's office, other forensic specialists, photographers, mass disaster specialists, experts in the identification of human remains, arson and explosives investigators, clandestine drug laboratory investigators, as well as other experts).
- 3.54 **Trace evidence:** Physical evidence that results from the transfer of small quantities of materials (e.g., hair, textile fibers, paint chips, glass fragments, gunshot residue particles).
- 3.55 **Track:** A mark left by footwear or a portion of a tire when it comes in contact with a receiving surface. The track may be two or three-dimensional depending on the nature of the substrate.
- 3.56 **Transient evidence:** Evidence which by its very nature or the conditions at the scene will lose its evidentiary value if not preserved and protected (e.g., blood in the rain).
- 3.57 **Unknown/questioned:** See comparison samples.

3.58 **Walk-through:** An initial assessment conducted by carefully walking through the scene to evaluate the situation, recognize potential evidence, and determine resources required. Also, a final survey conducted to ensure the scene has been effectively and completely processed.

Ada County Sheriff's Office Forensic Lab

4.0 Management Requirements

- 4.1 See Ada County Sheriff's Office Forensic Crime Lab Quality Assurance Manual
- 4.2 See Ada County Sheriff's Office Forensic Crime Lab Quality Assurance Manual
- 4.3 See Ada County Sheriff's Office Forensic Crime Lab Quality Assurance Manual
- 4.4 See Ada County Sheriff's Office Forensic Crime Lab Quality Assurance Manual
- 4.5 See Ada County Sheriff's Office Forensic Crime Lab Quality Assurance Manual
- 4.6 See Ada County Sheriff's Office Forensic Crime Lab Quality Assurance Manual
- 4.7 See Ada County Sheriff's Office Forensic Crime Lab Quality Assurance Manual
- 4.8 See Ada County Sheriff's Office Forensic Crime Lab Quality Assurance Manual
- 4.9 See Ada County Sheriff's Office Forensic Crime Lab Quality Assurance Manual
- 4.10 See Ada County Sheriff's Office Forensic Crime Lab Quality Assurance Manual
- 4.11 See Ada County Sheriff's Office Forensic Crime Lab Quality Assurance Manual
- 4.12 See Ada County Sheriff's Office Forensic Crime Lab Quality Assurance Manual

4.13 Control of Records/Technical Records: Crime scene documentation is extremely important to provide a detailed record of events, aid in report writing, assist with testimony, and allow for independent review by other experts.

4.13.1 General

- 4.13.1.1 Crime scene documentation includes a combination of notetaking, photography, and diagramming.
- 4.13.1.2 Documentation shall take place as crime scene processing is occurring.
- 4.13.1.3 All original documentation shall be retained.
- 4.13.1.4 If multiple lab staff respond to a scene, each forensic scientist shall document the tests they performed, reagent lot numbers used, controls, specific areas or items tested, and the equipment they utilized (e.g., phenolphthalein testing, metal detector). This can be done by each forensic scientist taking notes or by one forensic scientist taking notes and the other forensic scientist(s) initialing those notes. Only the forensic scientist designated as lead for the scene needs to produce a report.

4.13.2 Initial Response Request

Ada County Sheriff's Office Forensic Lab

- 4.13.2.1 Document date of the request for scene processing and who made the request.
- 4.13.2.2 Document specific information provided regarding the scene and the source of the information.
- 4.13.2.3 Ascertain whether legal authority for processing has been obtained or is needed.
- 4.13.2.4 Attempt to determine if any specialized services or equipment may be required.
- 4.13.2.5 Obtain contact information for an investigator at the scene.

4.13.3 Preliminary Scene Information

- 4.13.3.1 Document the time of arrival at the scene and who is present.
- 4.13.3.2 Document that the scene has been secured appropriately.
- 4.13.3.3 Document all pertinent information that can be provided regarding the scene investigation and the source of the information.

4.13.3.3.1 The following information shall be included, if available:

- Case number
- Lead investigator
- Scene location
- Victim and suspect information if known
- Other personnel present at the scene

4.13.3.4 For investigations conducted under a search warrant, review the warrant and ascertain the legal limits of the search. If available, retain a copy of the warrant.

4.13.4 Note-taking

Crime scene notes provide a thorough and comprehensive written account of actions, procedures, and analyses at the scene. Extensive note-taking shall be maintained throughout the scene investigation and may include:

4.13.4.1 Scene conditions such as:

- Doors locked/unlocked, open/closed
- Lights on/off
- Windows open/closed

Ada County Sheriff's Office Forensic Lab

- Shades up/down
- Temperature/weather conditions
- Odors

4.13.4.2 **General condition of victim(s) such as:**

- Position of body
- Apparent wounds present
- Clothing
- Personal belongings

4.13.4.3 Description and location of evidence (e.g., weapons, bloodstain patterns, fingerprints)

4.13.4.4 Reagent lot numbers and controls

4.13.4.5 Tests performed and equipment utilized

4.13.4.6 Time of body removal and by whom (if applicable)

4.13.4.7 Chain of custody on evidence collected

4.13.5 **Diagramming**

Crime scene diagrams serve to establish spatial relationships, provide an overall scene view, assist with preparation of demonstrative aides for court and serve as an investigative aide during interviews. In addition, diagrams can clarify items of evidence in a crime scene without extraneous items such as furniture, piles of debris, etc.

4.13.5.1 **Types of diagrams:**

4.13.5.1.1 Bird's Eye View (Overview) Diagram

A sketch on one horizontal plane that shows the scene as if viewed from above.

4.13.5.1.2 Exploded Diagram

Overview diagram with the addition of walls folded outward.

4.13.5.1.3 Three-Dimensional (Perspective) Diagram

Ada County Sheriff's Office Forensic Lab

A sketch depicting objects of evidence as they would appear to the eye with reference to relative distance, depth, and breadth.

4.13.5.1.4 Elevation (Vertical Plane) Diagram

A sketch on one vertical plane that shows the scene as viewed from the side.

4.13.5.1.5 Forensic mapping DEVICES

These include but are not limited to:

- Global Positioning Systems (GPS)
- Laser and electronic measuring devices (e.g., Total Data Station, Leica DISTO).

4.13.5.2 Items shall be included in a diagram:

- Compass orientation
- Scale or scale disclaimer
- Case number, date, location, initials of diagram creator

4.13.5.3 Items may be included in a diagram:

- Items of evidence/markers
- Permanent reference points
- Measurements from reference points to items of evidence/markers
- Additional objects that enhance evidence location (e.g., furniture, geographical features, roads, etc.)
- Legend

4.13.6 **Methods of measurements**

When the forensic scientist is recording investigative data regarding distances/heights or producing a sketch/diagram, measurements should be taken to provide a reference of the dimensions, to show the relationships of objects, and when necessary, properly document to enable scale reproductions.

Ada County Sheriff's Office Forensic Lab

4.13.6.1 Rectangular Coordinates (Coordinate Method)

Two measurements at right angles are made from fixed objects, such as walls, to the item. Indicate the location of the fixed object and direction measured, "5 ft. east of south wall", "4 ft. 6 in. south of north wall", etc.

4.13.6.2 Triangulation

Measurements are taken between two fixed objects and then from the fixed objects to the item, forming a triangle.

4.13.6.3 Polar Coordinates

Measure from a fixed object (i.e. the building) to the item. Then measure the angle in a clockwise direction between the measuring line and a line through the fixed object.

4.13.6.4 Base Line Measurements

Lay a tape down so that it crosses the entire room or area to be measured. Establish a reference point at each end of the tape, designated by a number or letter. The tape which runs between the two reference points becomes the base line for all other measurements in that area. Measurements are then made from the tape (baseline) by laying another tape measure perpendicular to the baseline out to the item of evidence or point of interest.

4.13.7 Photography and Imaging

4.13.7.1 Equipment

- Digital SLR camera
- Video camera
- Batteries (alkaline, lithium)
- Memory cards or other recording media
- External flash units for digital cameras
- Camera accessories to include cords, filters, shutter releases, and lenses
- Bubble level

- Scale/measuring device
- Tripod and camera mount

4.13.7.2 General Scene Photography

To properly document a crime scene, overall, mid-range, and close-up photographs shall be taken. Overall photos establish where the item of evidence is located within the context of the scene. Mid-range photos show the item in its immediate surroundings and relative position to other items of evidence. Close-up photos are used for identification purposes.

4.13.7.2.1 Overall Photographs

These show the relationship of all evidence in an area, or document the location of a crime scene. An example would be a photograph of the outside of a house with the street address showing or the living room inside the house where the body and a variety of different evidence is located. Some areas may require overlapping photos from each corner of the room. If placards are utilized to identify the location of evidence at the scene, photos should be taken before and after their placement.

4.13.7.2.2 Mid-range Photographs

These photographs should begin to document the relationship of smaller evidence to each other within the overall scene.

4.13.7.2.3 Close-up Photographs

These pictures detail the individual item of evidence. They will document the condition or placement of the object or show evidence related to the crime. Close up photographs should be done with and without a scale. Close up photographs should also fill the frame.

4.13.7.3 Photograph the entire scene prior to collecting evidence or disturbing the scene.

The following photographs should be included:

- 360° perimeter view of the overall scene
- Scene location established by landmarks, street signs, addresses and adjacent areas
- All access routes to/from the scene
- All entrances/exits to the structure(s)
- Interior overall views with an overlapping series for each room (include ceilings, doorways, hallways, etc.)
- Intermediate and close-up views of individual items of evidence

Ada County Sheriff's Office Forensic Lab

4.13.7.4 Continuity should be maintained between intermediate and close-up views.

4.13.7.5 Images of the scene used to depict a true and accurate representation of what was observed and processed (overall, mid-range and close-up images) shall be acquired as either RAW, TIFF or the highest resolution JPEG format for the camera used.

4.13.7.6 **Crime Scene Video**

Video-taping may be utilized as an additional method of documenting the scene. When video documentation is performed at a crime scene, the forensic scientist will videotape the scene in the same manner as is utilized in still photography. Landmarks will be used to identify the location of the scene. Evidence will be recorded in such a manner so as to show spatial relationship of the item in context with other items or areas in the overall scene. Whenever possible, the sound should be muted during video recording.

4.13.7.7 **Examination Quality Photography**

Toolmarks, tire tracks, footwear impressions, bloodstain patterns, bite marks, friction ridge detail, injuries to live or deceased victims, and so forth are examples of evidence that may be found at a scene and in which accurate measurement and size documentation are important to the investigation.

4.13.7.7.1 A scale shall appear in the photograph in order to produce an examination quality photographic print.

4.13.7.7.2 These images should also be taken at 90° (if possible) and in either the highest resolution jpeg or a lossless format.

4.13.7.7.3 Images shall be labeled in photographs

4.13.7.8 **Luminol/Bluestar® Photography**

Viewing and photographing Luminol or Bluestar® reactions require the same environmental preparations to reduce or eliminate available light. Indoor

Ada County Sheriff's Office Forensic Lab

scenes should be darkened as much as possible. Aluminum foil or other light blocking material may be necessary to cover windows and doors. Outdoor scenes should be photographed at night with as few lights illuminated as possible.

4.13.7.9 Upon return to the laboratory:

4.13.7.9.1 The media card shall be downloaded to the secure imaging system.

4.13.7.9.2 Verify that the number of images or the total size of data transferred to the media.

4.14 See ACSO Quality Manual

4.15 See ACSO Quality Manual

5.0 Technical Requirements

5.1 General

Crime Scene Investigations are unique; thus evaluating and processing each scene requires a particular combination of techniques, methods, flexibility, delegation of tasks, communication, and time management.

5.2 Personnel

- 5.2.1 If multiple forensic scientists respond to a scene, a lead shall be designated.
- 5.2.2 Completion and accuracy of documentation and reporting shall be the responsibility of the lead.
- 5.2.3 Non lab personnel shall be kept to a minimum to ensure the integrity of the scene.

5.3 Accommodation and Environmental Conditions

5.3.1 Safety

- 5.3.1.1 To prevent contamination of personnel and the scene, the appropriate protective equipment should be utilized (e.g., gloves, Tyvek suits & shoe covers, dust masks, respirators, eye protection, etc.) To minimize cross-contamination, personal protective equipment should be worn and changed when necessary.
- 5.3.1.2 Standard laboratory safety protocols should be followed in the field. Refer to the ACSO Crime Lab Health and Safety Manual.
- 5.3.1.3 Ensure that the requesting deputy/officer understands they are responsible for providing scene security. Forensic scientists should not begin scene processing until security has been provided and should not continue processing the scene if reasonable security is not maintained.
- 5.3.1.4 Each forensic scientist that has completed safety training, working with or around chemicals and biological material, is responsible for being aware of the hazards of those materials. The forensic scientist is responsible for knowing how to safely handle these hazardous chemicals or materials.

Ada County Sheriff's Office Forensic Lab

- 5.3.1.5 Gloves shall be worn when handling blood, bodies and biological materials at crime scenes or post-mortem examinations. When appropriate, personnel should wear suitable protective clothing such as laboratory coats, jumpsuits, Tyvek suits, field uniforms, overshoes, masks, safety glasses or caps.
- 5.3.1.6 Appropriate eye protection shall be worn whenever a hazard to the eyes exists. This would include chemical exposures and alternate light sources (UV, laser, etc.).
- 5.3.1.7 There shall be no smoking, eating, or drinking by personnel in the immediate vicinity of crime scenes or post-mortem examinations, except in designated safe areas.
- 5.3.1.8 Evidence collected for transport back to the laboratory should be packaged and sealed to maintain its integrity and prevent contamination of personnel or other items. Double paper bags or plastic bags may be used *temporarily* to contain items while they are in transit to the laboratory. All evidence containing known biological fluids shall be marked with appropriate biohazard labels.
- 5.3.1.9 Examination utensils (e.g., forceps, scissors, placards, measuring devices, etc.) used in processing shall be placed in an appropriate container for subsequent disinfecting at the laboratory.
- 5.3.1.10 When using aerosol type chemicals, proper engineering controls, work practice controls, or PPE must be employed to avoid chemical exposure.
- 5.3.1.11 Chemicals currently on the carcinogen and suspected carcinogen list shall not be used on live persons or in confined areas that are not ventilated. When the forensic scientist utilizes such chemicals, proper safety precautions shall be taken.

5.4 Testing Methods

5.4.1 Scene Assessment

5.4.1.1 The goals of a crime scene search are to ensure the recognition, documentation, collection, and preservation of all existing physical evidence. The recovered physical evidence is used to establish investigative leads; include and exclude suspects; and describe the objects and actions involved in the event.

5.4.1.2 Conduct a systematic and thorough search of the scene. It is incumbent upon the forensic scientist to identify and collect (or direct collection of) all items of evidence.

5.4.1.3 Establish a path of entry to be used by all personnel who must enter the scene.

- Typically this path should be a different route than that likely used by the perpetrator.
- Personnel allowed within the scene should have specific duties and should be kept to a minimum.

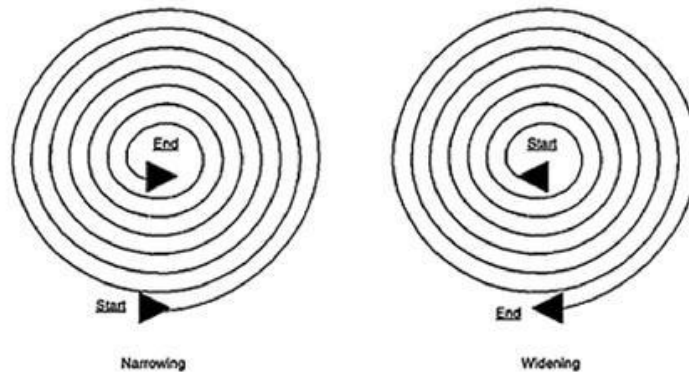
5.4.1.4 Conduct a walk-through of the scene and document observations.

