



# **Washington State Patrol Crime Laboratory Division**

## **Crime Scene Procedures Manual**

September 2023

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## 1.0 GENERAL INFORMATION

Work outside the laboratory at crime scenes is an important component of the duties of Crime Laboratory Division (CLD) personnel. The purpose of the CLD Crime Scene Procedures Manual is to provide Crime Scene Response Team (CSRT) members with procedures and guidance that will:

- Further the CLD commitment to providing the highest quality forensic services, which ultimately enhances public safety for the citizens of Washington
- Promote seamless procedures between CLD work inside and outside the laboratory
- Assist CLD staff in performing assigned duties and tasks at crime scenes
- Ensure that the work product at crime scenes is of the highest quality possible
- Establish guidelines for scene requests while maintaining a high level of customer service

The guidance provided in this manual is designed to enhance information in the Washington State Patrol (WSP) Crime Laboratory Division Quality Operations Manual (CLD QOM) and Forensic Services Guide (FSG). These documents provide the definitive statements of policies and procedures for all work conducted by CLD employees within the individual laboratories of the Division, or while outside the laboratory, whether at crime scenes, in court, training venues, or anywhere else the assigned duties of CLD personnel might take them. This manual is not intended to cover all situations or to supersede agency policies or procedures.

The purpose of this manual is to assist CSRT members in performing assigned duties and tasks within the area of Crime Scene Response. It serves as one source of information on crime scene procedures commonly utilized by the WSP CLD. It is not comprehensive, and should not be regarded as an all-inclusive procedure on Crime Scene Response.

### 1.1 THE ROLE AND FUNCTION OF CRIME SCENE RESPONSE WITHIN CLD

Crime Scene Response is a specific discipline within the CLD of the WSP. The CLD is part of the Forensic Laboratory Services Bureau (FLSB) of the WSP. As such, there are established methods and procedures specific to this discipline. Crime Scene Response requires interaction with every functional area and forensic discipline within the CLD. For this reason, the Crime Scene Technical Procedures Manual necessarily takes an inter-disciplinary approach to providing guidance in established methods and procedures.

The CSRT provides free crime scene assistance to law enforcement agencies in the investigation of major crimes. They assist local agencies with criminal investigations including: evidence recognition, evidence collection, bloodstain pattern analysis, shooting incident reconstruction, scene documentation, and crime scene reconstruction. This assistance may take the form of physical response or remote consultation (e.g. by phone or email). Discretion will be utilized to ensure scene response meets the needs of the customer while maintaining the priorities of WSP. Denial of scene response may be necessary in instances where personnel are unavailable, budget constraints prohibit response, or the needs of the customer cannot be fulfilled by the WSP CSRT. Any reason for non-response will be communicated fully with the user agency by CSRT personnel. The CSRT Manager will be notified of any non-response and will then notify the CLD Commander.

### 1.2 CRIME SCENE RESPONSE AND INTERNATIONAL STANDARDS OF ACCREDITATION

The management system in the International Standard of ISO/IEC 17025—meaning the quality, administrative, and technical systems that govern operations—applies equally in the crime scene environment as in the “controlled” laboratory environment.

Additional information regarding accreditation is found in the CLD QOM.

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### 1.3 QUALITY ASSURANCE

All crime scene scientists will work to continually maintain the highest degree of quality and integrity of laboratory services and to ensure that forensic conclusions are scientifically sound and valid. To this end, all laboratory analyses and related services performed by the CSRT shall meet generally recognized standards of the forensic community and its accrediting organizations. All scientists are required to familiarize themselves with the appropriate manuals and implement the CLD quality assurance policies and procedures in their work.

## **2.0 PRECAUTIONS AND SAFETY**

### **2.1 RESPONSIBILITIES FOR HEALTH AND SAFETY**

CLD maintains a health and safety program designed to safeguard employees from service-related injuries and health problems. The CLD Safety Manual documents the health and safety program of the CLD.

### **2.2 GENERAL SAFETY RESPONSIBILITIES OF CRIME SCENE PERSONNEL**

The law enforcement agency requesting CSRT assistance is responsible for providing scene security. CSRT personnel should not begin scene processing until security has been provided and is being maintained. Any crime scene is to be approached cautiously with initial attentiveness to safety and continued alertness to potential hazards. CSRT personnel are responsible for following the safety procedures identified in the CLD Safety Manual in addition to any safety precautions merited by a technical procedure conducted on-scene.

### **2.3 PRECAUTIONS AGAINST ROUTES OF BIOLOGICAL AND CHEMICAL CONTAMINATION**

Standard laboratory safety protocols are to be followed in the field at a crime scene. In addition to hazardous materials CLD personnel may encounter at the crime scene, there are safety precautions particular to the use of chemical agents that may be essential to the crime scene analyst's work. Personal Protective Equipment (PPE), such as gloves, protective eyewear, appropriate respirators, and proper ventilation, should be employed, when required, to limit contact with biological and chemical reagents.

### **2.4 PROTECTION AGAINST POTENTIALLY INFECTIOUS MATERIALS**

Gloves should, generally, be worn at all times while processing a crime scene and changed when appropriate. Depending on an assessment of the nature of the crime scene and the nature and concentration of potentially hazardous agents, additional suitable PPE such as Tyvek suits, field uniforms, jumpsuits, overshoes, shoe/boot covers, masks, and caps may be necessary.

Appropriate eye protection must be worn whenever a potential hazard to the eyes exists. This includes but is not limited to chemical exposure, alternate light sources (such as laser or ultraviolet), and the use of cutting tools.

### **2.5 CONFINED SPACE SAFETY**

Crime scene investigation may require the analyst to work in a confined space. Confined spaces can expose investigator(s) to hazards including toxic gases, explosive or oxygen-deficient atmospheres, electrical dangers or materials that can engulf personnel entering the space. General precautions for crime scene analysis in confined space include:

- Attention to ventilation and inhalation hazards
- Awareness of the potential for toxic gases, explosive or oxygen-deficient atmospheres
- Assessment of materials that could engulf and overwhelm personnel entering the space
- Electrical dangers
- Potential need for atmospheric monitoring
- Respiratory and personal protective equipment appropriate to the environment

Any confined space that contains unique hazards or requires special training will not be processed by members of the crime scene response team until the conditions are made safe or appropriately trained personnel are present.

## 2.6 FOLLOW-UP SAFETY PRECAUTIONS

All evidence should be packaged to prevent deleterious change such as exposure and contamination. Attention should be paid to potential seepage of liquid evidence including wet blood into/out of packaging materials.

Disposable materials contaminated with a potentially infectious material will be packaged and marked for disposal as a biohazard. If the requesting agency does not have the means to properly dispose of biohazard materials, the biohazard materials will be packaged and transported back to the responding laboratory for proper disposal.

Non-disposable examination utensils or equipment used in processing at the crime scene should be decontaminated on scene or placed in an appropriate container for subsequent cleaning and decontamination at the laboratory.

Soiled field uniforms used at crime scenes should be commercially laundered due to their potential for contamination with biological fluids and hazardous chemicals. See the WSP Regulation Manual for more information on uniforms.

Should a CSRT member later learn a blood source at a scene contained a blood borne pathogen, all other responding team members will be notified as soon as possible and the procedure for blood borne pathogen exposure in the WSP Regulation Manual will be followed.

## 3.0 DUTIES AND RESPONSIBILITIES

Duties and responsibilities within the discipline of Crime Scene Response follow the chain of command structure of the CLD and are defined within the WSP CLD QOM. The Organizational Charts on the FLSB Portal illustrates the structure of authority along which both responsibilities and communications flow.

### 3.1 PERSONNEL

#### 3.1.1 CRIME SCENE MANAGER

The CSRT Manager has oversight of processes that ensure high quality crime scene investigation, reconstruction, and analytical testing for cases submitted by the criminal justice community to the laboratory. The manager will ensure that CSRT maintains ISO/IEC 17025 criteria. The manager will control expenditures of discretionary funds.

The role of the CSRT Manager is to field calls for crime scene response, maintain the call out schedule, present reports to management, client and stakeholder groups, and at public events, coordinate training opportunities for team members and user agencies, coordinate technical reviews and other similar duties. These duties can be delegated to other CSRT personnel. The crime scene manager typically does not respond to call outs.

#### 3.1.2 TECHNICAL LEADS

The role of the technical lead(s) is to field calls for crime scene response, coordinate technical reviews, monitor the quality and timeliness of CSRT work product, make decisions regarding the technical practices and procedures performed at crime scenes, and review and update the training and technical procedures manuals. They also preside over training events and activities, monitor the progress of training plans for members of CSRT, and provide training and training opportunities for team members and user agencies, and other similar duties.

The technical leads report to the CSRT Manager regarding program activities and issues. They also act in administrative capacities when assigned by the CSRT Manager.

The technical leads also respond to call outs and act as either a primary or secondary responder.

#### 3.1.3 PRIMARY RESPONDER

A primary responder is a fully functional crime scene responder and generally is the lead at the scene. They may delegate different aspects of the scene to the other responders on scene, and are ultimately responsible for the resulting report and any courtroom testimony.

#### 3.1.4 SECONDARY RESPONDER

The secondary responder performs crime scene duties and tasks at the direction of the primary responder. They will also act as mentors to trainee responders on scene.

#### 3.1.5 TRAINEE RESPONDER

After successful completion of a trial service period, an employee will become a trainee responder. The trainee is a responder who is not taking on unsupervised crime scene responsibilities until they have completed the appropriate modules of the crime scene training manual. The trainee responder assists with crime scene duties on scene at the direction of the primary and/or secondary responders. The length of a person in trainee status depends on previous exposure to scenes and the progress of the trainee.

### 3.2 INITIAL RESPONSE

Initial request(s) for CSRT assistance generally come from law enforcement agencies investigating crimes. The CSRT Manager, or someone directed to assume those duties, will evaluate the request to deem the appropriateness of CSRT response. They will contact the on-call personnel with the initial scene information, including the requesting agency representative contact information.

Responding CSRT personnel are expected to obtain and document key information immediately upon receipt of the initial request. This includes the date of the request, specific information regarding the scene, the source of that information, and may include, but not limited to, the address, description of the location, time and date of the initial incident, type of incident, and the parties or weapons involved. The need, where necessary, for a coordinated response with the WSP CID will also be determined.