- Identify and protect potential transitory evidence.
- Document transitory evidence as soon as possible.

5.4.1.5 Apply the appropriate search technique(s) to identify additional items of evidence.

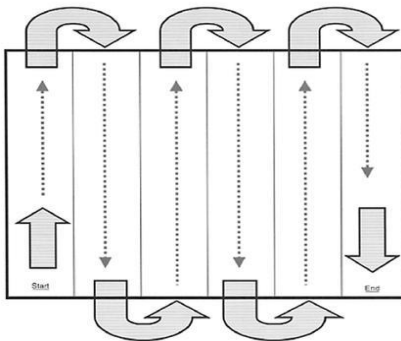
5.4.1.5.1 Spiral/Circle Method

A search technique where the forensic scientist walks from the center of the search area to a landmark and then back to the originating point along the same path (or vice versa). This is repeated until a full circle has been made encompassing the search area.

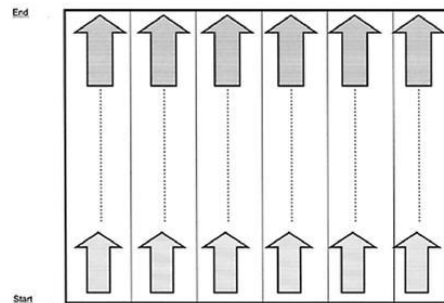


5.4.1.5.2 Strip (Line) Method

A search technique that divides the area into strips.



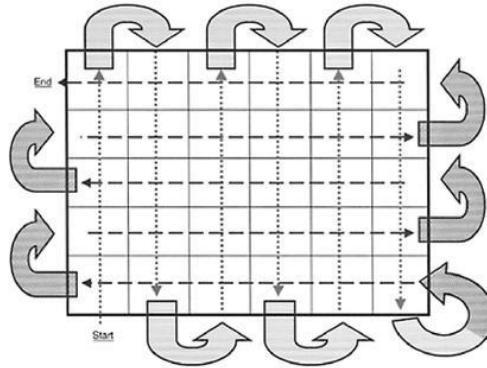
Strip Search



Line Search

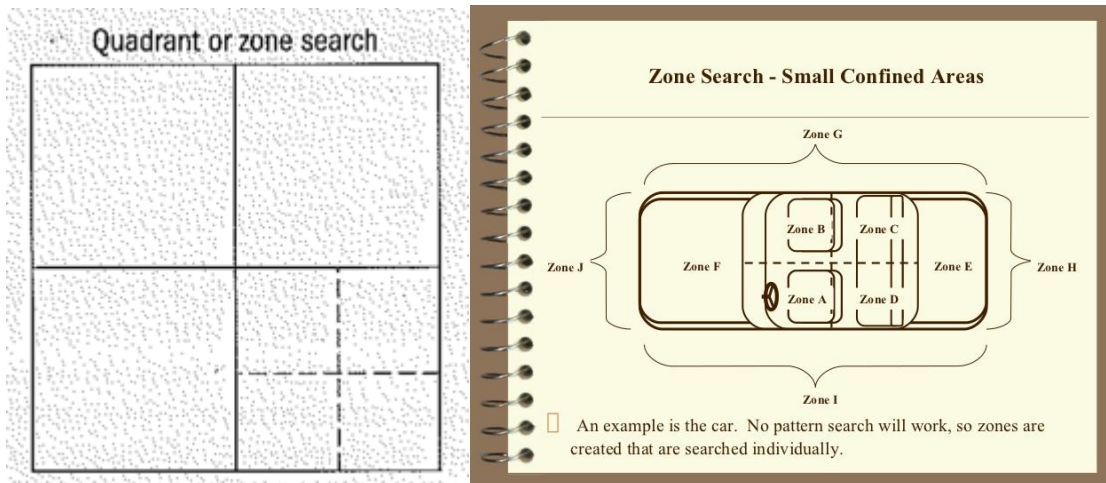
5.4.1.5.3 Grid Method

A search technique that divides the area into two sets of strips and two sets of lines that run 90° to each other. In very large search sites the quadrants may be subdivided to search the scene and make use of all available personnel.



5.4.1.5.4 Zone Method

A search technique that divides the area into quadrants. In very large search sites the quadrants may be subdivided to search the scene and make use of all available personnel.



5.4.1.5.5 Logical Association Method

A search technique that leads the forensic scientist from one evidence item to another following a logical progression or evidence trail.

5.4.1.5.6 Room-To-Room Method

A search technique that divides the indoor crime scene into segments by rooms.

Ada County Sheriff's Office Forensic Lab

5.4.1.6 After the initial search of the scene, discuss with the lead investigator the proposed method of processing. During discussions consider the following:

- Safety and health hazards
- The need for additional forensic scientists from specific disciplines
- The need for specialized resources (total station, anthropologist, aerial photographer, search teams, digital evidence specialist, etc.)
- Modification of scene boundaries if necessary
- Personnel assignments (photography, scene diagram, evidence custodian, etc.)

5.4.1.7 Establish a staging area for equipment and supplies. This area should be located outside the actual scene or in an area that will preclude contamination.

5.4.2 Biological Evidence

Biological evidence is generally in the form of liquid or dried blood, semen and saliva. Other biological evidence that may be encountered is hair, urine, feces, bones, teeth and other tissues. Since biological evidence may lead to the identification of a victim or suspect, it is imperative that this evidence be collected and preserved for DNA analysis. Proper collection includes preventing contamination from extraneous sources such as the crime scene personnel and other samples from the crime scene. Proper preservation ensures that degradation due to bacteria, humidity, high heat and other environmental factors is limited.

Photographs shall be taken prior to any testing, collection, or altering of the evidence.

5.4.2.1 Biological Evidence Collection

5.4.2.1.1 A description of the biological evidence should be documented (e.g., color, pattern, size, wet, clotted, damp or dry).

5.4.2.1.2 Biological evidence should be packaged in paper (porous) products.

5.4.2.1.3 The following order of preference for collection of biological evidence should be considered:

- Collect the entire item on which the evidence is located.
- Cut the evidence from its location. This is a reasonable course of action when dealing with large furniture, area rugs and carpet, drywall, door and window frames, etc. Prior authorization should be obtained before any cuttings are collected.
- Swab the evidence. Sterile cotton swabs are the preferred method of collection. Moisten a sterile swab using only enough water to collect the sample. Rotate the tip of the swab through the sample until adequate material has been collected. Concentrate the sample on the tip of the swab. Always consider collecting multiple swabs if sample quantity permits. Swabs from the same sample should be packaged together.

5.4.2.1.4 Special circumstances: Wet biological evidence should be dried prior to being placed into a storage location. It may be necessary to place wet biological evidence into plastic packaging for transportation purposes; however it should be removed from the plastic as soon as possible, allowed to dry and then packaged in appropriate paper (porous) packaging. Visible trace evidence should be collected from these items before they are bagged and transported.

In the case of liquid biological evidence, saturate several cotton swabs and allow to dry.

5.4.2.2 Physical Examination

Prior to chemical testing for biological evidence, physical examination shall be conducted.

5.4.2.2.1 **High Intensity Light:** When searching a crime scene for occult blood, the forensic scientist shall first use a high intensity light. Diluted blood will often leave a brownish stain. Blood may flow into floorboard cracks, carpet padding and behind baseboards. Blood in these types of areas can be located with a high intensity light source and presumptive blood testing can be performed.

5.4.2.2.2 **ALS:** Many biological substances, such as semen, saliva, and urine will fluoresce under certain wavelengths of light. Use of the 450nm filter with the orange goggles is a good starting point for such a search. If fluorescence is noted, other filters and/or goggles may be indicated to enhance the fluorescent image. (see section 5.5.1)

5.4.2.3 **BLUESTAR®**

Bluestar® is a catalytic blood test that gives a positive reaction in the presence of blood due to the peroxidase activity of hemoglobin. A positive reaction is a chemiluminescence that is observable in a dark environment. Bluestar® is most useful when blood is suspected but is not visible and may be used to help locate non-visible blood stains. Bluestar® is an ideal reagent to locate non-visible blood or enhance suspected blood that is on black or dark colored porous and non-porous substrates. More specific presumptive blood tests, such as phenolphthalein, may be subsequently used on Bluestar® positive areas/stains.

5.4.2.3.1 **Supplies**

BLUESTAR® FORENSIC¹

For the BLUESTAR® FORENSIC tablets you will need distilled water & a 125 ml spray bottle (mister) equipped with an adjustable spray nozzle.



5.4.2.3.2 **Method**

The working solution is prepared before use. For optimal results, this solution should be used within 3-4 hours after mixing. Each BLUESTAR® Forensic tablet reagent packet contains a beige tablet (containing Sodium Hydroxide) and a white tablet (containing Hydrogen Peroxide – Urea) which will make 125 ml of solution. 125 ml is generally sufficient for a 250 sq. ft. area.

- Remove the two tablets from the reagent packet and add to 125 ml of distilled water.
- Allow to completely dissolve (~1 to 2 minutes).
- Gently stir with a circular motion. DO NOT shake the container upside down.
- Determine the area to be sprayed with BLUESTAR®.

¹ Bluestar® Forensic can be purchased as tablets, ready to use kits or as super-strength magnum. Prepare each according to the manufacturer's instructions.

- Lightly mist the area and photograph immediately after application.
- Additional application may be necessary. However, use caution to avoid saturation and dilution of the target.
- Samples should be collected from the area(s) which displayed luminescence for additional testing.

5.4.2.3.3 Photography

Utilize standard low light photographic techniques ISO, aperture setting, shutter speed, and subject lighting.

Note that the chemiluminescence reaction with BLUESTAR[®] can be bright enough to be photographed without significantly darkening the room however, longer exposure times will typically be necessary to assure quality so use of a tripod is essential. See section 4.13.7.8 [Luminol/BlueStar Photography](#).

5.4.2.3.4 Interpretation

Positive: Chemiluminescence is observed when sprayed with BLUESTAR[®]

Negative: No chemiluminescence observed.

5.4.2.3.5 Identifying “false” reactions

False chemiluminescence reactions may occur to the presence of certain household detergents, chlorine, some paints and varnishes, copper, certain iron metabolizing plants and soils containing iron.

Such “false” reactions are easily identifiable because their color, brightness, and duration differ from those of the typical reaction with blood. False positives may result in a whitish chemiluminescence or one that has a fast initial burst of color that rapidly diminishes.

5.4.2.3.6 Cautions/Safety

- All other analysis and search options should be considered prior to BLUESTAR[®] application.
- Spraying of BLUESTAR[®] dilutes bloodstains.
- Because the BLUESTAR[®] reagent is primarily water it will cause dried bloodstains to dissolve. Any pattern evidence (e.g., shoeprints, fingerprints, impact spatter, etc.) will be negatively affected. If pattern evidence is located, BLUESTAR[®] use should be immediately stopped and the evidence and scene assessed to determine the best method to use in proceeding.
- BLUESTAR[®] works with blood stains and impressions. Consider testing with a more specific presumptive test for blood prior to application, when possible.

- Any samples collected after BLUESTAR® processing should be thoroughly dried prior to packaging. If possible, sample prior to the use of BLUESTAR®.
- Photographic equipment should be set up and ready for use prior to BLUESTAR® application.
- BLUESTAR® is a relatively non-specific presumptive test for blood, so other substances such as chlorine, metallic ions like manganese, copper and iron, some paints and varnishes, some vegetable and fruits, etc. may yield a positive reaction.
- Use in a ventilated area when possible.
- Wear eye protection and masks when spraying any reagent.

5.4.2.3.7 **Controls**

Positive: Known blood stain on a substrate

Negative: Unstained substrate

Controls are checked at the time of use.

5.4.2.4 Luminol

Luminol is used on suspected blood samples to locate non-visible blood or to enhance bloody impressions. Luminol is a clear, colorless reagent. When luminol comes into contact with the hemoglobin, an oxidation reaction, catalyzed by the peroxidase-like activity of hemoglobin, occurs. A positive result is a temporary light blue chemiluminescence visible best in a dark environment. The resulting chemiluminescence may increase the contrast of a blood impression on a dark substrate.

Luminol is especially useful for suspected blood deposited on dark colored, porous or non-porous surfaces. Results may be best on faint impressions or samples. Luminol may also be used to locate non-visible blood stains.

More specific presumptive blood tests, such as phenolphthalein, may be subsequently used on luminol positive areas/stains

5.4.2.4.1 Reagent

The reagent is mixed just prior to use.

Sodium carbonate, anhydrous $\geq 99.0\%$ ²	10 gm
Luminol ³ > 97.0%	0.2 gm
Deionized water	200 ml
Sodium perborate monohydrate ⁴	1.4 gm

Dissolve the sodium carbonate, sodium perborate, and luminol in the 200mL deionized water. Complete dissolution may take several minutes at room temperature. Place the reagent in a non-metal fine-mist sprayer for application.

Luminol is considered expired within 1-2 hours of preparation or when the controls don't yield the expected results, whichever comes first.



² Sodium carbonate anhydrous. CAS 497-19-8. Synonym: soda ash. Note: reference articles on Luminol do not distinguish between the use of sodium carbonate anhydrous and other hydrated versions of sodium carbonate therefore, all are acceptable for use presuming expected results with controls are obtained.

³ Luminol. CAS 521-31-3. Synonym: 5-Amino-2,3 Dihydro-1,4-phthalazinidione; 3-aminophthalhydrazide. Suppliers: Sigma# A8511; Aldrich# 12,307-2.

⁴ Sodium perborate monohydrate. CAS 10332-33-9. Note: reference articles on Luminol do not distinguish between the use of sodium perborate monohydrate and sodium perborate tetra- or 4-hydrate (CAS 10486-00-7) therefore, both are acceptable for use presuming expected results with controls are obtained.

5.4.2.4.2 Method

- Determine area to be sprayed with Luminol. Application must occur in a dark environment to view any resulting chemiluminescence.
- Have a camera on a tripod or stabilized ready to document any positive reaction.
- Mix reagent and test controls. Document lot numbers and control reactions.
- Lightly spray the area with Luminol and photograph any positive reactions.
- Repeat spraying may be necessary. However, use caution since this will dilute the stain and may cause running.
- Samples may be collected as needed from the positive area(s) for additional testing and/or preservation.

5.4.2.4.3 Photography

Utilize standard low light photographic techniques ISO, aperture setting, shutter speed, and subject lighting. See section 4.13.7.8 [Luminol/BlueStar Photography](#).

5.4.2.4.4 Interpretations

Positive: A light blue chemiluminescence is observed almost immediately upon application. The strength of the chemiluminescence will fade, typically over 1 to 2 minutes.

Negative: No change in chemiluminescence visible.

5.4.2.4.5 Cautions/Safety

- Blood impressions may be dissolved by the luminol reagent causing running or obliteration of fine detail. This is more likely with repeated spraying.
- Applying a chemical blood fixative (e.g. 2% 5-sulfosalicylic acid solution) prior to luminol treatment will reduce the luminol reaction and is not recommended.
- Any samples collected after luminol processing should be thoroughly dried prior to packaging. If possible, sample prior to the use of luminol.
- Photographic equipment should be set up and ready for use prior to luminol application.

- Upon drying, luminol contaminates the substrate with its component chemicals leaving a white, crusty residue.
- Other analysis and search options should be exhausted prior to luminol application.
- Consider testing with a more specific presumptive test for blood prior to application, when possible. Luminol is a relatively non-specific presumptive test for blood, so other substances such as chlorine, rust, iron-containing soil, metals, etc. may yield a positive result.
- Use in a ventilated area when possible.
- Wear eye protection and masks when spraying any reagent.

5.4.2.4.6 **Controls**

Positive: Known blood on a substrate

Negative: Unstained substrate (e.g., swab, fabric, filter paper).

Controls are checked with luminol prior to use.

5.4.2.5 Phenolphthalein

This oxidative test for the presumptive identification of blood is based on the catalytic activity of the heme group within the hemoglobin molecule. The phenolphthalein test is extremely sensitive and can be used to detect visible blood or occult blood that has been diluted or washed away.

5.4.2.5.1 Reagents

Stock Solution

Phenolphthalein ¹⁰	2 g
Potassium hydroxide, ≥85% ⁵	20 g
Deionized water	100 ml
Zinc, granulated, particle size approximately 20 mesh ⁶	20 g

Reflux until the solution becomes colorless (2-3 hours). Store in refrigerator in amber bottle with additional zinc added.

Working Solution A

Stock solution	1 part
Ethanol, ≥99.5% (200 proof) ⁷	4 parts

Store in dropper bottle with mossy or granulated zinc.

Working Solution B

3% Hydrogen peroxide⁸, USP



⁵ Potassium hydroxide. CAS 1310-58-3.

⁶ Zinc, granulated. CAS 7440-66-6. The listed particle size is approximate; products with a range of particle sizes including 20 mesh are also acceptable.

⁷ Ethanol. CAS 64-17-5. Synonym: ethyl alcohol.

⁸ Hydrogen peroxide expiration is 12 months after the bottle is opened. If the manufacturer's date is sooner than one year from date of opening, then that date will be used for the expiration date.

5.4.2.5.2 Method

If stain is not visible or very small, see procedure for screening for non-visible blood.

- Take a small cutting or swabbing of a targeted stain.
- Place 1 to 2 drops of phenolphthalein working solution A on the cutting or swab. Allow the reagent to soak into the sample.
- Place 1 to 2 drops of working solution B on the sample.
- Interpret and document the results in the case notes.

5.4.2.5.3 Interpretation

Positive: A positive reaction will show a pink color within 10 seconds after the addition of working solution B (hydrogen peroxide).

Negative: A negative reaction will not have a pink color change within 10 seconds.

Inconclusive: A color change that is suspected to be from substrate contamination, a positive reaction that occurs with the addition of working solution A only, or other circumstances that lead the forensic scientist to be cautious about a positive or negative interpretation. Note: the forensic scientist must document in their case notes the observation(s) that led them to make an inconclusive determination.

5.4.2.5.4 Cautions/Safety

- Do not place reagents directly on the evidence. Sample the evidence with a cutting or swabbing.
- It should be noted that the activity of the 3% hydrogen peroxide solution decreases over time. Caution should be used when using hydrogen peroxide that is older than 6 months.
- In order to optimize the efficacy of hydrogen peroxide, forensic scientists must store the working solution in a refrigerator/cooler when not in use and limit the reagents' exposure to air and light.
- In the absence of blood, the two reagents will begin to react with each other and give a hot pink color with time.
- The phenolphthalein test is a presumptive test and substances other than blood may yield positive reactions.

5.4.2.5.5 Controls

Positive: A known blood stain.

Negative: Unstained swab, fabric, filter paper, or empty spot well

Working solutions are checked at the time of use.

5.4.2.6 Leucomalachite Green (LMG)

This oxidative test for the presumptive identification of blood is based on the catalytic activity of the heme group within the hemoglobin molecule. The leucomalachite green test is extremely sensitive and can be used to detect visible blood or occult blood that has been diluted or washed away.

5.4.2.6.1 Reagents

Leucomalachite green	0.06 g
Sodium perborate	0.2 g
Methanol	20 mL
Glacial acetic acid	10 mL

Reagent should be prepared with each use.



5.4.2.6.2 Method

If stain is not visible or very small, see procedure for screening for non-visible blood.

- Take a small cutting or swabbing of a targeted stain.
- Place 1 to 2 drops of leucomalachite green reagent on the cutting or swab. Allow the reagent to soak into the sample.
- Interpret and document the results in the case notes.

5.4.2.6.3 Interpretation

Positive: A positive reaction will show a dark green color almost immediately.

Negative: No color change should be observed.

5.4.2.6.4 Cautions/Safety

- Do not place reagents directly on the evidence. Sample the evidence with a cutting or swabbing.
- The leucomalachite green test is a presumptive test and substances other than blood may yield positive reactions.

5.4.2.6.5 **Controls**

Positive: A known blood stain.

Negative: Unstained swab, fabric, filter paper, or empty spot well

Working solutions are checked at the time of use.

5.4.2.7 O-Tolidine (O-tol)

This oxidative test for the presumptive identification of blood is based on the catalytic activity of the heme group within the hemoglobin molecule. The o-tolidine test is extremely sensitive and can be used to detect visible blood or occult blood that has been diluted or washed away.

5.4.2.7.1 Reagents

O-tolidine	0.6 g
Glacial acetic acid	100 mL
Ethanol	100 mL
Hydrogen Peroxide	1-2 drops

Dissolve o-tolidine in acetic acid/ethanol mixture.



5.4.2.7.2 Method

If stain is not visible or very small, see procedure for screening for non-visible blood.

- Take a small cutting or swabbing of a targeted stain.
- Place 1 to 2 drops of o-tolidine reagent on the cutting or swab. Allow the reagent to soak into the sample.
- Place 1 to 2 drops of hydrogen peroxide on the sample.
- Interpret and document the results in the case notes.

5.4.2.7.3 Interpretation

Positive: A positive reaction will show a blue/green color within 10 seconds after the addition of hydrogen peroxide.

Negative: No color change within 10 seconds.

5.4.2.7.4 Cautions/Safety

- Do not place reagents directly on the evidence. Sample the evidence with a cutting or swabbing.

- It should be noted that the activity of the hydrogen peroxide solution decreases over time. Caution should be used when using hydrogen peroxide that is older than 6 months.
- In order to optimize the efficacy of hydrogen peroxide, forensic scientists must store the reagent in a refrigerator/cooler when not in use and limit the reagents exposure to air and light.
- The o-tolidine test is a presumptive test and substances other than blood may yield positive reactions.

5.4.2.7.5 Controls

Positive: A known blood stain.

Negative: Unstained swab, fabric, filter paper, or empty spot well

Working solutions are checked at the time of use.

5.4.2.8 Acid Phosphatase (AP)

The purpose of the acid phosphatase test is to detect the enzyme acid phosphatase, which is found in elevated levels in seminal fluid. This presumptive test is used to indicate the presence of seminal fluid; it does not confirm the presence of seminal fluid since the enzyme can be found in lower concentrations in other body fluids such as vaginal secretions and fecal material.

5.4.2.8.1 Reagents

Stock Solution

Sodium acetate	6 g
Glacial acetic acid	2 mL
Deionized water	500 mL

Mix the above ingredients.

Working Solution A

1-naphthyl phosphate sodium salt	~10 mg
Stock solution	~5 mL

Working Solution B

o-dianisidine, tetrazotized (zinc chloride complex)	~10 mg
Stock solution	~5 mL

Working solutions prepared at time of use.



5.4.2.8.2 Method

- Take a small cutting or swabbing of a targeted stain.
- Place 1 to 2 drops of working solution A on the cutting or swab. Allow the reagent to soak into the sample.
- Place 1 to 2 drops of working solution B on the sample.
- Interpret and document the results in the case notes.

5.4.2.8.3 Interpretation

Ada County Sheriff's Office Forensic Lab

Positive: A positive reaction will show a dark purple color within 60 seconds.

Negative: No color change should be observed within 2 minutes.

Inconclusive: A purple color change occurring in 1-2 minutes. The purple color must be the same hue as the positive control.

5.4.2.8.4 Cautions/Safety

- Do not place reagents directly on the evidence. Sample the evidence with a cutting or swabbing.
- In order to optimize the efficacy, forensic scientists should store the working solution in a refrigerator/cooler when not in use and limit the reagents exposure to air and light.
- The acid phosphatase test is a presumptive test and substances other than semen may yield positive reactions.

5.4.2.8.5 Controls

Positive: A known semen stain.

Negative: Unstained swab, fabric, filter paper, or empty spot well

Working solutions are checked at the time of use and additionally every 2 hours.

5.4.3 Impression Evidence

Impression evidence may take the form of a shoe, tire, toolmark, fabric, or any patterned impression. Wet or fragile impressions are susceptible to alteration during crime scene processing, so caution must be taken to preserve this type of evidence. Stepping Plates may be used to protect the floor surfaces during processing where impressions may be present.

5.4.3.1 Chemical Enhancement Methods

The purpose of chemical enhancements is to increase the detail and contrast between an impression and its substrate. If impression evidence can be collected without damage, it shall be packaged and preserved at the scene for chemical enhancement later in the laboratory under controlled conditions. Visible impressions or areas of suspected non-visible impressions that are not easily transported should be chemically enhanced on site.

Examination quality images shall be taken of a visible impression before enhancement. Documentation of the impression's location relative to its substrate and/or immediate surroundings shall also be included in the case notes.

After enhancement, examination quality images shall be taken of the impression if the enhancement resulted in greater detail, greater contrast, or visualization of additional impressions. If examination quality images are not taken after enhancement, the notes must indicate the reason.

5.4.3.1.1 Amido Black – Methanol Based

Amido black is used on bloody impressions and is a dark blue-black colored reagent. It reacts with the proteins present in blood, staining blood a blue-black color. The background reagent can be rinsed away which may increase the contrast of the impression on the substrate.

Amido black is especially useful for bloody or protein-based impressions deposited on lighter colored, non-porous surfaces such as glass, plastic, vinyl, etc. but may work on concrete or some papers. Results may be best on faint impressions.

5.4.3.1.1.1 Reagents

Developer Solution

Naphthol blue black	2 g
Glacial acetic acid	100 mL
Methanol	900 mL

Dissolve the naphthol blue black in the above ingredients.

Rinse Solution

Glacial acetic acid	100 mL
Methanol	900 mL

Final Rinse – Rinse with distilled water.

The Reagent and Rinse solutions are stored in bottles at room temperature or refrigeration.

The Reagent and Rinse solutions do not expire and may be used until the entire volume is consumed.



5.4.3.1.1.2 Method

- Stain and rinse a small area of substrate that is not part of the impression, to check for background staining. Do not use this reagent if significant background staining occurs.
- Apply the Reagent to the impression via spraying, pouring, or submersion. To ensure complete staining, the solution should remain in contact with the impression for at least 1-2 minutes to obtain maximum development.
- Apply the Rinse solution to remove Reagent stain from background areas. An optional water rinse may follow.
- Allow the impression to air dry.
- The impression may be re-stained to make darker, if desired.

5.4.3.1.1.3 Interpretation

Positive: A blue-black staining will appear within 1-2 minutes.

Negative: No change or less intense blue-black staining results.

5.4.3.1.1.4 Cautions/Safety

- Use in a very well-ventilated area. Methanol and glacial acetic acid in the quantity and concentration of this formulation are inhalation hazards.
- Wear eye protection and masks when spraying any reagent.
- Amido black works only with bloody or other protein-based impressions. Consider a presumptive test for blood prior to application, when possible.
- Porous substrates may absorb the blue-black reagent causing background staining that cannot be rinsed away. This might result in little contrast with the treated bloody impression.
- This chemical enhancement does not include a chemical fixative. Fresh blood impressions may be damaged or destroyed if not fixed prior to treating.

5.4.3.1.1.5 Controls

Positive: A known blood stain on a substrate.

Negative: An unstained area of the substrate.

Controls are checked with the reagent and rinse prior to use.

5.4.3.1.2 Amido Black – Water Based

Amido black is used on bloody impressions and is a dark blue-black colored reagent. It reacts with the proteins present in blood, staining blood a blue-black color. The background reagent is rinsed away which may increase the contrast of the impression on the substrate.

Amido black is especially useful for bloody or protein-based impressions deposited on lighter colored, non-porous surfaces such as glass, plastic, vinyl, etc. but may work on concrete or some papers. Results may be best on faint impressions.

The water based formula may be considered for use when the substrate is sensitive to methanol or in any situation where a less vaporous solution is desired.

5.4.3.1.2.1 Reagent

Deionized water	500 mL
5-sulfosalicylic acid dihydrate, ≥99.0	20g
Naphthol blue black	3g
Sodium carbonate	3g
Formic acid	50 mL
Glacial acetic acid	50 mL
Kodak Photo Flo solution	37.5 mL



Combine all reagent components in a ≥1L capacity bottle. Dilute mixture to 1L with deionized water. Although the mixture will be ready to use immediately, allow the mixture to stand for several days prior to use for best results.

The solution is stored in a bottle at room temperature or refrigeration. This reagent does not expire and may be used until the entire volume is consumed.

Rinse – water

5.4.3.1.2.2 Method

- Stain and rinse a small area of substrate that is not part of the impression, to check for background staining. Do not use this reagent if significant background staining occurs.
- Apply the Reagent to the impression via spraying, pouring, or submersion. To ensure complete staining, the solution should remain in contact with the impression for at least 3-5 minutes to obtain maximum development.
- Rinse with water to remove Reagent stain from background areas.
- Allow the impression to air dry.
- The impression may be re-stained to make darker, if desired.

5.4.3.1.2.3 Interpretation

Positive: A blue-black staining will appear within 3-5 minutes

Negative: No change or less intense blue-black staining results

5.4.3.1.2.4 Cautions/Safety

- Amido black works only with bloody or other protein-based impressions. Consider a presumptive test for blood prior to application, when possible.
- Porous substrates may absorb the blue-black reagent causing background staining that cannot be rinsed away. This might result in little contrast with the treated bloody impression.
- Use in a ventilated area when possible.
- Wear eye protection and masks when spraying any reagent.

5.4.3.1.2.5 Controls

Positive: A known blood stain on a substrate

Negative: An unstained area of the substrate

Controls are checked with the reagent and rinse prior to use.

5.4.3.1.3 Leucocrystal violet (LCV)

LCV is for use on bloody impressions. LCV is the reduced form of crystal violet and is a clear, colorless reagent. When LCV and hydrogen peroxide come into contact with the hemoglobin in blood, an oxidation reaction catalyzed by the peroxidase-like activity of the hemoglobin will occur. The result is a dark violet dye which has an affinity for proteinaceous substrates. The resulting violet color may increase the contrast of an impression on a substrate.

LCV is especially useful for bloody impressions deposited on lighter colored, porous and non-porous surfaces such as vinyl flooring, carpeting, fabric, etc. Results may be best on faint impressions.

5.4.3.1.3.1 Reagent

5-sulfosalicylic acid dihydrate, ≥99.0	10g
Hydrogen peroxide (%3 Concentration)	500 mL
Sodium acetate anhydrous	3.7g
Leucocrystal violet	1g



Combine the 5-sulfosalicylic acid, sodium acetate, and leucocrystal violet with the 500mL 3% hydrogen peroxide in a dark bottle. A 473mL volume of 3% hydrogen peroxide (the volume commonly sold at pharmacies) is an acceptable substitute for the 500mL 3% hydrogen peroxide volume.

The solution should be stored in a dark bottle and refrigerated. It expires 30 days after mixing.

Optional rinse – water

5.4.3.1.3.2 Method

- Apply LCV to the impression via spraying, pouring, or submersion and allow it to remain in contact with the impression for at least 30 seconds.
- Rinse non-porous substrates with water to remove excess LCV when necessary.