Steps in initial response include attempting to determine if any specialized services or equipment may be required, ascertaining whether the requesting agency has obtained or needs to obtain a search warrant, and providing the requesting agency with an estimated time of arrival.

For responses that may be scheduled at a later date (vehicle searches, etc.), every effort will be made to conduct the response during normal business hours.

### 3.3 PRELIMINARY SCENE APPROACH

Document any initial information provided by the requesting law enforcement agency including obtaining a completed Request for Laboratory Examination (RFLE) form from the requesting agency. This initial documentation will include the name of the investigating agency, the case number, the scene location, and should include the contact information for the lead investigator and victim and suspect information, if known.

Ensure applicable search warrants and/or a consent to search have been obtained by the requesting agency and obtain a copy to be included in the case record.

### 3.4 SCENE ASSESSMENT

Initial scene assessment is designed to ensure the recognition, documentation, collection, and preservation of physical evidence. Consultation with requesting agencies will identify boundaries encompassing all potential areas of interest, establish a path of entry to be used by all personnel entering the scene, and lay the framework for identifying and collecting items of evidence. The primary responder may also delegate tasks to other responders during this initial scene evaluation.

Prioritizing the scene investigation supports the quality of the investigation and the appropriate allocation of available resources. It also allows the identification and protection of potentially fragile and/or perishable evidence.

Once the boundaries of the crime scene have been established, identify a staging area for equipment, supplies, and collected evidence. This area should be located outside the actual scene when practical, but within the parameters of the secured area. The staging area may be inside a house, for example, if all of the scene evidence is confined to a certain area or if environmental factors at the scene become an issue.

Any biological or chemical hazards will be identified upon initial scene assessment. Should additional hazards become apparent after scene processing has begun, re-evaluation of scene processing may be necessary.



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The scope of the CSRT response is defined by the requesting agency and the responding team's capabilities as defined in this manual. Any procedure, requested by an agency that is outside the contents of this manual may be considered but must be approved by a Technical Lead or CSRT Manager and documented in the case record (see CLD QOM).

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## 4.0 SCENE DOCUMENTATION

Crime scene documentation is extremely important to provide a detailed record of observations, aid in report writing, assist with testimony, and allow for independent review by other expert(s). This may include preliminary photographs, rough sketches, and notes. All case file documentation requirements outlined in the CLD QOM will be followed. The case file must reflect the start and ending dates of the CSRT case. The start date will reflect the date of the initial callout and end with the completion of the administrative review process.

### 4.1 NOTE TAKING

Note taking is an essential component of a crime scene investigation, the quality and completeness of which is often critical to a complete analysis of a crime scene.

#### 4.1.1 ESSENTIAL GUIDELINES AND PRINCIPLES FOR NOTE TAKING:

- Note taking is a running and continuous description of the crime scene. It should be inclusive of the crime scene from start to finish
- Nothing is insignificant to record if it catches the attention or the eye of the crime scene analyst
- Err on the side of too much detail, rather than too little detail
- Use photographs and sketches to supplement the notes (including scene measurements)
- When appropriate include descriptors of environmental conditions including weather, lighting conditions, temperature extremes, odors, etc.
- Provide information on the identity of all WSP responders and their duties conducted on scene, requesting agency representatives present at the scene, and first responder information, if available
- The position and condition of the evidence, including measurements when appropriate
- Retain all notes even if rewritten
- All reagents must have lot numbers recorded
- All field notes/sketches shall have the initials of the individual that prepared them. All sketches are not-to-scale, unless otherwise noted.

#### 4.1.2 METHODS OF MEASUREMENT

When the crime scene analyst records distances/heights or produces a to-scale sketch/diagram, measurements should include the dimensions, show the relationships of objects, and when necessary, properly document the scene to enable scale reproductions.

It is ultimately the primary responder's responsibility to ensure measurements needed for reconstruction purposes are taken. Measurements can be taken by hand with tape measure, a scale/ruler, or a handheld laser measuring device. Measurements may also be taken from 3D laser scanner data. Measurements taken at a crime scene will be considered approximations and no measurements will be reported as quantitative measurements (angles measured from trajectory rods scanned with a Trimble X7 3D scanner are the exception – see section 18.3).

Measurements are also used when locating evidence on scene. The following are examples of techniques used in locating evidence:

- Rectangular coordinates (coordinate method): Two measurements at right angles are made from fixed objects, such as a wall, to the item. Indicate the location of the fixed object and the direction measured; for example “67” east of west wall” and “4 ft. 6 in. south of north wall.”
- Triangulation: Measurements are taken between two fixed objects and then from the fixed objects to the item, forming a triangle.
- Polar Coordinates: Measure from a fixed object (e.g., a building) to the item. Then measure the angle in a clockwise direction between the measuring line and a line through the fixed object.
- Base line measurements: Lay down a tape measure or string across the entire room or area to be measured. Establish a starting point and an ending point, which will each be noted as a reference point (RP), designated by a number or letter. Fix both RP’s so they can be re-established, if necessary at a later time. The tape, which runs between the two RP’s, becomes the base line for all other measurements in the crime scene. Measurements are then made from this tape (baseline) by laying another tape measure perpendicular to the baseline out to the item of evidence or point of interest.

## 4.2 DIAGRAMMING

Crime scene diagrams and sketches support the photographs and notes taken at the scene. They also serve to establish spatial relationships, provide an overall scene view, and assist with preparation of demonstrative aides for court. In addition, diagrams can clarify items of evidence in a crime scene without extraneous items such as furniture, piles of debris, etc. being represented in the diagram.

Determine the best perspective and method of sketching the scene when appropriate. Consider items that should be included and excluded depending on what is being represented and what may be important relationally. Clearly label the objects included in the diagram when appropriate. Indicate the perspective of the diagram in your notes (compass direction, floorplan, side, etc.). Overlays may be used to assist in documentation.

To-scale diagrams may be produced at the laboratory based on scene measurements and observations. A scale must be included on to-scale diagrams. Sketches will be considered not-to-scale, unless otherwise noted.

A hand drawn sketch, a sketch created in a software program such as Microsoft Word, or a scene diagram created in Trimble Forensic Reveal or Leica Geosystems Cyclone are required to be included in the case file for residence and outdoor scenes. The scope of the diagram is at the discretion of the primary responder. If a diagram is not included in the case file, a valid and documented reason must be included.

## 4.3 PHOTOGRAPHY

Photographs provide visual documentation of a crime scene. Overall photographs establish the location of specific items and evidence within the context of the scene. Additionally, they record the condition of the scene as first found by the WSP CSRT. For these reasons, it is important to photograph the entire scene prior to processing the scene or evidence collection.

To properly document a scene, overall, evidence establishing (mid-range), and close-up photographs will be taken when the scene allows.

- Overall photographs show where evidence or items are located within the entire context of the scene.
- Evidence establishing photographs show the item within its immediate surroundings and position relative to other adjacent items or evidence.

- Close-up photographs are used for identifying specific items of evidence and documenting more specific detailed patterns or impressions. The field of view will be filled with the subject matter and a scale will be included when the scene allows. Close-up images of evidence items should be taken in-situ and after the item has been removed from the scene, prior to packaging.

The following is a general photography guideline for documenting the scene. When the scene allows, photograph:

- Three hundred-sixty degree perimeter view of the entire scene
- Scene location as established by identifiable landmarks (i.e. street signs, addresses, adjacent buildings or landscape)
- Access routes to and from the scene, and in the case of buildings, all entrances and exits to the structure
- Overall views showing overlapping areas. In the case of an indoor crime scene, this would be overlapping serial views of each room including ceilings, doorways, hallways, etc. (when appropriate)
- Evidence establishing photographs of evidence location relative to reference points and other items of evidence
- Close-up photographs of evidence items with evidence numbers and scales
- Before and after photographs depicting locations of portions of walls, doors, car parts, flooring, carpeting, upholstery, etc. removed as evidence.

#### 4.4 DIGITAL IMAGES

Images of the crime scene used to depict a true and accurate representation of what was observed and processed (overall, evidence establishing and close-up images) will be acquired in RAW (NEF) and JPEG formats.

Only a single case should be recorded on any one media card at a time. If the first media card is filled during a single case, a second media card can also be used and should be reflected in the notes. If multiple cameras are used on scene, this will be documented in the notes.

If an image is unacceptable (i.e out of focus, under/over exposed), an additional image(s) should be taken until the desired image is captured. No images will be deleted.

##### 4.4.1 DISPOSITION OF DIGITAL IMAGES PRIOR TO CLEARING THE SCENE

The original digital images in JPEG format should be transferred to the agency on the secure digital memory (SD) card(s) from the camera prior to departing the scene as an item of evidence. The packaging for the SD card(s) containing these images will be marked with, at minimum, a unique identifier, the date it was packaged, the WSP CLD case number (if available), the investigating agency case number, and the primary responder's initials. Record the number of images in your case notes and verify that the same number of images are on the SD card(s). Transfer the SD card(s) to the investigating agency along with all collected evidence.

The images in RAW (NEF) format will be retained by the scientist and it should be communicated to the agency that RAW (NEF) format files of examination quality images can be examined by WSP CLD staff and accessed on the secure Digital Imaging System (ADAMS) upon the agency's request for latents and/or impressions examinations (see section 4.4.3 for digital image management).

If the crime scene requires an overnight stay, the memory card(s) containing the digital images should be secured on a CSRT staff member or within the room as appropriate throughout the duration of the stay.

#### 4.4.2 DISPOSITION OF DIGITAL IMAGES UPON RETURN TO THE LABORATORY:

If the JPEG images were not released to the agency prior to clearing the scene, the SD card must be stored securely in the laboratory until the images can be copied/transferred to permanent storage media (CD-R, DVD-R, or USB) and released to the investigating agency as an item of evidence. The SD card can also be sent directly to the agency as an item of evidence instead of being copied to another storage media. The reason for not releasing the images on scene must also be included in the notes.

The storage media (or the packaging for a SD card) will be marked with, at minimum, a unique identifier, the date it was created, the WSP CLD case number, the investigating agency case number, and the scientist's initials. Record the number of images in your case notes and verify that the total number of images are on the storage media. Enter the storage media into LIMS as a new item of evidence (e.g., Item 1: One CD/DVD containing xx number of images from crime scene) to initiate the chain of custody, and record that information in your case notes. The storage media can then be provided to the investigating agency (either by shipping or in person). The shipping records or confirmation signature of the agency representative should be retained with the case file to document the chain of custody.