- Allow the impression to air dry.
- Enhanced impressions that aren't rinsed should be photographed as soon as possible. This is to document the impression prior to any background color development that may occur.

An indirect sampling method may be used prior to LCV application, if desired. Define the area to be sampled and tested. Moisten filter paper with deionized water and press it onto the defined area. Mark the filter paper before removing it so the orientation is documented. Remove the filter paper and spray with LCV then proceed with the method described above. This technique may be less sensitive than directly spraying, pouring, or submersion because it relies on the efficacy of the stain to transfer to the filter paper.

5.4.3.1.3.3 Interpretation

Positive: A violet color within 30 seconds to 3 minutes

Negative: No color change. Unreacted areas will also turn violet over time if not rinsed. See Cautions.

Because impressions that are not visible may be enhanced or detected with the application of LCV, a violet color reaction may be interpreted and reported as a positive result with a presumptive test for blood.

5.4.3.1.3.4 Cautions/Safety

- LCV crystals that have turned yellow should not be used.
- The LCV reagent is light sensitive and may discolor over time due to exposure. LCV reagent should be colorless or near colorless. Should it appear blue or violet, consider making up fresh reagent. Store in dark bottles.
- Treated areas will change from colorless to violet over time, unless rinsed. The timing varies with environmental conditions and may occur within hours to several days after application.
- Use in a ventilated area when possible.
- Wear appropriate eye protection when using.

5.4.3.1.3.5 Controls

Positive: A known blood stain on a substrate

Negative: An unstained area of the substrate

Controls are checked with the LCV and rinse prior to use.

5.4.3.1.4 2% 5-sulfosalicylic acid solution

A 2% 5-sulfosalicylic acid solution fixes bloody impressions so they are not washed away during enhancement. Bloody impressions may fix through aging but fresh blood impressions may be fixed with heat or a 2% weight/volume aqueous solution of 5-sulfosalicylic acid. A prior fixing step is not necessary if 5-sulfosalicylic acid is a component of the enhancement reagent.

5.4.3.1.4.1 Reagent

5-sulfosalicylic acid dihydrate, ≥99.0	20g
Deionized water	1 L

Dissolve the 20g 5-sulfosalicylic acid in 1L water.

The solution may be stored in bottles at room temperature or refrigerated. This reagent does not expire and may be used until the entire volume is consumed.

5.4.3.1.4.2 Method

The solution can be applied to the impression via spraying, pouring, or submersion. To ensure complete fixing, the solution should remain in contact with the impression for several minutes at which point excess solution is rinsed off with deionized water.

5.4.3.1.4.3 Control

This reagent cannot be reasonably subjected to a Quality Control test either by testing against a known standard prior to use or by end point verification; therefore, no control is necessary.



5.4.3.2 Lifting

Lifting involves transferring a two-dimensional impression from its original surface to a surface that will provide better contrast, allow easier transportation, and perhaps aid in preservation. Two methods are available for lifting impressions; electrostatic lifters and adhesive lifters. The examiner should consider the substrate (porous, nonporous), substrate condition (wet, dry), substrate color, and the presence of interfering material (dirt, grease) when selecting a lifting device. There is a risk that the impression may be destroyed during attempts to do the lift. Therefore, footwear impressions should only be lifted in the field when the item containing the impression cannot be safely transported to the laboratory.

5.4.3.2.1 Electrostatic Dust lifting device

The electrostatic dust lifting device (ESDL) should be used on impressions of dry dust or dry residue on surfaces that are relatively clean. The device will work on both porous and non-porous substrates, but works best on dry dust impressions on relatively clean surfaces. If the impression is a wet residue or has become wet or damp prior to lifting, the ESDL may not work. The ESDL does not destroy wet prints. Therefore, if the type of impression is unknown, the ESDL should be used first. If the print is not lifted, then subsequent method(s) can be used.

5.4.3.2.1.1 Equipment

- Electrostatic dust print lifter
- Lifting film

5.4.3.2.1.2 Method

- Take examination quality photograph(s) of the impression prior to any lifting attempts.
- Assemble the ESDL. Attach the metal probe in the high voltage supply port if needed. Connect the ground wire, either antenna ground or alligator clip, to the ground port. Supply voltage to the main unit either with batteries or AC/DC outlet.
- Position the grounding device and attach the ground wire of the unit to the ground plate or other grounding material. The most effective position of the ground plate is when it is in maximum contact to a surface adjacent the impression.
- For impressions on *moveable objects*, such as newspapers, rugs, etc., the best position for the ground plate would be under the impression with the metal side up.
- For impressions on *immovable objects*, such as vinyl flooring or a wall, place the ground plate (metal side down) or the metal antenna next to, but not touching, the object.

- For impressions on *metallic objects*, such as a vehicle door, the ground wire may be attached directly to the metallic object.
- For metallic surfaces, first place a thin (1 or 2 mil), clear piece of Mylar or polyester on the impression before placing the lifting film. This step is not necessary for impressions on non-metallic surfaces.
- Place clean lifting film over the impression with the black side down (toward the impression) and silver side up (away from the impression). The lifting film must be larger than the impression to ensure a full transfer (it is prudent to use a larger piece than expected especially with latent or partial prints, as more detail may be present that is not apparent to the unaided eye).
- Mark the orientation of the film, if necessary.
- Place the probe on a corner of the metallized surface of the lifting film and turn on the voltage. Start at a lower voltage setting, and increase voltage as needed. It is not necessary to move the probe around the film. If any air bubbles develop as the film adheres to the substrate, they may be rolled out with a clean fingerprint roller.
- Discontinue the voltage to the film and allow the film to sit for at least 5 seconds to allow the static charge to dissipate.
- Remove the film, turn over on a clean flat surface, and evaluate the results. The results should be evaluated in a darkened room with strong oblique light.
- Subsequent lifts may be performed if the first was unsuccessful, typically due to a large quantity of transferred material (unsuccessful lifts due to an overall lack of transfer will not be successful in subsequent lift attempts). Second or third lifts may yield a "cleaner" impression as interfering background material may have been reduced during the first lift.
- A successful lift must be retained by securing it to prevent movement or destruction of the lift. Examination quality photographs are suggested. Unsuccessful lifts do not need to be photographed or maintained.
- The lifting film of unsuccessful lifts may be reused after cleaning with a soft cloth.

5.4.3.2.1.3 Cautions/Safety

- Not all dry impressions can be successfully lifted using ESDL.
- Attempts to lift dust prints on dirty backgrounds will cause both the dust print and dirty background to lift together. Subsequent lifts should be attempted to see if they would be successful.
- Never slide the lifting film across the surface with the impression.

- If using a fingerprint roller to eliminate air bubbles in the lifting film, do so gently to avoid shifting or excessive pressure that may damage the impression.
- As a precaution the electrostatic dust print lifter should not be operated by persons with pacemakers.
- A static electricity shock may occur when the forensic scientist touches the film if the forensic scientist fails to discharge the lifting film with the probe. To discharge the probe, allow it to sit in contact with the lifting film, with no voltage, for at least 5 seconds after the ESDL voltage is turned off.
- It is possible to receive electrical shocks from the lifting film, the ground plate, the metal probe, and a metallic surface. Such shocks will be avoided by not touching any of these parts when the current is on and by allowing the probe to discharge after use (see caution above).
- Do not allow the lifting film to come into contact with the grounding plate while the ESDL is on – this will cause arcing and the device will not work properly.
- If arcing occurs between the film and the ground, the power is too high or part of the film is touching or too close to the ground plate.

5.4.3.2.1.4 Documentation

- Mark the lifting film before removing it from the surface with the impression to allow for orientation. This may be impossible to do if the film was removed from the surface without orientation marks, clear photographs, and/or a supporting diagram.
- Label the back (top surface) of the lift with appropriate markings.
- Subsequent lifts from the same impression must be numbered or otherwise labeled to distinguish which was first, second, etc.
- Case notes shall have some statement(s) addressing the quantity and description of impressions located, along with which ones were lifted. This may be aided with, but not replaced by, photographs.

5.4.3.2.2 Adhesive and gelatin lifts

Adhesive lifting covers both gelatin and tape devices and permits lifting of some impressions when the ESDL is not available or was unsuccessful. Adhesive lifters should only be used if the evidence can-not be transferred to the laboratory and after photography.

A gelatin lift can be used on porous or non-porous surfaces for lifting original residue deposit, impressions that have been dusted with fingerprint powder, or impressions enhanced with some chemicals.

Tape devices, on the other hand, should only be used on non-porous surfaces and work best with impressions that have been dusted with fingerprint powder.

5.4.3.2.2.1 Equipment

- *Adhesive lifters* are generally tape of some kind. Adhesive lifters are generally purchased, however, fingerprint tape and other tapes can also be used.
- *Gelatin lifters* are commercially available in three colors; black, white, and clear.
- Clean fingerprint roller

5.4.3.2.2.2 Method - Gelatin Lifter

- Take examination quality photographs of the impression prior to any lifting attempts.
- Choose the color of gelatin lift based on what will result in the best contrast between the target impression and the backing color. Black often works well for dusty shoe impressions, while a fingerprint developed with black fingerprint powder may best appear on a white background.
- Remove the gelatin lift from the package and allow it to come to room temperature for 5-10 minutes *prior* to lifting an impression. This allows the gelatin to “relax” and will yield a more accurate size of the impressions.
- Cut the gelatin lifter to a size just larger than the target impression, if desired.
- Label the back of the lift to document the orientation, position, and location of the impression. This may also be done with mid-range photography that demonstrates the orientation of the impression in relationship to the surface it's deposited on.
- Peel the protective transparent cover away from the gelatin layer.

- Place one edge of the lift on the substrate and slowly smooth down the rest of the lifter over the impression, taking care to roll or press out any air bubbles. A roller may assist with this.
- After the lift has been smoothed over the entire surface of the impression, carefully remove it by the corners.
- Place it on a horizontal surface with the gelatin layer up and evaluate the results. The results should be evaluated in a darkened room with strong oblique light.
- Take examination quality photograph(s) of the lifted impression as soon as possible because the impression will fade over time. Unsuccessful lifts do not need to be photographed.
- To secure the lift for packaging, either cover with the protective plastic cover avoiding air bubbles, or tape it by the edges or corners (gelatin layer up) in the bottom of a flat cardboard box.

5.4.3.2.2.3 Method – Adhesive Lifters

- Take examination quality photographs of the impression prior to any lifting attempts.
- Place the adhesive lifter/tape at the edge of the impression and press or roll the tape across it, avoiding air bubbles. Repeat with overlapping tape lengths, if necessary.
- After the adhesive has been smoothed over the entire surface, carefully remove it from the corners.
- Place the adhesive on a clean fingerprint card, piece of paper, transparency sheet, or other similar product depending on which is likely to offer the best contrast for later imaging.
- Mark the lift to document the orientation, position, and location of the impression. This may also be done with mid-range photography that demonstrates the orientation of the impression in relationship to the surface it's deposited on.

5.4.3.2.2.4 Cautions/Safety

- Adhesive lifts should not be attempted on non-porous substrates.
- Gelatin lifts will melt between 40° and 45° Celsius (104° and 113° Fahrenheit). Objects that have been exposed to the sun or these temperatures will need to be cooled before attempting to use a gelatin lifter.
- Lifts may be stored at room temperature, though storage in a refrigerator is advantageous.

- Attempts to lift dust prints on dirty backgrounds will cause both the dust print and dirty background to lift together. Subsequent lifts should be attempted to see if they would be successful.
- Never slide the gelatin lift across the surface with the impression.
- If using a fingerprint roller to eliminate air bubbles in the gelatin lifter, do so gently to avoid shifting or excessive pressure that may damage the impression.
- Gelatin lifted impressions may fade and ultimately disappear over time. The rate of fading depends on storage temperature (cooler is better) and the material of the impression (e.g., silver fingerprint powders have lasted for several years without fading).

5.4.3.2.2.5 Documentation

- Mark and/or photograph the lift to allow for orientation.
- Label the back (top surface) of the lift with the appropriate markings.
- Subsequent lifts from the same impression must be numbered or otherwise labeled to distinguish which was first, second, etc.
- Case notes shall have some statement(s) addressing the quantity and description of impressions located, along with which ones were lifted. This may be aided with, but not replaced by, photographs.

5.4.3.3 Casting

Casting is a technique that is used to collect three-dimensional impressions. Three-dimensional impressions are those that have a significant depth to them, in addition to the length and width of the impression. Commonly, they may be found in soil, sand, or snow. The detail within the impression may vary according to the substrate.

5.4.3.3.1 Equipment

- Dental stone or other forensic casting material (e.g. Traxtone, Crime-Cast™, etc.)
- Water
- Bucket or plastic bag
- Stir stick/spoon
- Tongue depressor
- Adjustable metal forms (approximately shoeprint size)
- Tray (plastic or metal)
- Snow Print Wax™

5.4.3.3.2 General Casting Method

The dental stone is mixed with water to a consistency approximating thin pancake batter. This mixture is then gently poured into the impression and allowed to harden. A tongue depressor can be held a few inches above the impression and the mixture poured along that and then into the impression, to direct the flow and reduce the chance of damaging detail in the impression. Also, sticks may be placed on top of the casting material to help support the cast after it has dried.

The required amount of dental stone will vary depending on the size of the impression to be cast, therefore, variations are expected. One recommendation of volume/quantity is described below. Follow the manufacturer's directions for other forensic casting materials.

Two (2) pounds of dental stone may be placed into an 8x12 inch Ziploc plastic bag; this amount will cast an average sized shoe impression. In preparation for use at crime scenes, numerous 2 lb. bags can be prepared and stored.

- Retrieve a two-pound bag, add about 10 ounces of water, and thoroughly mix in the closed bag. The mixture should have the consistency of thin pancake batter. If needed, add more water or dental stone to create the correct consistency.

- Metal forms may be placed around the impression to contain the casting mixture. These are less critical with the advent of dental stone and other forensic casting materials⁹.
- Open the bag and with the bag at ground level, carefully pour the mixture into or next to the impressions, allowing it to gently flow into it. Fill the impression completely so that the mixture overflows out of the impression.
- When the cast is firm but still soft, scratch identifying marks on the exposed surface or write identifying marks with a permanent marker when the cast is dry.
- Allow the cast to dry for a minimum of twenty minutes in warm weather, longer in cold, wet conditions.
- Carefully lift the cast. Do not try to clean it; cleaning will occur in the laboratory.
- Package the cast in a large brown paper bag or cardboard box (not plastic) and allow to dry for an additional 48 hours.

5.4.3.3.3 Method for Underwater Impressions

Impressions that are underwater may still be cast. Do not attempt to drain away any of the water as it is unnecessary and may disturb the impression. Place a metal casting form around the impression taking care not to distort/disturb it – the top of the metal form should be above the water line. Lightly sprinkle the dental stone over the underwater impression until covered by about an inch of the casting material. Then mix the dental stone mixture to a slightly thicker consistency than typical and carefully scoop the mixture onto the impression. Allow to set for at least 60 minutes.

Impressions that are shallow may be cast using the standard procedure except with a mixture that is slightly thicker – the mixture will displace the thin layer of water.

5.4.3.3.4 Method for Casting Impressions in Snow:

5.4.3.3.4.1 DENTAL STONE

- Using only the Dental Stone powder, sift a thin layer over the impression.
- Allow 1-2 minutes between each additional layer to allow for adequate hardening of the casting material.
- Repeat the above steps until there is no more moisture for the Dental Stone to absorb

- Mix the remaining packet of Dental Stone with water and apply slowly to impression.

5.4.3.3.4.2 SNOWPRINT WAX

Impressions that are in snow should be sprayed with at least 3 to 4 layers of Snow Print Wax™ prior to casting, as it will preserve the detail. Allow to set for approximately 10 minutes. The wax shell is then cast with a slightly thicker-than-typical dental stone mixture that has been cooled.

- Be careful not to hold the can so close that the aerosol damages detail in the impression.
- Be sure that the entire impression is sealed with the Snow Print Wax or dental stone may seep through causing damage.
- Use cold water or some snow to help offset the exothermic reaction of mixing dental stone with water.
- Follow manufacturer recommendations for Snow Print Wax™ if they conflict with the above procedures.

5.4.3.3.4.3 Cautions/Safety

- Take examination quality photographs of the impression prior to casting.
- Do not clean out debris that is part of the impression or was present when the impression was made.
- Use of fixatives is not recommended as they are not required to provide a protective layer to the cast (when dental stone or other forensic casting material is used), they rarely have any effect on preserving detail in the impression, and with improper use may actually obscure detail. If the forensic scientist chooses to use a fixative, s/he must be able to articulate why it was necessary and that its use did not obscure minute detail.
- A light dusting of a very fine powder or talc over the impression may be performed to prevent some of the soil from adhering to the cast, in an attempt to get a cleaner cast. Use of this technique is at the discretion of the forensic scientist, assuming the technique and powder used are fine enough to ensure that minute detail is not obscured.
- The reaction of dental stone with water is exothermic. This will have implications when casting impressions in snow (see Snow Impressions above).
- Once a dental stone mixture (or other forensic casting material) has hardened, it is not reversible. Use the mixture quickly after it is mixed or

it may harden in the mixing container. Thicker mixtures and warmer temperatures will cause hardening more quickly compared to thinner mixtures and colder temperatures.

5.4.3.3.4.4 Documentation

- Any impression(s) must be photographed with examination quality photographs prior to casting.
- Label the back (top surface) of the cast with the appropriate markings using either a stick and scratching it when partially hardened, or with a permanent marker when fully hardened.
- Case notes must have some statement(s) addressing the quantity and description of impressions located, along with which ones were cast. This may be aided with, but not replaced by, photographs.

5.4.3.3.4.5 Mikrosil Casting

Mikrosil™, a silicone rubber casting material, is a two-part silicone type material available in brown, white, and black colors. Mikrosil™ is useful to the crime scene forensic scientist to collect and preserve three-dimensional toolmark evidence from a scene that can't be reproduced in photographs alone. Additionally, Mikrosil™ can be used to lift latent prints developed on irregular surfaces.

5.4.3.3.4.5.1 Equipment

- A Mikrosil™ package contains one large tube of silicone rubber casting material and a second smaller tube of silicone hardener (catalyst).
- Mikrosil™ Base (White, Brown, Black)
- Mikrosil™ Hardener
- Wooden tongue depressor or metal spatula
- Mixing surface (fingerprint lifting card will do)
- White fingerprint lift cards or other clean mixing surface
- String tags (optional)

5.4.3.3.4.5.2 Method

Mikrosil™ is available in three colors; brown, white, and black. The brown color is recommended for the reproduction of toolmark impressions. White Mikrosil™ is recommended for lifting latent print impressions that have been developed with black powder, and black Mikrosil™ is recommended for lifting latent print impressions that have been developed with a light color powder.

It is advised that the forensic scientist prepare a label for the Mikrosil™ cast since it is nearly impossible to write on the silicone rubber.

Remove any debris that may be in the impression.

5.4.3.3.4.5.2.1 Prepare the Mikrosil™

- From the large tube, place a line of Mikrosil™ sufficient to cover the impression onto the mixing surface.
- From the smaller tube, place a line of hardener next to the line of Mikrosil™; both lines should be the same approximate length. The proper ratio of hardener to Mikrosil™ is 1:1.5, but more catalyst will reduce the working time and less catalyst will increase the setting time.
- Thoroughly mix the two lines of Mikrosil™ together using a tongue depressor or metal spatula. This should take 30 to 60 seconds.

5.4.3.3.4.5.2.2 Application of Mikrosil™

- Remove the mixed Mikrosil™ from the card and apply to the surface taking care to work the casting material into or on the impression, but not allowing the mixing tool to come in contact with the impression.
- Place the prepared label in the Mikrosil™, and allow the cast to set. A wooden tongue depressor may be pressed into the Mikrosil™ cast before it sets when a label or tag is not practical.
- The setting time will be approximately 5 to 8 minutes in 68-degree temperature and 12 to 15 minutes in below-freezing temperature with a standard ratio of Mikrosil™ and catalyst.
- It is recommended that a photograph be taken of the Mikrosil™ cast on the area prior to its removal to aid in the orientation of the cast.

- Gently peel the Mikrosil™ from the impression after it has setup.

5.4.3.3.4.5.3 **Documentation**

Label and orient the lift with the appropriate markings.

5.4.3.3.4.5.4 **Packaging**

A newly recovered cast may become stuck to another recovered Mikrosil™ cast if they are packaged together. For this reason the cast should be packaged separately, in a small box or envelope, or packaged in such a manner that multiple casts do not come into contact with each other.

5.4.3.3.4.6 **Alternatives to Mikrosil™**

Forensic Sil, Accutrans®, or other similar based products manufactured by different companies can be used. These products are mixed and dispensed as follows:

5.4.3.3.4.6.1 **Equipment**

- These casting materials come in dual-stage tubes, which include both casting material and a special catalyst.

5.4.3.3.4.6.2 **Method**

Load a tube into the dispensing gun, squeeze the trigger and casting material and catalyst are mixed on demand through a special mixing tip. No mixing is required and you only use as much casting material as needed. Leave the applicator tip on the tube once finished. These products won't dry in the tube. When you are ready to make another cast, simply replace the used tip with a fresh one.

5.4.3.3.4.6.3 **Documentation**

Documentation principles are the same as for casting with Mikrosil.

5.4.3.3.4.6.4 **Packaging**

Ada County Sheriff's Office Forensic Lab

A newly recovered cast may become stuck to another recovered cast if they are packaged together. For this reason the cast should be packaged separately, in a small box or envelope, or packaged in such a manner that multiple casts do not come into contact with each other.

5.4.3.4 Tire Exemplars

The exemplar provides a record of the characteristics present on an item of evidence at a given time.

The impression a tire leaves will be slightly different depending on whether or not it is under load. If exemplars are being made for purposes other than elimination, they shall include the full circumference of the tire when under load. Typically this is between six and eight feet in length.

5.4.3.4.1 Elimination Exemplars

Partial exemplars may be collected for purposes of elimination of non-suspect vehicle tires or for documentation of an obvious exclusion based on tread design differences.

5.4.3.4.1.1 Imaging

An image of the tire tread is sufficient. A scale is recommended. Information about the tire and vehicle should be recorded.

5.4.3.4.1.2 White Adhesive Lift

Using a large adhesive lift, the residual material on a tire can be lifted off, providing a good representation of a section of the tread design. Information about the tire and vehicle should be recorded.

5.4.3.4.2 Full Tire Exemplars

When it is determined that the collection of tire exemplars is to be performed at the time of the vehicle process, the crime scene investigator should first seek the assistance of a Footwear/Tire Tread examiner. It may be beneficial to provide the Footwear/Tire Tread examiner with images of the impressions and/or vehicle tires ahead of time. In some cases, the collection of full exemplars may be deemed unnecessary. This shall not be determined by the crime scene investigator.

Note: If comparison of individual characteristics will be requested, the collection of the tires is required even when tire exemplars have been collected. The conclusions of a subsequent comparison may be limited if the tires are not available for examination.

5.4.3.4.2.1 Equipment

- Broom
- Kraft Paper

- Duct Tape
- Work Gloves
- Scissors/Utility Knife
- Chart Board
- Wet Media Film
- Tape or chalk for marking tire sidewalls
- Sharpie or other markers
- Cloth Measuring Tape

Either

- Petroleum Jelly or Silicone Oil
- Magnetic Fingerprint Powder
- Magnetic Fingerprint Powder Brush
- Clear Lacquer Spray

OR

- Black Printer's Ink
- Clear Plastic Sheeting

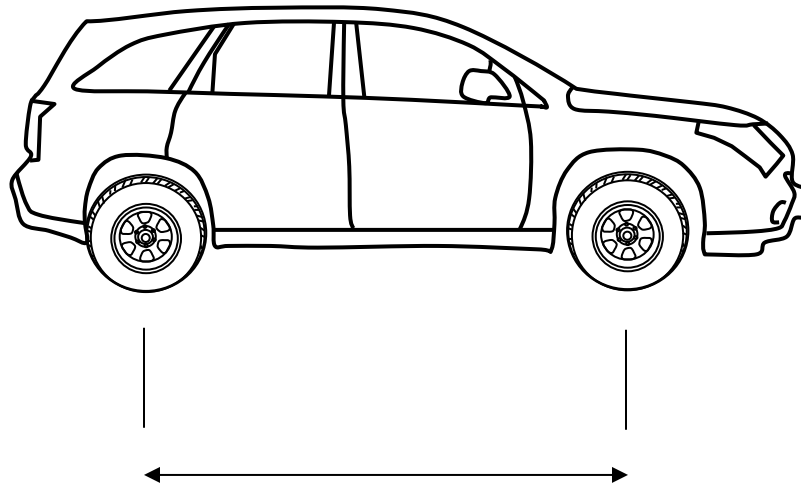
5.4.3.4.2.2 Method

Before using any of the techniques listed below, the following steps shall be performed.

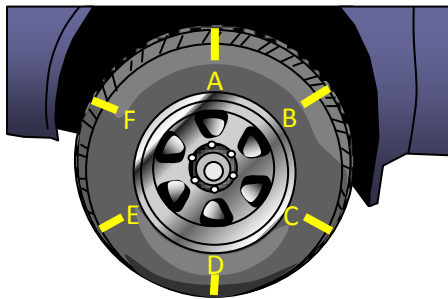
- Find an adequate surface to collect the tire exemplars. A smooth area of asphalt or concrete is sufficient and should be swept clean. The size of the area needed will depend upon the vehicle and tires, but will need to be at least long enough to permit one full tire rotation with enough extra room to bring the vehicle to rest off of the exemplar.
- Roll out enough paper to keep the tires from collecting debris while moving. Secure the paper with tape.
- Clean the tires by rubbing lightly while wearing work gloves. Cleaning should be to remove surface debris only. Rock-holds, etc. should be left in place.
- Measure the circumference of the tire(s) of interest using a cloth measuring tape.



- Measure the wheel base of the vehicle.



- Mark the tire with tape at 5 to 6 points equidistant around the tire and label alphabetically.



- The number of points may vary at the examiner's discretion depending on the size and design of the tire. Document the location of the labels on the tire with enough detail (e.g. close-up photography) that the labels can be re-created and/or replaced at a later date.
- Record the information from the tire side wall.
 - The make/model/year of the vehicle
 - Make/model of the tire
 - DOT number of the tire
 - P-metric tire size designation

- Mold numbers when possible

5.4.3.4.2.3 **Making Exemplars Using the Petroleum Jelly/Silicone Oil, Fingerprint Powder on Wet Media Film Method**

It is important to use only a small amount of petroleum jelly/silicone oil or detail will be lost or obscured. This method provides good detail and a transparent background that facilitates the comparison process.

- Tape sections of chart board together to achieve a length slightly longer than the tire circumference, typically 4-6 extra inches. If using wet media film, secure a length of film on top of one of the length of chart board.
- Using gloved hands, rub a very small amount of petroleum jelly or silicone oil to coat one or both of your hands.
- Then thoroughly rub the tread surface of the tire so an even, thin coating is applied to the full circumference.
- Place an end of chart board (with film) just in front of the tire.
- Drive the vehicle in a continuous motion over the chart board, depositing an impression on the film. As the tire rolls, mark the locations on the exemplar where the A-F labels on the tire correspond.
- Develop the impression by powdering it with magnetic fingerprint powder.
- Spray 3-4 coats of a fixative, such as a clear lacquer to preserve the exemplar and allow to dry as per manufacturer's instructions prior to handling or packaging. The impression will be damaged if it is touched before dry.
- Mark the exemplar with pertinent case information that includes the location and orientation of the tire.
- Two exemplars from each tire are recommended. The exemplars should be off-set so that they do not end in the same location.

5.4.3.4.2.4 **Making the Tire Exemplars Using Black Printer' Ink**

- Tape sections of the chart board together to achieve a length slightly longer than the tire circumference, typically 4-6 extra inches. Repeat this step.
- Apply a thin layer of printer's ink to one of the sets of chart board. This will be the ink pad.
- Tape clear plastic sheeting to the other set of chart board.
- Line the chart board sets up so that the tire is inked and then rolls over the plastic sheeting.

- Drive the vehicle in a continuous motion over the chart board, depositing an impression on the film. As the tire rolls, mark the locations on the exemplar where the A-F labels on the tire correspond.
- Mark the exemplar with pertinent case information that includes the location and orientation of the tire.
- Two exemplars from each tire are recommended. The exemplars should be off-set so that they do not end in the same location.
- Allow the ink to dry. This may take overnight or longer.

5.4.3.4.2.5 Documentation

The following information shall be recorded in the case notes regarding exemplars:

- Method of exemplar collection
- The number of exemplars collected from each tire
- Tire sidewall information (as outlined above in VEHICLE/TIRE PREPARATION)
- Vehicle information (make, model, year, VIN)

The following information shall be recorded on each exemplar collected:

- Case #
- Date of collection
- Initials of the examiner
- Location of the tire on the vehicle (e.g. front right, rear left, etc.)
- Direction of travel
- Where on the exemplar the specific tire locations designated A-F correspond
- Direction toward front of vehicle
- Indication of the outside and inside edge of the impression (as the tire is mounted on the vehicle)

5.4.3.4.2.6 Storage

Once the exemplars are completely dry, they can be rolled up and packaged.

5.4.4 Trace Evidence

Trace evidence is a generic term for small, often microscopic material. Small items such as fibers, hairs, broken glass fragments, paint fragments, and assorted microscopic debris may be left by a person or picked up from contact with the environment or another person.

5.4.4.1 Collection of Trace Evidence

There are a variety of methods that may be used to collect trace evidence. The choice of collection method will depend upon variables such as the evidence type, the substrate and the need to determine the exact location of the evidence.

5.4.4.1.1 Particle Pick

Particle picking is the recommended technique when visible trace evidence is to be collected. This is the only method that allows the forensic scientist to determine the exact location a specific piece of trace evidence was recovered from.

5.4.4.1.1.1 Equipment

Particle picking may be performed without equipment, using only the forensic scientist's gloved fingers, or with the aid of a Post-it note, tweezers, forceps, or other tools. Serrated tools are not recommended as they are difficult to clean and keep contamination-free.

5.4.4.1.1.2 Method

- Visually examine the evidence with the unaided eye and/or with the aid of a magnifying lens.
- When trace evidence is located, use either gloved fingers or a tool (e.g., forceps, tweezers, etc.) to collect the trace evidence and place on the adhesive of a Post-It note and then fold over, in a paper fold, glassine envelope, or other appropriate container and label. A Post-it note can also be used as the collection device.

5.4.4.1.1.3 Cautions/Safety

- There may be trace evidence that is not visible. Therefore, additional collection techniques may need to be employed to ensure collection of non-visible trace evidence.
- Use of tools, such as forceps and tweezers, may cause damage to the trace evidence.

Ada County Sheriff's Office Forensic Lab

- Clean any collection tools thoroughly between samples to prevent cross-contamination.
- Avoid serrated tools as they may be more difficult to clean thoroughly.