#### 4.4.3 DIGITAL IMAGE MANAGEMENT

All digital images captured on scene in RAW (NEF) format will be uploaded to the secure Digital Imaging System (ADAMS) upon return to the laboratory or as soon as practical. The images will be uploaded under the crime laboratory case number at the assigned scientist's laboratory unless an alternative is noted in the casefile.

If the examiner's digital image workflow will be done in Adobe Photoshop Lightroom, a copy of the RAW (NEF) format digital image files should be transferred to the examiner's computer hard drive or external hard drive. These images can then be imported into Lightroom through the Library module ensuring that any changes made to the images are written to .XMP sidecar files. Once the images are imported to Lightroom, they can be edited for illustration or demonstrative purposes. The .XMP files will be uploaded to the secure Digital Imaging System (ADAMS) in the same crime laboratory case number and location as the RAW image files prior to technical review.

If the examiner's digital image workflow involves edits through the secure DIS without processing in Lightroom, all changes will be tracked through the secure Digital Imaging System (ADAMS).

### **4.5 SPECIAL CONSIDERATIONS - PHOTOGRAPHY**

#### 4.5.1 PHOTOGRAPHY AT NIGHT

Some crime scenes cover a large area that must be photographed on a single image to show the relationship among details. Night scenes pose a problem because the area may be too large to be illuminated by a single flash firing only once. The desired exposure can be created by painting the area with light. This technique can effectively light up a large area on one exposure; however, like all specialized techniques, it is better to bracket a number of exposures to ensure that the information is obtained.

#### **Procedure**

Multiple people may be required to perform this procedure. Designate one individual as the camera operator and any others to supply an external light source.

- Setup the camera on a secure tripod and lock it in place. Set the camera on manual, put on the proper ISO setting (start with ISO such as 400 and adjust as needed. Place on either B(bulb) or S (shutter) mode
- Determine how many flashes it will take to properly expose up the area
- Determine the distance the flash should cover on each exposure
- An aperture (f/stop) of f/8 can be a good starting point and then can be adjusted accordingly
- Adjust the white balance as needed
- Turn on the flash and allow it to fully charge while the flash operator gets in position
- Place something dark in front of the lens and lock the shutter open with a cable release cord or shutter button release
- Point the flash to cover the first area of the photograph, ensuring the flash operator does not get in between the flash and camera. Once the camera operator removes the dark object from in front of lens, the flash operator fires the flash manually
- Once the flash has fired, re-cover the lens with the dark object until the flash operator is in position for the second exposure, and so on, until the appropriate number of flashes has properly exposed the area
- Once the pre-determined number of flashes have been fired, end the exposure
- Repeat with other exposures to ensure the desired results are obtained
- The use of a flashlight can be used to illuminate the area of interest without the use of a flash

#### 4.5.2 PHOTOGRAPHY OF LUMINOL/BLUESTAR

Some scenes may require the use of Luminol or Bluestar to detect latent blood. The very nature of the chemiluminescence can be photographed to record the reactions. This process generally requires two analysts, one to operate the camera and one to spray the blood enhancement reagent. A video camera to record the chemiluminescence can also be set up.

##### **Preparation**

Viewing and photographing chemiluminescent reactions requires the same environmental preparations to reduce or eliminate available light. Indoor scenes should be darkened as much as possible. The use of 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.

##### **Procedure**

The camera operator should be experienced with this type of photography.

- Place the camera on a tripod. If a video camera is also going to be used, a second tripod should be set-up. The videography can begin before the reagent is applied
- Photograph the area prior to applying the reagent. The camera and tripod should not be moved until all photographs of a specific area have been taken

- Ensure the built-in flash is turned off and set the camera's aperture and shutter speed to the appropriate settings. In most cases, an aperture setting of approximately f4.5 and a 30 second exposure should be sufficient
- Spray the reagent. When the chemiluminescent reaction becomes visible, begin the exposure. Continue spraying reagent, as needed, throughout the exposure
- Sometime during the exposure, an external flash can be manually fired above the chemiluminescent area. This may provide a small amount of light to illuminate the area without overpowering the chemiluminescence (if the ceiling is high, the flash may need to be bounced off an adjacent wall or object)
- Move the camera and tripod to a new area to be processed and repeat the procedure, as necessary

The chemiluminescence will only last for a short period of time and will start to diminish after approximately 30 seconds.

#### 4.5.3 PHOTOGRAPHY OF IMPRESSION EVIDENCE

In the case of fragile impressions (such as impressions in snow, sand, mud, or blood), it is important to photograph the impression as soon as possible to prevent loss through environmental or other factors. Procedures for impression collection are identified in Section 9.0 of this manual.

##### **To photograph a 3D impression (one with depth):**

- Take evidence establishing photographs of the impression in-context
- Securely mount the camera to a tripod
- Place the tripod over the impression ensuring the back of the camera (the sensor plane) is parallel to the impression. A small level or angle finder is useful in assuring the camera is perpendicular to the angle of the impression
- Examination quality images must be captured in RAW(NEF) format
- Place a measuring device (scale) alongside the impression making sure that the scale is near the level of the bottom of the impression without covering or obliterating it
- Take close-up photographs, making sure the impression is substantially filling the photographic frame
- Create oblique lighting from several angles using an off-camera flash unit or flashlights. Note that flashlights may produce hot spots in the photograph
- Take additional photographs while moving the flash or flashlight to the opposite sides of the impression to provide counter shadows

Examination quality photographs of impressions that contain both identification information and scales are critical for the preservation and documentation of impression evidence. Scales that run the length or width of an impression may be used, although the use of an L-shaped scale is best.

#### 4.6 **VIDEOGRAPHY**

Video recording, in addition to photography, may be used as a method of documenting the crime scene. Videography supports but does not eliminate the need for still photographs.

Techniques for making a video recording of a crime scene follow similar protocols as still photography. It should include an overall view of the crime scene including surrounding landmarks, an intermediate view showing the position of items and evidence within their immediate surroundings, and a close-up view that allows for the identification of specific items.

The sound component of the video recorder should be turned off during the crime scene documentation.

## **4.7 PHOTOGRAPHY EQUIPMENT QUALITY ASSURANCE**

### **4.7.1 CAMERA EQUIPMENT TRACKING**

Information regarding cameras and accessories will be maintained by the CSRT Manager.

### **4.7.2 MAINTENANCE AND TRANSPORT**

DSLR cameras and accessories require very little outside maintenance. Most of the user maintenance on the cameras and accessories will consist of preventive measures and routine cleaning. Occasionally, routine maintenance such as sensor cleaning can be performed by an outside vendor. If an outside vendor needs to be contacted, notify the CSRT Manager.

Preventive measures include:

- Turning off the camera before removing an attached lens
- Avoiding harsh cleaners such as solvents
- Removing batteries from the camera body and flash units when not in use
- Storing and transporting the camera and accessories in a hard protective case

Routine cleaning includes:

- Using a blower to remove dust from the camera body, lens, mirror, and viewfinder
- Gently wiping the exterior of the camera body and accessories with a cloth
- Applying a small amount of lens cleaner to the lens and wiping with a soft cloth

If a camera becomes defective for any reason it will be immediately removed from service and marked as appropriate. The CSRT Manager will be notified and a service request through Nikon will be initiated. The camera will then be sent (if appropriate) to Nikon for repairs as soon as practical.

Any maintenance (excluding preventive measures and routine cleaning) or outside service performed to a camera must be recorded. This information will be stored on SharePoint.

The cameras will be stored in designated CSRT response vehicles or at one of the WSP Crime Laboratories. The cameras will be transported to and from a crime scene in a hard protective case.

### **4.7.3 PERFORMANCE VERIFICATIONS**

Performance verifications are not required for DSLR cameras and accessories because the images that are created indicate whether the equipment is working properly.



#### 4.7.4 SAFETY

Keep the sun well out of the frame when shooting if possible. Sunlight focused into the camera when the sun is in or close to the frame could cause a fire. Viewing the sun or other alternate light sources through the viewfinder could cause visual impairment.

## 5.0 EVIDENCE COLLECTION AND PRESERVATION

The discipline of crime scene response requires diverse skills in scene processing including the collection, preservation, and the inventory of physical evidence. Types of evidence may include but are not limited to latent prints, footwear or tire impressions, biological fluids/stains, trace evidence, and firearms evidence.

Crime scene analysis requires a systematic and thorough search of the scene. It is incumbent upon the analyst to identify and collect, or direct the collection, of evidence.

The WSP CLD QOM and the FSG define the procedures for evidence handling, packaging, and collection. These procedures are applicable to evidence collected by CSRT personnel. The procedures identified in this manual are designed to enhance and explicate—and not replace--the procedures for evidence collection and packaging presented in other CLD manuals. Deviations from established procedures will be documented in the analyst's notes.

Evidence collected by CSRT personnel will be fully documented, identified, and packaged as to protect it from loss, cross transfer, contamination, and/or deleterious change. All evidence will be turned over to the agency with jurisdiction over the case prior to clearing the scene.

### 5.1 EVIDENCE COLLECTION

The validity of information derived from a crime scene investigation depends on the items of evidence being collected, handled, and stored correctly. CSRT personnel will process a scene in such a way to ensure the integrity of the evidence and protect it from contamination. Reference the FSG for evidence collection guidelines and specific packaging instruction.

### 5.2 EVIDENCE PACKAGING AND PRESERVATION

Evidence collected from a crime scene by laboratory personnel shall be protected from loss, cross transfer, contamination and/or deleterious change, whether in a sealed or unsealed container. Where appropriate, further processing to preserve, evaluate, document, or rendering the evidence safe, shall be accomplished prior to final packaging. Evidence packaging must be marked with a unique case number, such as the requesting agency case number, and a unique item number. The scientist who collects the evidence should initial the packaging. In addition, the primary responder will initial all outer packaging. The WSP CLD QOM and the FSG provide further operative guidance for evidence packaging, marking, and sealing.

### 5.3 COMPUTER AND DIGITAL IMAGING EVIDENCE

The crime scene analyst is concerned with both digital imaging as a tool for electronically recording evidence from the crime scene, and also with digital evidence in many different formats that may be recovered from the crime scene.

Digital evidence recovery may present unique challenges. Personnel with expertise in electronic crime investigation may be needed to collect digital evidence. In the absence of the requesting agency having computer forensic experts, the WSP Special Investigations High Tech Crime Unit (HTCU) may be contacted for consultation. The HTCU can be reached during business hours at (360)704-4242 and after hours by contacting the local WSP Communications and requesting the WSP HTCU Sergeant.

#### 5.4 POST SCENE RESPONSIBILITIES

Final survey of the crime scene is a systematic review prior to leaving the crime scene. It is made to ensure that all identified evidence has been collected and that no evidence or materials generated by the investigation, or equipment used, are inadvertently left behind. CSRT will be sure if any dangerous materials or conditions are present in the scene that they have been reported and addressed prior to clearing the scene.

The requesting agency should be given instruction on how to properly store and preserve the collected evidence prior to it being submitted to the laboratory for analysis (i.e. drying wet bloodied items prior to sealing its final packaging material, freezing/refrigerating DNA evidence).

Equipment used at the crime scene must be decontaminated, either prior to putting it away in the vehicle or as soon as possible upon returning to the laboratory.

## 6.0 BIOLOGICAL EVIDENCE

Biological evidence such as liquid or dried blood, semen, saliva, tissue, hair, urine, feces, bones, or teeth may be important to the investigation of a crime.

### 6.1 PRESUMPTIVE TEST FOR BLOOD

Initial examination is frequently necessary at crime scenes to screen evidence for the possible presence of a relevant biological substance, such as blood. When selecting a potential stain or doing a general swab for blood, evaluate the area to ensure no other evidence will be disrupted (i.e. friction ridge detail, hairs, etc.). These presumptive tests are not species-specific and will produce a positive reaction with animal blood.

#### 6.1.1 PHENOLPHTHALEIN

Phenolphthalein is a catalytic test for the presumptive identification of blood based upon the peroxidase-like activity of hemoglobin. Use of phenolphthalein follows the procedure outlined in the WSP Biochemical Analysis Procedures Manual.

It may be necessary to collect phenolphthalein positive swabs if the sample being collected is of limited quantity. If a phenolphthalein positive swab is to be collected, it should be packaged into a separate swab box from any subsequent swabs taken of the same area. This swab box should be labeled as containing a phenolphthalein positive swab. The swab box(es) containing swabs of the same area, and the box containing the phenolphthalein positive swab, should then be packaged together under the same item number.

Note on the swab box and outer packaging whether the area/stain sampled was phenolphthalein positive.

### 6.2 CONFIRMATORY TEST FOR BLOOD

The examination of bloodstains to determine if they are human blood is sometimes necessary to verify if further analysis of these bloodstain patterns are necessary and/or associated with a criminal event.

#### 6.2.1 ABACARD HEMATRACE

A Hematrace test will only be conducted on presumptively positive visual bloodstains. Product literature reports that the lower limit of sensitivity for human hemoglobin is approximately 1 in 1,000,000 dilution of whole human blood.

A "High Dose Hook Effect" may be seen for extremely concentrated human hemoglobin samples (such as whole human blood) which appears as a negative result. All samples will be diluted in the running buffer to avoid this issue.

It has been reported that ferret blood and upper primate blood can produce false positive results with this product.

#### Procedure

- Collect suspected stain onto a cotton swab.
- Break the head of the cotton swab into the running buffer container (provided in Hematrace kit). Soak the sample for 5 minutes gently swirling the sample for 10 seconds or more without foaming the buffer.

- Using the supplied dropper add 4-5 drops of the incubated sample liquid to the sample well “S” of the test card.
- The results shall be recorded at ten minutes.
  - Ensure that there is a pink line at the control area “C.” If there is no pink line visible at the control area “C” the test is inconclusive.
  - If there is a pink line at the “T” area the sample is positive for human hemoglobin.
  - If no pink line is visible at the “T” area the sample is negative for human hemoglobin.

### Precautions

Do not store cards in extreme heat for long periods of time (above 130°F).

If buffer is frozen, thaw before use.

## 6.3 CHEMICAL BLOOD ENHANCEMENT TECHNIQUES

There are a number of blood detection and enhancement reagents available for use by crime scene investigators. The use of these detection and enhancement reagents will be left up to analyst discretion. These include, but are not limited to, Leuco Crystal Violet, Luminol, Bluestar Forensic, and Amido Black. Consideration must be given to the use of these techniques if subsequent DNA analysis will be conducted as they may inhibit the DNA typing process. Typically, any blood enhancement technique is conducted after all other analysis on-scene is complete.

### 6.3.1 LEUCO CRYSTAL VIOLET (LCV)

LCV is an enhancement/presumptive test for blood on both porous and nonporous surfaces. LCV may assist in crime scenes when there is suspicion that blood may have been cleaned up from a surface and/or is no longer visible to the naked eye. LCV can also enhance bloody impressions for further documentation.

LCV is the reduced (colorless) form of crystal violet. 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, resulting in a dark violet color. The resulting violet color may enhance the contrast of any impression(s)/bloodstains on a substrate, or may develop non-visible stains.

### Procedure

Take photographs of the area to be treated prior to any enhancement attempts. For potential impressions, take examination quality photographs.

- A positive and negative control must be tested prior to the use of the reagent and documented in the case notes.
- Apply the LCV reagent to the area of interest. This is typically done by spraying a fine mist of the reagent.
- Development is typically within 30 seconds.
- Allow the processed area to air dry.

## Documentation

Photograph the area after enhancement. Should an impression be present, take examination quality photographs.

Case notes must have some statement(s) addressing the quantity and description of enhanced bloodstains/impressions located, along with which one(s) were enhanced. This may be aided with, but not replaced by photographs.

### 6.3.2 LUMINOL

Luminol based reagents are presumptive tests for blood and may assist in crime scenes where blood has been cleaned up from both porous and nonporous surfaces and is no longer visible to the naked eye. Luminol can readily detect old bloodstains and minute amounts of blood that have been washed out or cleaned up.

Luminol is a chemical that reacts with the heme compounds found in blood to produce a blue-colored chemiluminescence visible in a darkened area. Heme compounds also exist in most animal blood, so a positive reaction is not species-specific.

#### Cautions

- Because luminol can only be visualized in darkened areas, it should only be used at crime scenes where darkening the entire area is possible.
- The use of luminol may cause dried bloodstains to dissolve, negatively affecting any impression or pattern evidence. If pattern evidence, such as footwear impressions, is located, luminol use should be immediately discontinued until there is an assessment of the evidence priorities and the best way of proceeding.
- Luminol could further dilute an already diluted stain, pushing the stain beyond the DNA analysis detection limits.
- Care should be taken that spraying luminol at a crime scene does not impede movement around the crime scene without tracking the luminol around the scene and possibly contaminating other evidence.

#### Procedure

- A positive and negative control must be tested prior to use each day the reagent is used and documented in the case notes.
- The area where the luminol reagent will be used should be as dark as possible. Extinguish all light sources and, if necessary, cover windows with some kind of material to darken the area.
- Spray a fine mist of the reagent solution in a sweeping motion over the area of interest. Avoid saturation of the area.
- Photographs can also be taken for additional documentation of chemiluminescence related to bloodstains (see section 4.5.2).
- If a positive reaction is observed, additional misting might enhance results for photographing, with care taken not to dilute the stain.

#### Interpretation

A positive presumptive reaction to blood will produce a blue-colored chemiluminescence visible for a short duration of time (~30 seconds) in the darkened environment. Observation of a pattern of luminescence in the sprayed area can be interpreted as a positive result. A result can be interpreted as negative when either there is no chemiluminescence or when the entire area sprayed is chemiluminescent with no discernable pattern visible (auto-chemiluminescence).

False positive reactions may occur as a result of the presence of peroxidases, metal ions, or oxidants. The most common of these interfering substances are hypochlorite-based bleaches, some vegetable matter, and metal ions such as copper. With the exception of copper, luminol reactions with items other than blood are generally different in their duration and intensity.

A presumptive positive reaction for the presence of blood should be subsequently tested using the phenolphthalein reagent. A positive result is an indication for the presence of blood and a sample of that area may need to be collected for DNA testing. A negative result when using phenolphthalein as a follow-up would not usually be collected as it may be a false positive or the sample is too dilute for DNA testing.

It may be necessary to collect a phenolphthalein positive swab if the sample being collected is of limited quantity. If a phenolphthalein positive swab is to be collected it should be packaged into a separate swab box from any subsequent swabs taken of the same area. This swab box should be labeled as containing a phenolphthalein positive swab. The swab box(es) containing swabs of the same area, and the box containing the phenolphthalein positive swab, should then be packaged together under the same item number.

False negative reactions may occur as a result of strong oxidizing agents or other interfering substances.

### 6.3.3 BLUESTAR FORENSIC

Bluestar Forensic may be used to assist in locating latent bloodstains on both porous and nonporous surfaces and may be useful at crime scenes where bloodstains may have been washed out, wiped off, or otherwise concealed.

The cautions, testing procedure, and interpretation for Bluestar Forensic are similar to that of luminol (see section 6.3.2 above).

Caution: Bluestar is available commercially as a training version and is detrimental to DNA. The training version is for training only and shall not be used in the processing of a crime scene.

### 6.3.4 AMIDO BLACK

Amido black, also known as naphthol blue-black, is an enhancement technique for use on faint, bloody impressions that have been left in blood on both porous and nonporous surfaces. It reacts with proteins present in blood and results in a blue-black color, typically increasing the contrast of the impression on the substrate.

#### **Cautions**

Amido black is a reagent known to interfere with DNA analysis. Any sampling for potential DNA analysis should be performed prior to the application of the amido black reagent.

#### **Procedure**

All blood must be dried prior to application. A positive and negative control must be tested prior to use each day the reagent is used and documented in the case notes. A positive test will result in the development of a blue/black print.

1. Take examination quality photographs of the impression prior to any enhancement attempts if the visible impression is suitable for preservation.
2. Stain and rinse a small area of substrate that is not part of the impression to check for background staining. Should background staining occur, do not use this enhancement method.
3. Fix the bloody impression to ensure that it is not dissolved or washed away during the enhancement process. This step may be omitted if a fixing agent is included in the reagent. To fix an impression, spray the impression (or immerse it if moveable) with 2% 5-

sulfosalicylic acid for approximately 10 minutes, then immerse or rinse for approximately 5 minutes with water.