5.4.4.1.2 Adhesive/Tape Lifts

Adhesive/tape lifts are used to collect trace evidence from a variety of surfaces, such as vehicle seats and clothing items. This method of collection is not recommended for substrates that will strongly adhere to the tape lift adhesive (e.g. paper products, cardboard, etc.). This method is useful when collecting trace evidence that is not visible or apparent to the unaided eye. The technique collects trace evidence from an area defined by the forensic scientist so determining the exact location of a specific piece of trace evidence is not possible.

5.4.4.1.2.1 Equipment

Adhesive/tape lifters, clear and colorless (e.g., adhesive lift sheets - whole or cut to smaller sizes, Scotch tape, fingerprint lifting tape, mailing tape)

Plastic sheets, clear and colorless (e.g., transparency film, sheet protectors), may be pre-printed with a grid to aid in later examination

5.4.4.1.2.2 Method

- Expose the adhesive layer of the adhesive/tape lift. Do this just prior to use to avoid contamination.
- Repeatedly pat the adhesive/tape lift in the target area, being careful not to overload the adhesive surface
- Place the lift onto a clear plastic sheet to protect the collected trace evidence from contamination, damage, or loss.
- Repeat the process until the area defined is finished.
- Package in an envelope or other container to prevent contamination, damage, or loss.

5.4.4.2 Trace Standards

5.4.4.2.1 Hair Standards

Microscopic hair comparisons are performed on human head and pubic hairs. Hairs from the same body region of one person are known to have a variation in characteristics; therefore, it is important to obtain a sufficient number of hairs to adequately represent the range of all characteristics present.

5.4.4.2.1.1 Head Hair Standards

A complete head hair standard consists of at least 24 to greater than 50 hairs collected from five (5) different areas of the scalp: center, front, back, and both sides. Hairs that are cut are not an appropriate standard.

- Collect loose or shedding hairs. Use a clean, new comb to vigorously comb through the head hair of the subject. Be sure to collect hairs from the center, front, back, and both sides. Do this over a clean piece of paper or envelope to collect hairs that are dislodged.
- Pull hairs from various areas of the scalp by grasping a hair(s) firmly near the root and pulling quickly. Place collected hairs into the same package as the loose/shed hairs.
- Repeat these steps until at least 24 hairs are collected.
- Secure the paper fold or seal the envelope to prevent contamination, damage, or loss of the hairs.
- Label the outside of the package with the individual's name and the body region it was collected from.

5.4.4.2.1.2 Pubic Hair Standards

A complete pubic hair standard consists of at least 24 to greater than 50 hairs collected from different areas of the pubic region. Hairs that are cut are not an appropriate standard.

- Collect loose or shedding hairs. Use a clean, new comb to vigorously comb through the pubic hair of the subject. Be sure to collect hairs from different areas around the pubic region. Do this over or near a clean piece of paper or envelope to collect hairs that are dislodged.
- Pull hairs from various areas of the pubic region by grasping a hair(s) firmly near the root and pulling quickly. Place collected hairs into the same package as the loose/shed hairs.
- Repeat these steps until at least 24 hairs are collected.
- Secure the paper fold or seal the envelope to prevent contamination, damage, or loss of the hairs.

- Label the outside of the package with the individual's name and the body region it was collected from.

5.4.4.2.1.3 Secondary Hair Standards

A secondary standard is not obtained from an individual directly, but from an object or location where the individual is believed or known to have deposited hair (e.g., a hairbrush). Necessity should be the only reason to obtain secondary hair standards vs. pulled/combed hair standards (e.g., missing person).

Secondary hair standards may be obtained if it can be demonstrated or documented that the hair collected from the object/location is unlikely to include hair(s) from other individuals.

5.4.4.2.1.4 Cautions/Safety

- Do not package hair standards from different individuals in the same envelope or package hair standards with hair evidence. This could allow cross contamination to occur.
- Securely seal all possible openings in packaging, including seams and air holes.
- Avoid stretching or breaking the hairs when pulling them.

5.4.4.2.2 Fiber Standards

Fiber comparisons are performed on both natural and synthetic fibers. A potential fiber source may have one or more different kinds and colors of fibers that are present, and the differences may only be apparent using microscopic or instrumental techniques; therefore, it is important to obtain a fiber standard that adequately represents all of the fiber types present in the potential source.

A fiber sample that is being excised from a potential source must be large enough to capture the variation of fiber types present. Differences in the color or texture of a fabric, carpet, or other source should alert the forensic scientist that different fiber types might be present so a standard must be collected from each discernible area.

5.4.4.2.2.1 Moveable Objects

If the potential source of a fiber transfer can be packaged and transported to the laboratory with ease, then it should be submitted in its entirety (e.g., clothing items, throw rugs, etc.)

- Package moveable items in clean, and previously unused, packages such as envelopes, paper, paper and plastic bags.
- Securely seal and label the package with a description of where the standard came from and other appropriate markings.

5.4.4.2.2.2 **Immoveable Objects**

If the potential fiber source is from a large object or one not easily transported, such as car upholstery or carpeting from a dwelling or vehicle, use the following method to collect a fiber standard.

- Cut a representative sample from various areas of the object. Be sure the cut is deep enough that the backing material or substrate is also collected.
- If the object appears uniform, only one sample needs to be collected.
- Collect samples that are visually different (e.g., different colored areas, faded areas due to sunlight, worn sections, etc.)
- A sample size of approximately 1 X 1 inch is fine unless variations are visible, thus warranting a larger size cutting. If the source appears uniform, a smaller size cutting may be acceptable.
- Package in an envelope, paper bag, plastic bag, or other container.
- Securely seal and label the package with a description of where the sample came from and other appropriate markings.

5.4.4.2.2.3 **Cautions/Safety**

- Do not pull or tape lift fiber standards.
- Securely seal all possible openings in packaging, including seams and air holes.
- Do not allow potential fiber sources to come into contact with fiber evidence samples. Cross contamination may occur.

5.4.4.2.3 **Paint Evidence**

Paint comparisons are performed on a variety of paint types including vehicle paints, architectural paints, spray paints, cosmetic lacquers, etc. A potential paint source may have one or more different kinds and colors of paint that are present (e.g., vehicles), and the differences may only be apparent using microscopic or instrumental techniques; therefore, it is important to obtain paint standards that adequately represent all of the paint types present on a potential source.

Ada County Sheriff's Office Forensic Lab

The forensic scientist should consider the possibility of a physical match of paint chips to the source when determining how to collect paint standards.

5.4.4.2.3.1 **Moveable Objects**

If the potential source of a paint transfer can be packaged and transported to the laboratory with ease, then it should be submitted in its entirety (e.g., painted crow bar, bicycle, etc.)

- Package moveable items in clean, and previously unused, packages such as envelopes, paper, paper and plastic bags.
- Securely seal and label the package with a description of where the standard came from, along with any other labeling requirements.

5.4.4.2.3.2 **Immoveable Objects**

If the potential paint source is from a large object or one not easily transported, such as a vehicle, use the following method to collect a paint standard.

- Locate the/an area of damage, if applicable (e.g., damaged vehicles). Collect from an area as close to, but not within, the point of damage. If a physical match examination is deemed appropriate, collect all the damaged body panels rather than attempting to remove paint standards.
- Use a clean razor blade, scalpel, or appropriate tool to gently pry, carve, or chip the paint from the surface down to the foundation or substrate. If possible, do not remove the paint by scraping as all paint layers may not be represented and/or the layer structure may be destroyed.
- Collect about a nickel-sized combined amount of paint from a particular damaged area, when possible.
- Place the paint evidence into a paper fold or small paper envelope, carefully sealing to prevent loss.
- Securely seal and label the package(s) with a description of where the sample came from, along with any other labeling requirements.
- Continue to collect paint from each damaged area in the same manner, even if the object appears uniformly painted. Also collect samples that are visually different. Package and label each area separately.

5.4.4.2.3.3 **Cautions/Safety**

- Substantial variations in thickness and layer sequences over short distances can exist across a painted surface. This is particularly true in architectural paint and for vehicle paint where curves, corners, and

edges are often impact points and may have been subjected to previous damage, sanding, or over-painting. Known paint samples should be collected from these areas, when recognized.

- When contact between two painted surfaces is indicated, the possibility of cross-transfers must be considered. Collect both objects or paint standards from both surfaces.
- Securely seal all possible openings in packaging, including seams, corners and air holes.
- Do not allow potential paint sources to come into contact with paint evidence samples. Cross contamination may occur.

5.4.4.2.4 **Glass**

Glass comparisons are performed on window glass, vehicle glass, object glass, and other glass types.

A critical factor in comparing glass evidence to a potential glass source is whether the characteristics of the evidence sample fall within the range of variation present in the source; therefore, it is important to obtain a sufficient number of glass samples to adequately represent the range of all characteristics present.

The forensic scientist should consider the probative value of a physical match of glass to the source and the determination of the direction of force.

5.4.4.2.4.1 **Method**

Collect as much of the original glass as possible.

5.4.4.2.4.2 **Packaging**

- Package each standard collected separately in a cardboard box or other rigid container (do not use glass containers) and secure to reduce the likelihood of further breakage or damage to the fractured edges. Small glass particles may be packaged in folded Post-it notes, paper folds, envelopes, paper bags, etc. and then placed in a padded envelope if necessary to prevent damage and/or injury.
- Securely seal and label the package with a description of where the standard came from.

5.4.4.2.4.3 **Cautions/Safety**

Broken glass edges are extremely sharp. Handle with caution. Use personal protective equipment or tools to reduce the risk of being cut.

5.4.4.2.5 Other Types of Trace Evidence

Other types of trace evidence to consider when processing a scene may include, but is not limited to soil, foliage, metal fragments, and wood fragments.

Ada County Sheriff's Office Forensic Lab

5.4.5 Firearms/Toolmark Evidence

Firearms evidence can include firearms, ammunition, discharged cartridge cases, projectiles/ fragments, bullet impact marks, and gunpowder residue.

5.4.5.1 Collection and Packaging of Firearms Evidence

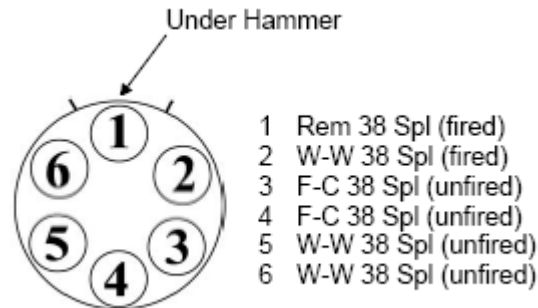
The primary concern during the collection and packaging of a firearm is safety. ALWAYS HANDLE A FIREARM AS IF IT IS LOADED AND KEEP IT POINTED IN A SAFE DIRECTION.

Preservation of evidence that may be present on the firearm (e.g., blood, trace evidence, latent prints) shall be assessed prior to packaging the evidence. Transitory evidence (e.g., hairs, fibers) shall be documented at the scene and collected prior to packaging the firearm. If dried flaking blood is present, the firearm shall be wrapped in paper (prior to any additional packaging, such as a gun box) to contain any dislodged evidence. When a firearm is collected from the scene, the forensic scientist should consider whether swabs should be collected for DNA preservation purposes.

5.4.5.1.1 Revolvers

The following guidelines should be used when handling a revolver:

- 5.4.5.1.1.1 Photograph the firearm prior to handling or collecting it. If the firearm was moved prior to your arrival, also note the alleged original position and the name of the person who reportedly moved the firearm.
- 5.4.5.1.1.2 When collecting a revolver, pick the firearm up by the textured surface on the grips or by the edges of the trigger guard. Never move a firearm by inserting an object inside the barrel or trigger guard. This is unsafe and can damage potential evidence.
- 5.4.5.1.1.3 Document the position of the hammer.
- 5.4.5.1.1.4 If the revolver is cocked (hammer back), carefully let the hammer down by manipulating the trigger while holding the hammer spur.
- 5.4.5.1.1.5 Mark the position of the cylinder on both sides of the top strap prior to opening the cylinder.
- 5.4.5.1.1.6 Document the direction of rotation of the cylinder (clockwise or counter clockwise).
- 5.4.5.1.1.7 Record the number of chambers and document the brand and condition (i.e., fired, unfired) of the ammunition in each chamber (refer to the following example).



5.4.5.1.1.8 Individually remove the cartridges/cartridge cases from the revolver and package each one separately in an envelope or paper bag to prevent alteration or obliteration of microscopic markings.

5.4.5.1.1.9 Secure the firearm in a box or package in paper (i.e., bag, wrap, envelope).

5.4.5.1.2 **Semi-automatic Pistols, Rifles, and Shotguns**

The following guidelines should be used when handling a gun:

5.4.5.1.2.1 Photograph the firearm prior to handling or collecting it. If the firearm was moved prior to your arrival, also note the alleged original position and the name of the person who reportedly moved the firearm.

5.4.5.1.2.2 When collecting a firearm, pick it up by the textured surface on the grips or by the edges of the trigger guard. Never move a firearm by inserting an object inside the barrel or trigger guard. This is unsafe and can damage potential evidence.

5.4.5.1.2.3 Document the position of the hammer.

5.4.5.1.2.4 If the firearm is cocked (hammer back), carefully let the hammer down by manipulating the trigger while holding the hammer spur.

5.4.5.1.2.5 Document the position of any manual safety devices and/or de-cocking levers.

5.4.5.1.2.6 Carefully disengage the magazine and remove it from the firearm. Package the magazine in a paper bag or envelope.

5.4.5.1.2.7 Open the action and visually check the chamber for a fired or unfired cartridge/shotshell. Remove any cartridge/shotshell, document the brand

Ada County Sheriff's Office Forensic Lab

and condition (i.e. fired, unfired) and package it in an envelope or paper bag to prevent alteration or obliteration of microscopic markings.

5.4.5.1.2.8 Secure the firearm in a box or package in paper (i.e., bag, wrap, envelope).

5.4.5.2 Gunpowder Residues

When a firearm is discharged, unburned and partially burned particles of gunpowder, gas, soot, metallic particles stripped from the bullet and vaporized metal from the bullet are propelled out of the barrel along with the bullet toward the target. If the muzzle of the weapon is sufficiently close, these products will be deposited onto the target. It is the distribution of gunpowder particles and other discharge residues around the bullet hole that permits an assessment of the distance from which a firearm was discharged.

The clothing from a shooting victim shall be carefully preserved so as to prevent damage or disruption to powder residues deposited around bullet or shot shell component holes. The cutting or tearing of clothing in the area of these holes must be avoided as the clothing is being removed. Each item of clothing should be packaged separately in paper. If it is necessary to fold an article of clothing, place a piece of paper over the article to prevent contact and reduce the possibility of transferring residues to other areas.

5.4.5.2.1 Gunshot Residue Kits

When a firearm is shot, in addition to the projectile(s), a mass of debris comes out the muzzle. These gunshot residues (GSR) can include various primer residues, residues from projectiles, and partially burned and unburned gun powered particles. Additionally, GSR can be transferred to an individual by discharging a firearm, handling a firearm or fired ammunition components, or by contact with another object that has GSR on it. The presence of GSR on a person may provide useful information linking an individual with an action that could transfer this residue to them.

- As a very general guide, after four to eight hours it is unlikely that residues will be found on a live and mobile individual's hands unless steps have been taken to preserve such evidence (e.g. bagging the hands).
- The residue can persist for longer periods of time on some areas of interest such as on the deceased, on clothing or other stationary objects.
- The decision to collect a sample is affected by many variables and must be based on the investigative information available.

- This type of analysis is not performed by the Laboratory, but the crime scene team will collect samples for analysis by an outside laboratory. \

5.4.5.2.1.1 Method

Refer to instructions manual included in kit.