4. Saturate the impression with the amido black reagent. This may be done by spraying or pouring the reagent onto the impression, or immerse the impression on a portable object into a tray containing the reagent.
5. Development is typically quick, but allow for a minute or two to pass to ensure complete development for the methanol based reagent and 3-5 minutes for the water based reagent.
6. Rinse the impression with the de-stain solution, removing the stain from the background.
7. The impression may be re-stained to make darker, if necessary.
8. Repeat the rinse using deionized water if methanol-based reagent was used.
9. Allow the impression to air dry.
10. Take examination quality photograph(s) of the enhanced impression and/or collect, package, and preserve the entire enhanced impression.

Amido black can follow LCV processing in cases where a color change or better contrast is sought.

Apply the developer to the item by dipping or using a sprayer or squirt bottle to cover the target surface. Sufficient staining normally occurs in less than 2 minutes. Then apply the rinse. These two steps can be repeated to possibly improve contrast. After maximum clarity is achieved, apply the final rinse.

Developed impressions shall be photographed for preservation.

## 6.4 PRESUMPTIVE TEST FOR THE PRESENCE OF SEMEN

### 6.4.1 ACID PHOSPHATASE TEST (AP)

Acid phosphatase (AP) is an enzyme found at elevated levels in semen and at lower levels in some other biological fluids such as vaginal secretions.

#### **TESTING PROCEDURES:**

Before use on casework samples, working reagents shall be tested with at least a 1:100 diluted positive semen control each day of use. A negative control shall also be tested. The results of these tests shall be documented in the case notes.

Note: It is recommended to prepare the diluted positive semen control with PBS (instead of water) to increase its long-term reactivity if stored frozen and used after a long period of time.

#### **SPOT TEST (INDIVIDUAL STAINS):**

1. Moisten a piece of filter paper or swab with dH<sub>2</sub>O.
2. Press or gently rub the filter paper or swab on the suspected semen stain.
3. Apply Brentamine reagent to the paper or swab and allow 2-3 minutes for color development.
4. Test result and approximate location(s) of stain(s) shall be documented in the case file.

When the AP reagent is applied to the test sample, a purple color forms in the presence of AP activity.



## 6.5 BIOLOGICAL EVIDENCE COLLECTION, PACKAGING, AND PRESERVATION

Biological evidence such as blood, seminal fluid, and saliva (even in minute amounts) and other body fluid stains can be vital information gathered by the crime scene analyst.

Universal precautions must be used in the handling of all biological materials, whether fluids or dried. Dry stains may flake when disturbed or collected, creating minute airborne particles which could be absorbed through the skin or mucous membranes (See Section 2 -- Safety above).

### **General principles of collecting and handling biological evidence at the crime scene include:**

- Air-dry all biological evidence prior to submission to the laboratory
- Ensure that a stained area from an item of evidence does not come in contact with another item of evidence or another stained or unstained area
- Change gloves, as necessary, to avoid sample-to-sample contamination
- Prioritize the collection of biological evidence at the crime scene, ensuring the preservation of potentially fragile evidence
- Biological evidence should be packaged in paper (i.e. paper bags, swab boxes)
- If there is a danger of contamination due to saturation of items that cannot be air-dried prior to collection, the item(s) may be placed in plastic (unsealed) and handed over to the requesting agency and documented in the notes. Instruct the agency to air dry and re-package the item in paper at their facility as soon as possible

Table 1 is a summary of collection methods and special considerations in handling biological evidence at the crime scene.

<b>Table 1: Collection/Processing Methods and Special Considerations in Handling Biological Evidence</b>		
EVIDENCE	METHODS	SPECIAL CONSIDERATIONS
Wet Blood	Absorb a sample from the stain onto a DNA free swab, saturating the swab, and allow the swab to dry in a swab box	
Dry Blood	Collect item, cut out the stained area, or collect the stained area onto a DNA free swab moistened with sterile water.	
Latent Blood	Chemical enhancement helps visualize and enhance bloodstains including latent bloody footwear and friction ridge impression evidence.	Some processes, such as amido black, degrade DNA.
Semen/saliva/urine	An Alternate Light Source (ALS)/Forensic Light Source (FLS) may be used to locate a possible biological substance.	The recommendation of wavelength for biological substances is 430 – 515 with the use of orange goggles.
Physical Evidence from Sexual Assaults	Collect linens, towels, tissues, condoms, clothing, or fabric contacted by the suspect and/or victim.	Bedding and clothing may contain crucial evidence even when it has been washed.
Touch Evidence	Collect the item of evidence if possible or take a swabbing of the item with a DNA free swab moistened with sterile water.	A wet swab followed by a dry swab should be used to collect touch DNA. This is especially useful for items that have been processed using cyanoacrylate.

The following are preferences for collection of biological evidence that should be considered in each instance of biological evidence:

- Collect the item on which the evidence is located
- When determining if the actual item should be collected, consider whether or not the item is of a reasonable size for packaging. If the item will not fit in the usual packaging container protect the area of interest with paper and collect the entire item. This may include things such as car seats, doors and other vehicle or building materials
- Cut the evidence from its location
  - If collection of the item is deemed unreasonable, the next consideration is whether the evidence can be cut out of the item. 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 from the requesting agency before any cuttings are obtained. The item's orientation within the scene should be marked prior to removal so that in the future its original location can be determined. Package samples in paper products (bags, envelopes, etc.).
- Swab the evidence
  - Moisten a DNA free cotton swab using sterile water to collect the sample. Concentrate limited samples on the tip of the swab. Always consider collecting multiple swabs if sample quantity permits. Swabs from the same location on the evidence should be packaged together to prevent the assignment of separate item numbers to the same sample. Label the container directly, even if the outer packaging will also be labeled.

Consult the WSP FSG for additional information regarding biological evidence collection.

## 7.0 BLOODSTAIN PATTERN ANALYSIS

Bloodstain pattern analysis is the scientific study of the physical properties of blood in motion and the static aftermath to provide information specific to the dynamic event(s) that occurred during the incident that created the bloodstain(s). Further analysis in the laboratory can also help determine whose blood it is and, in cases where multiple people are bleeding, can be critical in terms of sequencing events.

Satisfactory completion of the Bloodstain Pattern Analysis (BPA) Training Curriculum is necessary for BPA in the field.

Prior equivalency may be substituted for all or part of the training with supporting documentation; however, a BPA competency must be successfully completed prior to starting casework.

### 7.1 DOCUMENTATION OF BLOODSTAIN PATTERNS

Recording the orientation, location, size, number, and position of bloodstains with respect to the overall crime scene through a combination of notes, diagrams, photographs, and the collection of the actual bloodstains is vital for their interpretation. Collection of the actual substrate containing the bloodstain pattern(s) is a valid method to supplement the documentation of this evidence.

A representative stain from any pattern considered to be bloodstains will be phenolphthalein tested for blood and the results of that test recorded in the notes. Bloodstains or bloodstain patterns located on a decedent or their clothing may be subject to the jurisdiction of the County Coroner or Medical Examiner. If permission is not granted to test suspected bloodstains on a decedent's body or their clothing, it may be appropriate to assume that red/brown stains that exhibit the appearance, behavior, and context of bloodstains are considered to be bloodstains unless proven otherwise by further examination when applicable. The reason for not testing suspected bloodstains on a decedent, their clothing, or areas immediately surrounding the decedent should be included in the case notes.

Documentation guidelines described previously in this manual also apply for bloodstain pattern analysis. When documenting bloodstains, the analyst should (when applicable):

- Attempt to classify the pattern
- Measure the width and length of representative stains in a pattern, indicating directionality if applicable
- Measure the overall size of a pattern, noting the highest and/or lowest bloodstain(s) when applicable
- Record the location (measured to approximate center of pattern)
- Sketch the pattern to include the measurements of the stains and placement of the patterns on objects
- Roadmap the bloodstains and/or bloodstain patterns

Bloodstain pattern analysis on clothing or other fabric materials is best suited for examination in the laboratory. Wherever possible, collect the item (or the complete bloodstained portion of the item) for later analysis in the laboratory.

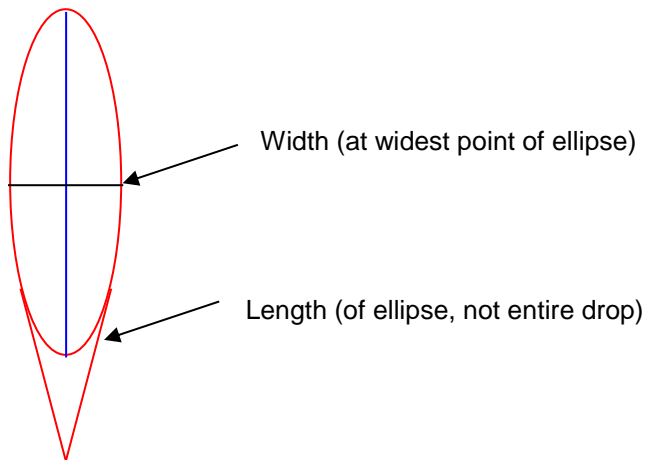
After a pattern has been fully documented (including photographs), collect a sample from a representative bloodstain(s) within the pattern for DNA analysis (when appropriate). Determination of which patterns are from separate events, or potential multiple bleeders, will be helpful in guiding sample collection.

## 7.2 ANALYSIS AND RECONSTRUCTION

Accurate descriptors of bloodstain patterns using standard terminology provide a valuable resource for post-scene analysis and later scene interpretation. Experimentation in a laboratory setting that is fully documented with notes, video, and/or photographs should also be considered when performing a reconstruction. Other documents to consider, but not limited to, would be additional forensic laboratory reports, hospital, Medical Examiner or pathologist reports, investigative supplemental reports, and witness statements. Anything used in a reconstruction must be documented and included in the case file.

## 7.3 BLOODSTAIN ANGLE CALCULATIONS

Below details the equation for determining the impact angle of bloodstains. Impact angles have historically been used to calculate the approximate Area of Origin of impact spatter bloodstains on vertical surfaces. However, determining the Area of Origin can be highly inaccurate due to the unknown effects of gravity and air resistance acting on the blood drops in flight, and no uncertainty of measurement can be applied to the calculations. Therefore, Area of Origin is not performed by the WSP CSRT. Impact angles can be calculated as supporting documentation for classifying castoff bloodstain patterns.



Calculating Impact Angle ( $\theta$ )

$$\theta = \sin^{-1} ( W / L )$$

**W = width of stain**

**L = length of stain**

Adobe Photoshop shall be used for calculating the impact angles of spatter bloodstains. RAW (NEF) images of spatter bloodstains for impact angle calculations will be captured on scene. The images must be captured perpendicular to the spatter bloodstains and include a scale. The images will be imported into Photoshop and sized using the scale in the images. An ellipse will be fitted to the spatter bloodstains and the length and width of the ellipses will be recorded in the case file. The impact angles will then be calculated using the equation above and recorded in the case file. A minimum of three spatter bloodstains will be selected for impact angle calculations to assist in classifying castoff bloodstain patterns. The impact angle calculations will be verified in Technical Review.

Area of Convergence analysis can be performed for impact bloodstain patterns to give an approximation in two dimensions of the location of the spatter producing event. Care should be used when considering elliptical bloodstains exhibiting downward directionality on vertical surfaces as it may indicate that the stain's trajectory had been influenced by gravity.

#### **7.4 BLOODSTAIN TERMINOLOGY**

The terminology used when documenting and reporting bloodstain patterns should follow a taxonomy approach. The notes should list the physical characteristics to support the classification. The bloodstain terminology used is based on the definitions from the American Academy of Forensic Sciences Standards Board (ASB) and can be found on the WSP CSRT SharePoint site.

## 8.0 IMPRESSION EVIDENCE (FOOTWEAR, TIRE)

An impression may occur when an object such as a shoe or tire impresses or impacts a receiving surface and the characteristics or features from the impressing object are transferred onto the receiving surface.

Impression evidence may be fragile in nature and therefore consideration should be taken to document, collect, or preserve this evidence in a timely fashion. Any identified impression evidence should be protected so it is not destroyed or contaminated by personnel at the scene, weather, or other environmental conditions.

### 8.1 COLLECTION METHODS AND SPECIAL CONSIDERATIONS IN HANDLING IMPRESSION EVIDENCE

Photography (see section 4.5.3), lifting, casting, and chemical enhancement are techniques that can help capture and preserve impression evidence. Take examination quality photographs of impression evidence before any casting or other collection or enhancement of impression evidence.

Case notes should have some statement(s) addressing the quantity, appearance, and description of the impressions located, along with which ones were cast, enhanced, and/or otherwise collected. This may be aided with sketches and photographs.

### 8.2 CASTING IMPRESSION EVIDENCE

In addition to documentation and exam quality photography, casting an impression should be conducted if the impression(s) exhibit detailed features/patterns. Prepare the impression by removing any loose debris that clearly fell into the impression after it was made. Debris that may be embedded in the impression should be left in place. No material should be removed if there is any possibility of destroying any part of the impression by doing so. If needed, metal forms may be placed around the impression to contain the casting mixture.

If the impression is in sandy or loose soil, an aerosol fixative (e.g. hairspray) can be used to stabilize it. Avoid a direct application into the impression as the pressurized aerosol spray may disrupt the impression. Instead, mist the spray in the air space above the impression to allow the spray to fall into it.

Dental stone or similar commercially purchased casting products are recommended for casting impression evidence.

- Mix the casting material and water according to the manufacturer's recommendations. Adding the water to premeasured amounts of casting material in a plastic bag makes pouring the cast relatively easy.
- Mix by kneading the bag until a uniform consistency similar to pancake batter is obtained and ensuring that all of the lumps are eliminated. The viscosity of the mixture may need to be adjusted based upon the nature of the impression (e.g., fragile impressions may require a thinner mix, impressions on an angle may require a thicker mix).
- Generally, about two to three pounds of casting material is sufficient to cover an average size footwear impression.

- If not using pre-measured bags of casting material, product can be mixed in an appropriate container such as a mixing bowl. Make sure enough is mixed to cover the impression in one application.
- Carefully pour casting material outside the perimeter of the impression and direct the flow into the impression. Ensure the impression is completely filled and/or covered evenly. In the event that the casting material does not flow completely into the impression, the top surface of the casting material can be carefully agitated to help it flow. Casts should be of sufficient thickness to avoid breakage. If necessary, additional casting material may be poured over the top of the original cast to complete the cast and/or add thickness.
- For fragile and shallow impressions, pour casting material from outside the perimeter so that it rapidly flows over the impressions. A thinner mixture of casting material is necessary for this technique. Avoid pouring directly onto the impression until a sufficient layer of material has accumulated over the impression.
- Casts are set in approximately 20 minutes to 2 hours depending on environmental conditions, the thickness of the cast, and the consistency of the original casting material.
- Once set, carefully lift the cast by digging around the cast so that pressure is not applied to the cast itself.
- Do not clean the cast; cleaning will occur in the laboratory.
- Write or scratch an identifying mark on the back of the cast with a marker along with the date and initials of the analyst.
- Package casts in a rigid container to ensure that the cast will not break. Be sure the cast is completely dry before packaging. Do not package in plastic.

When casting a tire track the section(s) of the impression with the most detail should be chosen.

#### 8.2.1 CASTING IMPRESSIONS ON CONCRETE

Occasionally, mud or soil impressions are observed on concrete. These impressions can sometimes be successfully lifted using a slight variation of the method described above.

**Additional equipment:** Duct tape

- Outline the area surrounding the impression with duct tape to aid in the release of the cast from the concrete
- Pour the casting material onto the impression assuring that it flows onto the tape
- Allow the cast to set
- Label the exposed surface of the cast with the appropriate markings
- Lift the duct tape to free the cast from the concrete
- Package as described above

#### 8.2.2 CASTING UNDERWATER IMPRESSIONS

Impressions that contain a shallow amount of water may be cast using the procedure described in 8.2 but will use a mixture of casting material of slightly thicker consistency. The mixture will displace the thin layer of water.

Impressions that are completely underwater may still be cast. Attempt to dam the impression and remove as much water as possible without damaging the impression. Sift or sprinkle an even layer



of dry casting powder over the impression until the bottom is covered. Then mix and pour wet casting material into the impression. If the impression simply has water in it and is not fully submerged, casting material can be mixed and poured from the outside of the impression, allowing the casting material to flow into the impression, which will displace the water.

- Do not attempt to drain any of the water as it 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 loose dry casting material over the underwater impression until the impression is covered by about an inch of material
- Mix additional casting material to a slightly thicker consistency than typical, and carefully scoop the mixture onto the impression. Allow to set for at least 60 minutes
- Label and package as described above

### 8.2.3 CASTING IMPRESSIONS IN SNOW

- Impressions that are in snow should be sprayed with at least 5 to 6 layers of Snow Print Wax™ or similar type material prior to casting, as it will preserve the detail. If Snow Print Wax™ is unavailable, spray paint may be used as an alternative. Paint and Snow Print Wax™ aerosol wax offer contrast when photographing the impression.
- Be careful not to hold the can of Snow Print Wax™ aerosol wax or paint so close to the impression and at an angle that the aerosol spray damages detail in the impression.
- Be sure the entire impression is sealed with the aerosol wax or the casting material stone may seep through, causing damage.
- Allow the overspray to set for at least 10 minutes.
- Cast the wax shell with a slightly thicker-than-typical cast material mixture.
- Use cold water or some snow to help offset the exothermic reaction when mixing the casting material with water.

## 8.3 IMPRESSION COLLECTION WITH GELATIN LIFTERS

Gelatin lifters can be used for the lifting of footwear and other impression evidence, marks in dust, and trace evidence. The thick, low-adhesive gelatin layer permits the lifting of trace material from almost every surface, including porous materials such as paper and cardboard.

### **Method**

1. Examination quality photograph(s) of all impressions should be taken prior to any lifting attempts
2. Choose the color of gelatin lifter based on which will result in the best contrast between the target impression and the backing color. Black often works well for impressions left in dust.
3. The gelatin lifter should be large enough to cover the target impression
4. Label the back of the lifter with the orientation, item number, date and name or initials of person making the lift
5. Peel the protective transparent film away from the gelatin layer and wait several minutes for the lift to return to original size since separating the protective transparent film can cause the gelatin layer to temporarily stretch.

6. Place one edge of the lifter, gel side down, on the impression and slowly smooth down the rest of the lifter over the impression, taking care to roll or press out any air bubbles and to ensure uniform contact with the impression. A roller may assist with this step
7. After the lifter has been smoothed over the entire surface of the impression, carefully pick it up, starting at the corners
8. With the gelatin layer facing up secure the lifter by the edges or corners onto the bottom of a flat, covered container such as a cardboard box to protect the exposed gelatin layer. Do not replace the protective film onto the gel
9. Take examination quality photograph(s) of successfully lifted impression(s)

#### **Cautions**

- The gelatin layer will melt between 40° and 45° Celsius (104° and 113° Fahrenheit). Objects that have been exposed to the sun which have reached these temperatures will need to be cooled before use
- 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 may be attempted if the first lift resulted in a large quantity of undesired transferred material
- Never slide the gelatin lifter across the surface with the impression
- If using a roller to eliminate air bubbles in the gelatin lifter, do so gently to avoid shifting or excessive pressure that may damage the impression
- Lifted impressions will 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., impressions enhanced with silver fingerprint powders have lasted for several years without fading)

### **8.4 IMPRESSION COLLECTION WITH STATIC LIFTERS**

Vinyl static cling films (static lifters) such as the Stat-Lift™ can be used to lift footwear and other impression evidence made of fine materials such as dust on most substrates.

#### **Method**

- Choose the appropriate color and size of the static lifter for your impression evidence.
- Peel the static lifter off the backing and carefully place over the impression(s). You may tape the lifter in position to stabilize it.
- Label the back of the lifter with the orientation and other appropriate case information.
- Apply thorough and even pressure across the lifter to transfer the impression. You may use a roller for this step.
- Remove the lifter from the impression and place on a flat surface with the dust side up.
- Take examination quality photograph(s) of the lifted impression(s).
- Cover with backing or paper and tape the cover in place.
- Package in an appropriate container.

### **8.5 IMPRESSION COLLECTION WITH ADHESIVE LIFTS**

Large adhesive sheets can be used to lift footwear and other impression evidence made of fine materials, such as dust on a nonporous substrate.