5.4.5.3 Trajectory Processing and Analysis

Trajectory analysis includes the identification and processing of trajectory evidence and the determination of bullet angle of impact. Observations of impact sites can provide information about the possible projectile, the type of firearm involved, intermediate objects in the path of the projectile, direction of travel (entrance or exit) and other details. In certain circumstances, the trajectory of the projectile may be determined and in turn, the possible positions from where a shot originated. Identifying the possible position of the source (shooter[s]) reduces the sites to search for evidence and may provide investigative leads and supplemental information. Shooting incidents are dynamic and varied, as is the evidence produced during such an event. The methods outlined below demonstrate techniques that can be used to process these scenes.

5.4.5.3.1 Equipment

- Cameras
- Tripod
- Trajectory rods
- Centering cones
- Rubber O-rings
- Angle finder (digital or inclinometer)
- Plumb bob
- String
- Protractor
- Laser
- Mirrors
- Calculator

5.4.5.3.2 **Cautions/Safety**

The lasers used for these purposes can be intense and exposure to the eyes can cause damage. Never look directly into the beam and always alert others in the area before the laser is turned on.

Lead is typically present on or in projectiles associated with shooting incidents and can be found in holes and impacts created by these projectiles.

5.4.5.3.3 **Method**

The following guidelines should be used when documenting and processing trajectory evidence:

- 5.4.5.3.3.1 Bullet hole/defect shall be photographed prior to any attempt to determine the trajectory (overall, intermediate and close-up, without and with scales and evidence markers).
- 5.4.5.3.3.2 If multiple defects are present, unique identifiers shall be used in the documentation to differentiate between the holes that are observed.
- 5.4.5.3.3.3 Document the location of the bullet hole in your notes (sketch, measurements, diagram).
- 5.4.5.3.3.4 Document the bullet hole length and width.
- 5.4.5.3.3.5 Notes need to contain precise information on observations and measurements and shall support any conclusions made. Whenever possible, reported origins of projectiles should be given in context with the scene rather than just numbers or directions.
- 5.4.5.3.3.6 If applicable, collect, and document trace evidence. This type of evidence may have been transferred from the projectile itself or may indicate that an intervening object may have been involved.
- 5.4.5.3.3.7 Determine the direction of bullet travel, if possible (entrance vs. exit). Observations such as beveling, paint fractures, pinch point, lead-in marks, etc. can be included in the documentation.
- 5.4.5.3.3.8 The choice of the method that is used (laser angle finder, inclinometer, etc.) to determine the trajectory is up to the forensic scientist and shall be documented in the notes.
- 5.4.5.3.3.9 Using the trajectory kit:

- Carefully place a trajectory rod through the entrance hole (and associated exit hole, if applicable).
- If applicable, place a cone shaped centering cone on the rod and gently guide the tapered end into the entrance hole and use a rubber O-ring to hold the guide in place. Use a second centering cone for the exit hole.
- Determining Vertical Angle—Place the angle finder along the top of the trajectory rod and record the measurement of the vertical impact angle relative to the horizontal plane. Alternatively, a laser angle finder or protractor can be used to determine the impact angle. With the protractor in a vertical position, place the center of the flat edge flush with the center of the bullet hole. From a 90° angle (side-view), determine the vertical impact angle. It is important to document whether the measured angle is in relationship to the target surface or the horizontal plane. This can be documented by a description and/or a sketch.
- Determining Horizontal Angle—With the protractor in a horizontal position, place the center of the flat edge flush with the center of the bullet hole. Alternatively, a laser angle finder or protractor can be used to determine the impact angle. From a 90° angle (top-view), determine the horizontal impact angle. It is important to document whether the measured angle is in relationship to the target surface or the vertical plane. This can be documented by a description and/or a sketch.
- A laser can be attached to the end of the trajectory rod to project/extend the trajectory in either direction.

5.4.5.3.3.10 For demonstrative purposes, the trajectory reconstruction can be photographed in conjunction with trajectory rods, strings and/or a laser and photographic fog. The forensic scientist shall be cognizant of the effect that the placement of the camera in relationship to the trajectory will have on the resulting photograph (the trajectory can appear skewed due to the angle and level of the camera).

5.4.5.3.3.11 Distances, such as the horizontal distance from the target to the muzzle at a given height, can be measured from the reconstruction (or calculated based on common trigonometric relationships of right triangles).

5.4.5.3.4 Reporting

The forensic scientist shall report the results of any trajectory determinations that were made. If an forensic scientist chooses to report numbers for the angle determinations, a notation shall be made to include the variance. This can be accomplished by adding a footnote or general statement for all trajectories.¹⁰ In addition to reporting the numerical value, it is recommended

¹⁰ Example: "All trajectories measured in this report reflect a $\pm 5^\circ$ variance unless otherwise noted."

that the forensic scientist also use directional descriptors for ease of understanding the report.

Modifiers such as “slightly” or “acutely” can also be used. Additional descriptions of the relative location of the impacts and the terminus of the bullet are also helpful examples of supporting documentation that should be included in the report.

5.4.5.4 Toolmark Evidence

A toolmark is any impression, scratch, gouge, cut or abrasion made when a tool is brought into contact with an object, leaving a mark.

5.4.5.4.1 Photography

Overall, mid-range and close-up (examination quality) photographs shall be taken of the toolmark. Close-ups shall be taken with a scale.

5.4.5.4.2 Measurements

Measurements shall be taken to document the toolmark in relationship to the ground and/or other fixed objects.

5.4.5.4.3 Casting/Collection

If an item cannot be submitted for toolmark examination, a cast should be made using a flexible casting material such as Mikrosil.

Refer to Mikrosil casting procedure.

5.4.6 Latent Friction Ridge Impression Evidence

When the friction skin area of the palmar or plantar regions of the body are touched to a receiving surface, a reproduction of the ridge design from that friction skin area may be left behind on that surface.

5.4.6.1 Latent Print Recovery

When processing evidence, consideration shall be given for all types of physical evidence and the order in which the evidence should be collected. The most common forms of latent print processing in the field are powder processing (dusting) and use of cyanoacrylate (CA). Other processing methods may be used depending upon the circumstance of a particular case. A latent print discipline expert shall be consulted prior to chemical processing.

In most circumstances, smaller items of evidence should be collected for processing in the lab. Field processing should be limited to large items that cannot be easily transported and fixed structures.

All areas processed will be assessed for the presence of visible friction ridge detail. Areas of ridge detail deemed to be suitable for collection will be marked with a unique identifier. The unique identifier must be such that the latent can be properly re-located in the scene and matched back to any lift cards collected or photographs.

5.4.6.1.1 Physical/Powder Development

5.4.6.1.1.1 Equipment

- Gloves
- Latent print powders
- Light source
- Camera equipment
- Nylon/fiberglass brush and/or magnetic wand
- Fingerprint tape
- Glossy fingerprint cards

5.4.6.1.1.2 Method

5.4.6.1.1.2.1 If there are no DNA Concerns, re-hydration of the print can be considered. This is accomplished by lightly huffing on the area with

the print, waiting for the moisture to dissipate and then applying additional powder.

- 5.4.6.1.1.2.2 Use of a disposable brush and secondary containers of powders ensures that the risk of contamination of powders and brushes is kept to a minimum if DNA is a concern.
- 5.4.6.1.1.2.3 Only the ends of the brush bristles should be coated with the powder, and the brush should be gently tapped several times to remove all but a minimum amount.
- 5.4.6.1.1.2.4 With the brush handle in a nearly perpendicular position to the surface, the bristle ends are lightly and delicately moved over the surface. Discoloration of the latent print residue will usually appear immediately. With a nylon/fiberglass brush and a proper amount of powder, the impression will develop in density with each light pass until no further development can be observed.
- 5.4.6.1.1.2.5 Magnetic powder must be applied with a magnetic applicator. Surface areas examined generally must be processed more slowly with magnetic powders, and great care must be exercised to prevent actual contact between the end of the wand and the surface. Disposable, sterile magnetic wands may be employed or wands may be retained and reused as long as decontamination with a 10% bleach solution occurs between scenes or sooner as applicable.
- 5.4.6.1.1.2.6 Multiple prints in close proximity may be collected on the same lift. In some instances, one may need to perform multiple lifts of the same print to capture the best quality latent lift.
- 5.4.6.1.1.2.7 Once lifted, the tape will be affixed to either a lift card of appropriate color (i.e., white cards for black and bi-chromatic powder) or a transparency cover. Lift cards will be marked with appropriate identifying information such that the card can be matched back to the items of evidence and/or the scene location.
- 5.4.6.1.1.2.8 If the forensic scientist believes it is unlikely that the impression can be lifted, then the forensic scientist should make all attempts to collect and package the evidence with the area of ridge detail.

5.4.6.1.2 **Cyanoacrylate ester**

Cyanoacrylate (CA, i.e., superglue) fuming has been shown to be an effective means of latent print development on non-porous and some semi-porous surfaces (e.g., plastic, carbon paper, metals, glass, tapes, wood, rubber and rock). Cyanoacrylate ester fumes are monomers that polymerize on latent print residue and create a more stable impression.

5.4.6.1.2.1 Equipment

CA at crime scenes is used in various forms: a commercial kit or packs, a fume wand or liquid CA in combination with a heat source.

5.4.6.1.2.2 Methods

5.4.6.1.2.2.1 Liquid CA with heat source

Liquid glue is placed in a disposable container (aluminum foil works well), which is then placed over a heat source in the vehicle, processing area, or fuming chamber resulting in the production of fumes. Heating may be accomplished with a coffee cup warmer or a light fixture assembly (60 watt bulb). **DO NOT USE A HOT PLATE OR DIRECT FLAME.** Once the test print shows sufficient development, ventilate area to evacuate all fumes.

5.4.6.1.2.2.2 HotShot™

- These kits work rapidly and produce copious amounts of cyanoacrylate fumes. Each HotShot™ contains the plastic container, an Activator Packet, HotShot™ drum and a vial of print developer.
- Remove contents, empty activator packet into container.
- Remove clear tab covering hole on bottom of HotShot™ canister.
- Place canister into container with hole side down. **DO NOT TOUCH THE DRUM.** The drum will become very hot. The plastic container will also become very hot and should not be touched either.
- Empty print developer onto top of metal cap of canister, or equivalent of about 15 drops. Fumes will begin as the HotShot™ canister heats up. Make certain this is done in a well-ventilated area or fuming chamber.
- After fuming is complete, allow the container to cool down and dispose of contents in an appropriate manner.
- Re-establish air flow and evacuate fumes prior to entering an area that has been processed with cyanolacrylate.

5.4.6.1.2.2.3 CA Pad or Pack

Use of commercially available cyanoacrylate packs (e.g., Hard Evidence) is slower than heating or chemically accelerated fuming development, but is easy to use without the necessity for handling chemicals. This is a good choice when the area to be fumed is exceptionally large and time is not a factor.

- Place the opened cyanoacrylate pack in the enclosed area. If the pack is dried out, it should not be used and should be thrown away.
- The addition of humidity to the fuming chamber/enclosed area (such as a vehicle interior) plays a major role in successful development of white ridge detail in latent prints. This may be accomplished by placing warm water in a cup or similar vessel in the fuming chamber/enclosed area.
- Close the fuming 'chamber'. Monitor the test print at 5 to 10 minute intervals, and stop when the test print becomes visible.
- Sometimes over-development will occur, usually in the form of a heavy white deposit obscuring most of a latent print. Use of an adhesive lifting technique (e.g., tape, lifter, etc.) is effective in lifting away the heavy upper deposits, revealing underlying ridge detail.
- Evacuate the chamber for a period of 10 minutes prior to additional evaluation/processing.

5.4.6.1.2.2.4 Fuming Wands

The fume wand (sometimes called a glue wand) is combination with pre-loaded, disposable cyanoacrylate ester cartridge.

Fueling: Refer to the manual in the kit for specific manufacturer's instructions.

Ignition: Refer to the manual in the kit for specific manufacturer's instructions.

5.4.6.1.2.2.4.1 Method

- At the normal (maximum) setting, a dense stream of cyanoacrylate vapors will begin to emerge within a minute. Place the wand through an opening into the target area. For a vehicle

interior, lower one window slightly, taping around the window edges until only a small area remains (regular lift tape works well).

- Sometimes in vehicles it is necessary to use two or more cartridges. When one cartridge is exhausted, remove the wand from the window and install another cartridge using metal tweezers. Repeat until you believe adequate vapor is present. Once the vapors have filled the area, remove the wand and seal the opening. Allow the vapor to remain in the vehicle or fuming area for at least 15 minutes or until the test print demonstrates sufficient development.
- Open the vehicle doors to evacuate all fumes prior to entering the vehicle.

5.4.6.1.2.2.4.2 **Cautions/Safety**

- Cyanoacrylate ester fumes are strongly irritating to the eyes and respiratory system. Fuming should only be conducted in a well-ventilated area and non-porous gloves should be worn to prevent skin contact.
- Wands: The fuming wand and cartridges become very hot and should be handled with caution. In some cases it is difficult to determine if the wand is lit. The flame may not be visible. Thus, one should not rely on whether or not the flame is visible to determine if the wand is still burning.
- HotShots™ (or similar) fingerprint developer: Upon activation, the canister will become very hot. Caution should be used when placing on a heat sensitive surface like plastic. This kit must be used in a well-ventilated area and care must be taken to avoid breathing in vapors.
- Latent print development with super glue fumes can be accomplished by creating a fuming chamber (vehicle interior, improvised enclosed area, plastic bag, fish tank, etc). It should be noted, that the cyanoacrylate esters can cause a glaze-like coating to cover the entire evidentiary surface resulting in considerable loss of contrast when over-fuming occurs.
- Do not refill butane-fueled wands near a heat source.
- Do not store cyanoacrylate in areas that can become hot (e.g., the trunk of a car); the cartridges may start to fume and the pads/packs or liquid may dry out.
- Cyanoacrylate should be allowed to come to room temperature prior to use.

5.4.6.1.2.2.4.3 **Controls**

- A positive/negative control will be performed with each use and recorded in the notes. For a positive control, place a sebaceous print onto a clean black lift card or substrate of choice. The test card is placed within the confines of the area to be fumed (for example, a vehicle interior). The test card must be visible so that latent print development may be monitored to avoid over-fuming.
- Lot numbers for the CA wand cartridge, fingerprint developer kit or pack must be recorded in the case notes.

5.4.6.1.2.2.4.4 Results and Interpretations

Any areas of ridge detail that are suitable for collection after fuming should be photographed prior to additional processing with powder.

5.4.6.1.3 Other Chemical Methods

Specialized chemical processing is best reserved for use in the laboratory. However, if an item is too large for transport, specialized chemicals may be used at the scene. Refer to the Impression section of this manual for chemical methods used for enhancement of bloody impressions. For other types of impressions, defer the processing of the evidence in the field to a Discipline Expert.

5.4.6.2 Elimination Finger Prints

When fingerprints are found at the scene of the crime, consideration should be given to the possibility that the impressions could belong to someone whose presence is legitimate. Rolled inked impressions (elimination fingerprints) should be taken from members of the household, witnesses, officers, or anyone who might have touched something at the scene.