### Method

- Remove an adhesive sheet from the backing and carefully place it over the impression.
- Apply thorough and even pressure across the adhesive sheet to transfer the impression to the sheet.
- Remove the sheet from the impression substrate and transfer it sticky side down onto transparency film.
- Label the adhesive lift with the impression orientation and other appropriate case information.
- Package in an appropriate container.

## 8.6 MAKING EXEMPLAR TIRE IMPRESSIONS

### 8.6.1 ROLLING METHOD

Exemplar prints must be taken while the tires are on the vehicle. If they have already been removed, place them on a similar vehicle before making exemplars.

1. The tires may need to be wiped down with heavy work gloves or rags to remove any surface debris. Be careful not to dislodge rocks that may be embedded in the tread. If appropriate, collect soil/material that is adhering to the vehicle for comparison to soil/material at the scene. Note: The material on the tires is likely not of value; however this may be case dependent and should be discussed with the requesting agency's investigator if necessary.

The best surfaces will be asphalt or concrete. Be sure the surface is swept to remove as much debris as possible.

2. Start with cardstock or art board or similar type material that is about 4 – 6 inches longer than the measurement of the circumference of the tire. The typical length of cardstock needed for a passenger vehicle tire is approximately 8 feet.
3. Place the cardstock in front of the tire. It does not matter if you start with the front or back tires first. Adhesive tape can be used to attach the separate lengths of cardstock together.
4. Mark each tire with tape, chalk, or other form of visual identifier on at least 4 points equidistance around the tire and label each section, such as 1, 2, 3 and 4.
5. A picture can be taken to record the approximate location of these marks in relation to the side labels. This will help in the comparison process.
6. When processing the front tires, ensure the back tires do not run over the cardstock used in the processing of the front tires.
  - a. After the tire has been cleaned, use a shoe polish sponge or gloved hand that has been loaded with a silicone spray or petroleum jelly to spread over the entire surface of the tire tread. Slow drying black spray paint or black fingerprint ink may be used as an alternative and once rolled will not need magnetic fingerprint powder application.
  - b. The vehicle will have to be rolled forward to finish spreading over the portion of the tire that was in contact with the ground.
  - c. Hand push the car over the cardstock and note the location of the visual identifiers when they contact the cardstock (noting the stem valve is also recommended).
  - d. Note the proper sequence on the cardstock as the tire passes over each (i.e. 1st, 2nd, 3rd).

7. Write the tire (front/back, passenger/driver), direction the tire was rolled, date, case number, etc., on each section of cardstock before removal.
  - a. Record in your notes, on the cardstock, and/or photography, the following: make, model, and size.
8. Develop the impression by using magnetic fingerprint powder only. Regular powder with a regular brush will damage the impression.
9. A clear acrylic lacquer may be sprayed over the processed impression and allowed to dry.
10. Package with paper to protect each processed impression.

When all exemplars are completed, discuss with the requesting agency's investigator about collection of the tires for comparison.

If a comparison of the tire against a questioned impression at a scene is required, the tires must be submitted.

#### 8.6.2 WET MEDIA METHOD

1. Wipe tires down to remove any surface debris. Be careful not to dislodge rocks that may be embedded in the tread.

The best surfaces will be smooth, dry asphalt or concrete. Be sure the surface is swept to remove as much debris as possible.

2. Roll out enough paper to keep tires on them after rolling
3. Mark and label ~ 4 equidistant points (including the valve stem) on the sidewall.
4. Lay out 2 sections of firm paper board (each are at least the length of the tire circumference) end on, in front of the tire; the first one will serve as an "ink pad", lay out clear wet media film on the second
5. Apply black oil-based block printing ink in a very thin film using a roller such as a fingerprint roller.
6. Push the vehicle onto the ink pad and then onto the film, mark the location of the sidewall labels as they contact the wet media film
7. Mark the exemplar with information about the tires and direction of travel
8. Allow to dry, may take 4-6 hours depending on the environment

If the exemplars do not reflect sufficient tire tread details, prepare additional exemplars.

Once dried the wet mount can be rolled up and packaged appropriately.

When all exemplars are completed, discuss with the requesting agency's investigator about collection of the tires for comparison.

If a comparison of the tire against a questioned impression at a scene is required, the tires must be submitted.

#### 8.7 **MAKING ADHESIVE LIFT EXEMPLARS OF TIRE TREAD AND SIDEWALL PATTERNS**

Adhesive tire tread and sidewall lifts may be taken to document the design pattern that continues from the tread onto the sidewall of the tire. These lifts can be used by the impression examiner for exclusionary purposes.

##### **Method**

- Remove surface debris from an area of the tire tread including both sides of the adjacent sidewalls.

- Dust the tread and sidewalls with black fingerprint powder or a suitable substitute if there is not enough residual dirt on the tire.
- Remove an adhesive sheet from the backing and carefully place it over the dusted tread and sidewalls.
- Apply thorough and even pressure across the adhesive sheet to transfer the powder from the tread/sidewall design to the sheet.
- Remove the sheet from the tire and transfer it sticky side down onto transparencies.
- Label the adhesive lift with the tire information, orientation, and other appropriate case information.
- Package in an appropriate container.

When all exemplars are completed, discuss with the requesting agency's investigator about collection of the tires for comparison.

If a comparison of the tire against a questioned impression at a scene is required, the tires must be submitted.

## 9.0 FIREARMS EVIDENCE

Safety is the first consideration when collecting firearms evidence from the crime scene. When possible, general documentation of the firearm should be taken of all sides and markings prior to moving or rendering the firearm safe. Careful attention to the position of any safeties/hammer/etc. of the firearm should also be documented.

### 9.1 COLLECTION AND DOCUMENTATION OF FIREARMS

The following are general principles and methods associated with collection and preservation of firearms at the crime scene.

- Fragile or easily lost trace evidence (i.e., hair, fibers etc.) observed on firearms should be removed and collected separately
- Any evidence with possible blood or body fluids should be air-dried if possible, then packaged in paper bags, envelopes, or cardboard boxes
- Do not attempt latent print, or other evidence processing at the scene
- Photograph the item before it is moved
- If the firearm has been moved and rendered safe before CSRT arrival at the scene, a note should be made as to its reported original position, condition, any associated ammunition components, the order they were removed along with the name of the individual who reportedly moved it, if available
- If the firearm is rendered safe by agency personnel other than CSRT at the scene, a note should be made as to its reported condition and orientation, any associated ammunition components, the order they were removed, and who made the firearm safe (if known)
- Record markings and photograph if possible (serial numbers, make/model, etc.)
- Once photographed in its originally found position, photograph all sides of the firearm including the serial number
- Never move a firearm by inserting any object inside the barrel or trigger guard. This is unsafe and can damage potential evidence
- Document the headstamp of any ammunition associated with the firearm (may not be necessary for loaded magazines)
- If the firearm is a revolver, the position and type of ammunition or fired components should be documented
- The firearm should be unloaded taking care not to destroy any latent, trace, blood, or other evidence
  - a) When possible, do not cycle the action when unloading the firearm
  - b) If the weapon cannot be made safe, the packaging should reflect this
  - c) When possible the firearm should be secured with the action open and packaged in a way to demonstrate that the firearm is safe
  - d) Zip-tie the action open (e.g. hammer to the frame or between the hammer and frame, run a zip-tie down the magazine well)
  - e) The firearm can now be secured in a box for collection
- Package firearm in a rigid container (gun box), seal, and mark container. Recommend indicating the condition as loaded or unloaded and the direction the muzzle is pointing. Loaded

magazines/ammunition must be packaged separately from the firearm unless there is a documented reason of why this was not possible.

Note: If the weapon cannot be made safe and is being submitted to the lab, the firearm shall be hand carried by the investigating agency to the lab.

### Special Considerations

For firearms found in water, place the firearm in a container of the same water from which it was recovered and submit the item immediately. Leaving a firearm in the same water in which it was found will slow the rusting process.

## 9.2 COLLECTION AND DOCUMENTATION OF FIRED COMPONENTS

- All bullets and bullet fragments should be collected when practical, unless their collection might cause too much damage to the structure that the bullet or fragments are imbedded in, or if the agency requesting assistance from CSRT refuses it. Any reason for not collecting all of the bullets or fragments will be documented in the notes
- Bullets, shotshell wads, shot pellets, and slugs should be packaged separately.
- Cartridges, cartridge cases, and shotshells should be packaged separately.
- When appropriate, recover any unfired ammunition from the scene of the same brand and/or type as was found in the firearm or at the scene for potential laboratory examination

## 9.3 CHEMICAL TESTING OF BULLET DEFECTS

Chemical testing is used to determine if a hole, or ricochet mark, is the result of the passage of a bullet or a bullet impact. Suspected primary, or entrance bullet defects should be tested for the presence of copper and lead when possible. These are the main components that typically comprise a bullet. Locations of potential bullet defects may prohibit chemical testing (i.e. if a bullet defect is high up on a building).

The copper test needs to be done before the lead test.

A known positive and negative control will be tested prior to use. This quality control check will be documented in the case notes.

A positive test for lead or copper permits a defect to be identified as consistent with the passage of a bullet or a bullet impact.

A negative chemical reaction for lead or copper does not necessarily mean that a defect was the result of something other than a fired bullet. The type of substrate, composition of the bullet, and the size of the defect may affect the chemical color tests and should be noted.

### Selecting Defects to Test

- Test all primary defects for the presence of copper and lead, and test any subsequent corresponding entrance defect(s), if possible, for the presence of copper and lead if those subsequent defects will be used to determine the path of the projectile on scene. If a defect is not tested, the reason will be documented in the casefile.