5.4.6.2.1 Equipment

- Ink source (i.e., inkpad or ink strips)
- Small ink roller
- Elimination fingerprint and palm print cards
- Powder and lift cards may also be used

5.4.6.2.2 Method

- Instruct the subject to relax the hand and fingers and let operator do the work.
- Roll one finger on a fresh inkpad placing the finger so that it is inked from below the first joint to a point near the tip of the finger, and from nail edge to nail edge.
- An ink strip or inking foils may also be used to apply the ink. The areas should be covered with a light layer of ink. Lack of ink or excessive ink will yield insufficient prints.
- Roll the finger from nail bed to nail bed in the appropriate space on the elimination card.
- One hand of the operator should be used to grip the subject's finger between the first and second joint. The operator's other hand should control the pressure and guide the movement of the finger that is being rolled.
- The roll should occur in one steady movement, using the same amount of pressure.
- The finger is then lifted from the card. Never 'rock' a finger over a print that has already been transferred on the card.
- Repeat this process for each finger.

Powder may also be used – powder the ridge detail and lift with tape. Place lift on a paper.

GOOD FINGERPRINT STANDARD



- Fingers rolled nail edge to nail edge
- Information below first joint is recorded on most prints
- Slap prints include part of second joint
- Thumb slaps have been rolled up to record the thumb print (mostly on right thumb)

5.4.6.3 Elimination Palm Prints

For elimination palm prints, it is ideal to use a small inked roller or inking foils to ensure the entire palm of the subject is covered with a sufficient amount of ink. Place the palm print card on a palm print tube, foam pad or solid surface then follow one of the listed procedures.

- Palm print tube with the palm print card affixed at an angle: Place the card/tube on a flat surface and place the base of the subject's palm on the

Ada County Sheriff's Office Forensic Lab

card/tube. Roll the card/tube by applying slight pressure to the subject's palm, allowing the entire palm surface (to the fingertips) to make contact with the card/tube.

- Foam pad: Place the subject's inked palm flat onto the palm print card applying enough pressure to force the surface of palm to make uniform contact with the card, but do not apply so much pressure that the ridges become distorted and detail is lost..
- Solid surface: Place the palm print card near the edge of the surface, then place the inked base of the palm on the palm card, slowly pull the subject's palm and the palm card off the edge of the surface and downward until the finger tips have made contact with the card.
- Fill out all appropriate information on the elimination print cards and make sure the clarity of the prints is sufficient for comparison.

5.4.7 Living/Deceased Human Evidence or Standards

Nearly all procedures utilized by the crime scene forensic scientist may need to be employed when processing human remains depending on the type(s) of evidence encountered.

5.4.7.1 Human Remains Processing at a Crime Scene

- 5.4.7.1.1 Document the position and location of the body within the scene through notes, photographs, sketches and/or measurements to reference points.
- 5.4.7.1.2 Document transient evidence located on the body (i.e., trace evidence, biological fluid stains/patterns, impression evidence). Removal of clothing articles may be necessary to preserve pattern evidence; however it is highly recommended that the forensic scientist communicate with the Coroner's Office prior to removing the clothing.
- 5.4.7.1.3 It is best practice to collect transient evidence prior to the removal of the body. Careful consideration shall be made for the possible presence of biological evidence that could be left by a perpetrator. Bindings, ligatures, the neck, breasts, ankles, arms, bite-marks, or certain areas of the clothing could contain evidence from strangulation, sexual assault, dragging, pocket-rifling or other types of aggressive contact.
- 5.4.7.1.4 Trace evidence observed on the body should also be collected prior to placing the decedent in the body bag.
- 5.4.7.1.5 If swabs are collected from the body or bindings, that information should be disseminated to the investigator and coroner's office, so that collection is not duplicated at a later time.
- 5.4.7.1.6 Full inked fingerprint standards should not be collected at the scene. Upon approval from the coroner's office, one or two inked impressions may be taken at the crime scene for rush identification.
- 5.4.7.1.7 If there is potential evidence on the hands, place a paper bag over each hand labeling the bags to designate right and left and secure with tape prior to removal of the body.
- 5.4.7.1.8 The presence of liver mortis, rigor mortis or other decomposition characteristics should be documented. Outdoor and indoor temperatures should be noted in addition to the location and condition of fans, air conditioners, and heaters.
- 5.4.7.1.9 Before the body is removed from the scene, ensure evidence will not be destroyed along the path of transport.
- 5.4.7.1.10 Bindings and ligatures shall not be disturbed, unless they attach the body to the scene. Minimize the number of cuts to bindings necessary to release the body from the scene. Never cut through a knot. Tape and label ends of ligatures or bindings that were cut by investigators.

- 5.4.7.1.11 If multiple bodies are present at a scene, it is necessary to identify which body specific evidence was collected from with a unique identifier (i.e., name, number).

5.4.7.2 Skeletal Recovery

The successful recognition and recovery of human skeletal remains is important in determining the identity of the individual(s), as well as providing investigators with forensic evidence in which to further their investigation. Proper techniques must be employed in order to retrieve as many bones of the human body as possible; this increases the probability of positive identifications based on anomalous features unique to an individual. Forensic Forensic scientists shall work in conjunction with the Coroner's office.

5.4.7.2.1 Equipment

- Rakes
- Square and spade shovels
- Plastic trowels
- Paint brushes
- Dental tools
- Tongue depressors
- Survey flags
- Survey paint
- Measuring tape
- Wooden stakes
- Colored string
- Canvas or plastic tarps
- Sifting screens
- Camera
- Grid paper
- Notebook

5.4.7.2.2 Method

5.4.7.2.2.1 Scattered

- 5.4.7.2.2.1.1 Document location of remains to include measurements.

Ada County Sheriff's Office Forensic Lab

- 5.4.7.2.2.1.2 Document condition to include vegetation growth or animal interaction.
- 5.4.7.2.2.1.3 Once remains are removed, examine the area directly underneath remains. The forensic forensic scientist should sift the dirt directly underneath if there is a possibility of evidence being present.

5.4.7.2.2.2 Buried

- 5.4.7.2.2.2.1 Document the environment of the burial. Is the area compact, disturbed, shallow, or other.
- 5.4.7.2.2.2.2 Stake out a work area around the burial area for diagramming and measuring purposes.
- 5.4.7.2.2.2.3 Locate a fixed point in the landscape to perform the appropriate measurement technique(s).
- 5.4.7.2.2.2.4 Locate the grave outline by visualizing cracked soil or depressions.
- 5.4.7.2.2.2.5 Work horizontally.
- 5.4.7.2.2.2.6 Sift the soil level by level.
- 5.4.7.2.2.2.7 Orient the shovel blade so that the ground is scraped away horizontally.
- 5.4.7.2.2.2.8 Document all changes in soil density, color or texture.
- 5.4.7.2.2.2.9 Stop and document as each item of evidence is discovered. Evidence shall not be removed unless it is transitory.
- 5.4.7.2.2.2.10 Stop when the skeletal remains are first discovered.
- 5.4.7.2.2.2.11 Remove enough dirt to determine the orientation of the body.
- 5.4.7.2.2.2.12 Pedestal the skeletal features, i.e., remove all soil around the skeletal elements without disturbing their position.
- 5.4.7.2.2.2.13 Expose without removal and document.
- 5.4.7.2.2.2.14 Disinter the remains and all associated evidence.

5.4.7.3 **Autopsy Evidence**

The autopsy is very individualized; each case dictates what evidence should be collected and what observations are essential. The Coroner's Office will determine which examinations are to be conducted at the autopsy; the forensic forensic scientist's function is to assist with the recognition, documentation, and collection of evidence. The forensic forensic scientist may be asked by the investigator to photograph during the autopsy.

5.4.7.4 **Deceased Prints**

- Exemplars shall be taken of all homicide victims unless the decedent's condition does not allow for collection.
- Where the body may be decomposed, burned, mummified, or in a state of extreme rigor, an appropriately trained Latent Print forensic forensic scientist should be called.
- Refer to the Latent Print analytical method regarding advanced techniques for deceased printing.

5.4.7.5 Victim, Suspect, and/or Witness

5.4.7.5.1 Legal Issues

If exigent circumstances exist to indicate that any perishable evidence (e.g., trace, biological fluid and impression evidence) may be lost or destroyed, the forensic scientist should advise the lead investigator to ascertain if the evidence can and should be collected without consent to search or a search warrant.

5.4.7.5.2 Biological and Trace Evidence

- Photograph and collect visible trace evidence (e.g., glass, hair) on the person or clothing
- Examine the hands of the individual for biological transfer evidence (e.g., blood).
- Document and collect any evidence located.

5.4.7.5.3 Clothing Evidence

- Photograph the clothed individual
- Take close-up photographs of any pattern or transfer evidence visible on the clothing
- Document each item of clothing collected and package separately
- If pattern evidence is an issue, the forensic forensic scientist should be cautious not to fold the clothing onto itself to avoid contamination from one area of the clothing item to another.
- If the evidence is wet, the clothing should be dried before packaging. If this is not practical, package the wet clothing in paper bags.

5.4.7.5.4 Injuries

- All injuries should be documented through notes, photographs and measurements as to type of injury (i.e., gunshot wound, laceration, abrasion, contusion, etc.), shape, color, size, and location
- Overall photographs shall be taken of the individual for identification purposes.

Ada County Sheriff's Office Forensic Lab

- Close-up photographs shall be taken of the injury with and without a scale
- A swab should be collected from recent bite mark injuries for possible DNA analysis

5.4.7.5.5 Sexual Assault Victims

Certified medical personnel conduct sexual assault examinations, including collection of a Sexual Assault Forensic Evidence Kit and the victim's clothing.

5.4.7.5.6 DNA Standard Evidence

Collect two oral (buccal) swabs by rubbing each swab thoroughly on the inner facial cheek of the individual. Package all two swabs together in an envelope and label with the individual's name.

5.4.7.5.7 Shoeprint Standard Evidence

Some scenes where shoeprint evidence has been collected will require the collection of elimination shoeprints from victims, suspects, witnesses and other individuals associated with the scene. Collection of the pair of shoes is preferred, but not always reasonable, especially with witnesses or Emergency Responders. There are several methods used to collect elimination shoeprint impressions.

- Dust the soles of the shoes with fingerprint powder and press the sole onto a sheet of adhesive paper. Place a clear sheet of plastic over the print to protect it.
- Lightly smear the outsoles of the shoes with petroleum jelly then press the outsoles onto a sheet of clean white paper. The impressions may be enhanced by lightly dusting with dark fingerprint powder.
- An inkless shoe print kit can be used by having the individual step onto the inkless pad and then onto the chemical sensitive paper.
- Other products available for use are gel lifters and Biofoam.

5.4.7.5.8 Fingernail Evidence

- Collect known samples from the suspect and/or from the victim. If length of the nails permits, the nails should be clipped and collected. Clippings from each hand shall be collected and packaged separately.
- In cases where documented injuries suggest scratching, fingernail scrapings or clippings should be collected from the suspect and/or victim. Fingernail scrapings are collected using a clean or sterile toothpick with a rounded end or a small wooden dowel. The hand of the individual is placed on a piece of clean paper and the underside of the nails are scraped

Ada County Sheriff's Office Forensic Lab

depositing the contents onto the paper. The fingernail scrapings are then folded into the paper and sealed in a paper envelope.

5.5 Equipment

5.5.1 Alternate Light Source (ALS)

The ALS can be used to detect a wide variety of forensic evidence using the principles of fluorescence, reflection, and absorption.

5.5.1.1 Method

Various items of forensic interest (i.e. trace evidence, biological stains) can be enhanced with the use of ALS with appropriate filters. Refer to the operations manual of the ALS model prior to use.

5.5.1.1.1 High intensity white light with blue filter and no goggles may be used to visualize blood.

5.5.1.1.2 Violet (400-430nm) and blue (430-470nm) colors with yellow/orange goggles are used to visualize biological substances.

5.5.1.1.3 The blue, blue-green (460-510nm) and green (500-550nm) colors with orange and red goggles are used to visualize fiber and general trace evidence or fluorescent latent print powders and dyes.

5.5.1.2 Cautions/Safety

- Precautions should be used when operating any ALS.
- Proper eye protection shall be worn by anyone operating an intense light source.
- Permanent eye damage can occur from direct illumination to the eye or reflected or refractive light hitting the eye.
- Exposing the skin to the beam of light can cause burns and other skin damage.
- All persons in proximity of usage shall adhere to the above safety guidelines.

Ada County Sheriff's Office Forensic Lab

5.5.2 Metal Detector

In some instances, a search for metal items may be needed. Metal items can include spent rounds, cartridge cases, and/or weapons. On surfaces such as concrete, asphalt, gravel, and hard dirt, the areas to be searched will most frequently be searched visually. A visual search may also be employed when grassy, wooded, and overgrown areas need to be examined. In addition, the surface being searched may contain evidence at the sub-surface level. The use of a metal detector can be employed when searching any surface type, but would be most beneficial in the grassy, wooded, and overgrown areas or in instances when evidence may be located at a shallow sub-surface level.

5.5.2.1 Methods

Refer to manufacturer's guide for general operation and maintenance information.

5.5.2.1.1 Verification of the metal detector should be performed before each use.

- Scatter the following samples approximately 1-2 feet apart from each other and sweep the detector over each sample piece. The depth of the samples can be varied at the forensic scientist's discretion.
 - a. Brass cartridge case
 - b. Nickel-plated brass cartridge case
 - c. Aluminum cartridge case
 - d. Steel cartridge case
 - e. Lead bullet
 - f. Copper jacketed bullet
 - g. Penny
 - h. Iron nail
 - i. Ground only (negative control - no sample)
- Document the results (+/-) in the case notes. A "positive" indicates the metal detector successfully pinpointed the target sample. A "negative" result indicates the metal detector failed to pinpoint the sample.
- If there is a discrepancy, check the batteries first to make sure they are properly charged. Then make sure the proper parameters are being used.
- If there is still a problem with obtaining appropriate results, the detector will need to be taken out of service and checked by the manufacturer or service provider.

5.5.2.1.2 Once the sensitivity is set, the forensic scientist is ready to use the metal detector for the search. The metal detector operates using an audible "beep" to alert the user of the possible presence of a metallic object within

Ada County Sheriff's Office Forensic Lab

the area under the loop or coil. Some detectors emit a just-audible background/ threshold tone to aid in the location of targets.

- 5.5.2.1.3 As the forensic scientist walks the area of the search, the metal detector should be held to the front of the forensic scientist, and the loop or coil of the detector should be moved from left to right, back and forth, keeping the loop in continuous motion parallel to the ground being searched. If the loop or coil is held stationary, metal may not respond.
- 5.5.2.1.4 When an area being searched causes an audible "beep", the loop of the detector should be trained on the area, moving the loop in an "X" pattern until the target is identified by finding the center of the "X" where the detector "beeps".
- 5.5.2.1.5 When the target area is determined, the forensic scientist should perform a visual search of the target area. The area should be thoroughly hand searched and, depending on the terrain, a sub-level search can also be performed.
- 5.5.2.1.6 After the area is hand searched, the forensic scientist should collect any items of evidentiary value using appropriate procedures for the handling and packaging of evidence. If no items of evidentiary value are located in the target area, the forensic scientist should continue to search the area, repeating the above procedure when audible "beeps" sound. Completion of the metal detector search is based on the parameters of the investigation and on the discretion of the forensic scientist.

5.6 Traceability

There are no measurements taken by crime scene responders that require traceability.

5.7 Sampling

It may be necessary to collect a representative sample at a crime scene. An example is the collection of swabs when a bloodstain pattern is consistent and appears to be from one source. The forensic forensic scientist shall document the specific location(s) where the sampling occurred.

5.8 Handling of test items

See Ada County Sheriff's Office Forensic Crime Lab Quality Assurance Manual

5.9 Assuring the quality

See Ada County Sheriff's Office Forensic Crime Lab Quality Assurance Manual

5.10 Reporting

See Ada County Sheriff's Office Forensic Crime Lab Quality Assurance Manual