- Associated exit defects do not need to be chemically tested
- Other areas of suspected bullet defect damage within the context of the scene should be chemically tested when possible
- Defects/damage that is the obvious result of a fired projectile may not require chemical testing (i.e. when a fired bullet is visible within the defect). The reason for not testing these areas of damage will be recorded in the notes

#### 9.3.1 DITHIOOXAMIDE (DTO) TEST FOR COPPER

##### **Procedure**

- Moisten filter paper or Bench Kote with the ammonia solution
- Apply moistened paper directly to the surface to be tested (do not rub) maintaining contact for approximately 30 seconds before removing
- Apply DTO solution to the moistened paper

##### **Result**

A green/gray color reaction indicates a positive reaction for the presence of copper

#### 9.3.2 2-NITROSO-1-NAPHTHOL (2NN) TEST FOR COPPER

##### **Procedure**

- Moisten filter paper or Bench Kote with the ammonia solution
- Apply moistened paper directly to the surface to be tested (do not rub) maintaining contact for approximately 30 seconds before removing
- Apply 2NN solution to the moistened paper

##### **Result**

An orange color indicates a positive reaction for the presence of copper

#### 9.3.3 SODIUM RHODIZONATE (NaRho) TEST FOR LEAD

##### **Procedure**

- Moisten filter paper or Bench Kote with the acetic acid solution
- Apply moistened paper directly to the surface to be tested (do not rub) maintaining contact for approximately 30 seconds before removing
- Apply NaRho solution to the moistened paper
- Optional: apply a 5% HCl solution

##### **Result**

A dark purple color indicates a positive reaction for the presence of lead. Upon the addition of HCl (optional) the orange background should clarify and the dark purple change to purple-blue.

### 9.4 BULLET DEFECT DOCUMENTATION

#### **Method**

The following should be done when documenting bullet defects:

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- The bullet hole/defect(s) should be properly photographed; note the shape and any impact features
- Measure the dimensions of the hole/defect
- Document the location of the bullet hole/defect in your notes (sketch, photos, measurements, 3D scanner data etc.).
- If applicable, collect trace evidence from the hole/defect
- If possible, determine if the defect is an entrance or exit point and look for corresponding re-entry points
- Label any primary defect(s) with a letter designation (example A, B, C etc.)
- Subsequent entry defects believed to be caused by the same bullet should be labeled with a number following the letter designation; for example, a second entrance defect believed to be caused by the same bullet that caused defect A would be labeled A1 and so on.
- Exit defects should be labeled as the exit defect of the corresponding entrance defect

## 9.5 TRAJECTORY DOCUMENTATION

### Method

The following guidelines should be used when documenting a bullet trajectory:

- Carefully place a trajectory rod through the entrance hole (and associated exit hole, if possible).
- Cut viewing windows into the material as needed in order to more accurately determine corresponding bullet defects and the trajectory.
- If necessary place a cone shaped centering guide on the rod and gently guide the tapered end into the entrance hole. A rubber o-ring may be used to hold the guide in place. Use a second centering guide for the exit hole, if necessary.
- The trajectory determination shall be properly photographed with trajectory rods. The analyst must 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).
- A laser can be attached to the end of the trajectory rod to project/extend the trajectory in either direction.

**Measuring trajectories with a 3D laser Scanner** (also see Module 18.0 Laser Scanning for Crime Scene Documentation, section 18.3):

- Trimble X7 scanners will be utilized to measure trajectory angles (note: externally provided scan data can be used as long as the 3D point accuracy and angular measurement accuracy of the scanner used are the same or better than the Trimble X7 scanner).
- The scanner should be placed within 10 m of the trajectory rod and be in an orthogonal position to the rod.
- Each trajectory rod should be scanned once using a 7 minute scan setting (standard resolution).
- Vertical (elevation) and azimuth (horizontal) trajectory angles will be measured in Cyclone software and documented in the case notes. These angle measurements will be reviewed in the Cyclone database during Technical Review.

### Measurement Uncertainty of Trajectory Angles

The measurement uncertainty of trajectory angles was determined by the WSP CSRT for measuring trajectory angles of trajectory rods in the scanner data obtained from Trimble X7 laser scanners. The procedure used for the evaluation of measurement uncertainty:

1. required the specific measuring device or instrument used (Trimble X7 laser scanners) for a reported result to have been included in or evaluated against the estimation of measurement uncertainty for that method;
2. included the process of rounding the expanded uncertainty (following normal, mathematical rules of rounding);
3. required the coverage probability of the expanded uncertainty to be a minimum of 95.45% (often referred to as approximately 95%); and
4. determined the schedule to review and/or recalculate the measurement uncertainty (discussed below).

When reporting trajectory angles measured from trajectory rods following the outlined 3D laser scanning methodology above an Expanded Uncertainty (k=2) of  $y \pm 2.6$  degrees will be reported for a level of confidence of approximately 95%, assuming a normal distribution.

The expanded uncertainty was rounded (normal, mathematical rules of rounding apply) and reported to two significant figures (one decimal place). The test result will also be rounded and reported to the first decimal.

The reported expanded measurement uncertainty is limited to angles measured from trajectory rods using the 3D laser scanning method that the WSP CSRT employs. This uncertainty can be applied if another 3D laser scanner model is used on scene as long as that scanner has a published 3D point accuracy and an angular accuracy as good as or better than the Trimble X7 laser scanner.

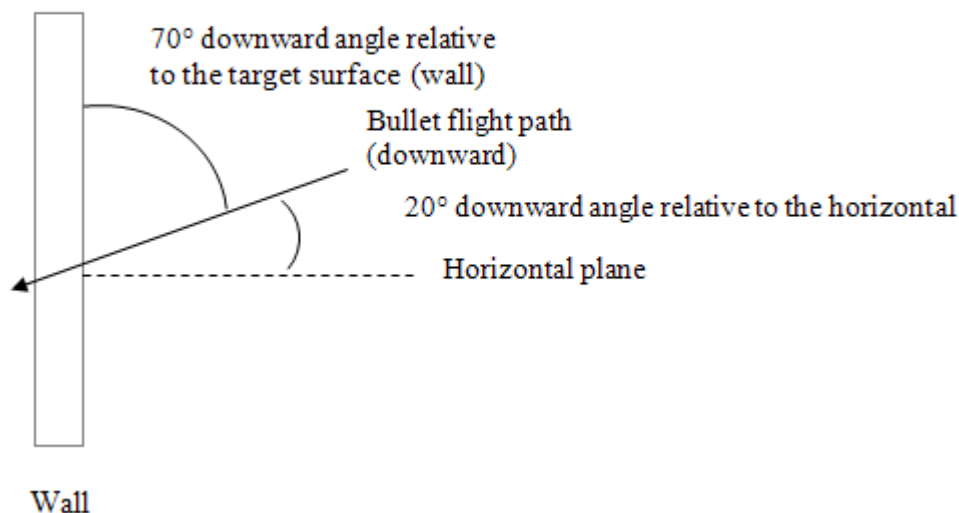
The uncertainty does not need to be recalculated for personnel changes as long as the new personnel have received at minimum, the same level training as outlined in the CSRT Training Manual and the equipment has been demonstrated to operate as intended.

All Trimble X7 laser scanners are operated by WSP CSRT personnel. As a quality control, auto-calibration of the scanner occurs prior to each scan. The scanner will not operate unless this auto-calibration passes (see section 18.2 for additional information on the quality assurance of the Trimble X7 laser scanners).

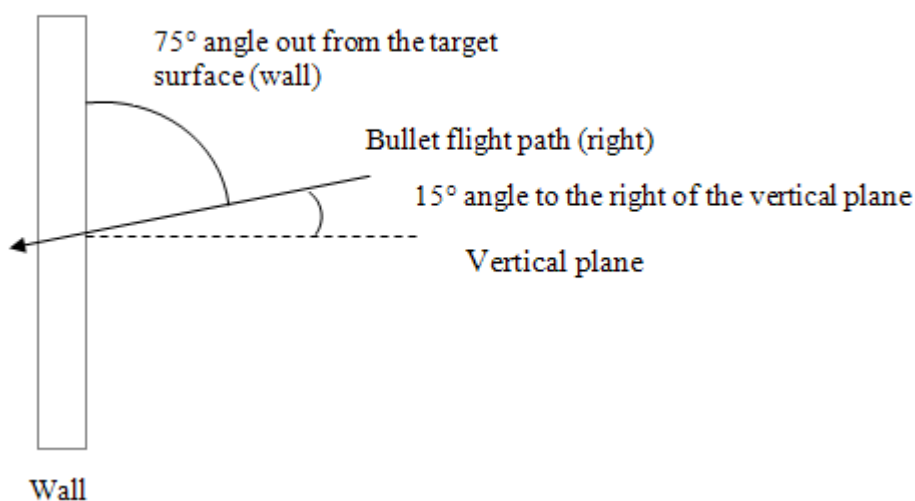
### EXAMPLES OF TRAJECTORY DOCUMENTATION

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### SIDE-VIEW OF WALL



### TOP-VIEW OF WALL



## 9.6 DISTANCE (PROXIMITY) DETERMINATION

The entrance point of a bullet trajectory should be examined for gunshot residue. If a pattern is detected or thought to be present, the item or area should be documented and photographed. If the item can be collected, it should be carefully preserved to prevent damage or disruption to powder residues deposited around a bullet hole or the shotgun pellet pattern. The cutting or tearing of the item in the area of the holes must be avoided when the item is being removed. If the item is clothing from the victim, then each item of clothing should be packaged separately to protect from cross-contamination. Obtain permission from a Medical Examiner or Coroner prior to collecting clothing from decedents on scene. For shotgun pellet patterns the same process should be followed.

Clothing with gunpowder residue:

- Completely air-dry the clothing if possible and appropriate
- Place clothing item flat onto clean paper sufficient to cover the item
- Use paper to separate areas of clothing to ensure that the area of clothing with the gunshot residue does not come into contact with other areas of the garment
- Plastic will cause biological material on the clothing to deteriorate and should not be used

#### 9.6.1 SHOTGUN PELLET PATTERNS

The total shotgun pellet pattern should be fully documented to include photographs with scale as well as the general size and location of the pattern.

The discharge of a shotgun against a flat surface other than 90 degrees will produce an elliptical pattern. The approximate angle of incidence can be calculated by dividing the minimum diameter by the maximum diameter of the elliptical pattern and then using the arcsine function to obtain the incident angle. It should be noted if any "flyers" (outliers) are included or excluded when determining the incident angle.

A few samples of the shot should be collected from the pattern if possible.

## 10.0 TOOLMARK EVIDENCE COLLECTION

A toolmark is any impression, scratch, gouge, cut or abrasion made when a tool is brought into contact with an object, leaving a mark and should be documented like other impression evidence. Toolmark evidence may be present at various types of crime scenes, from burglary to homicide.

### 10.1 TOOLMARK TERMINOLOGY

The following definitions are used in the discipline of toolmark identification:

**Tool:** The harder of two objects, which when brought into contact with another object results in the softer object being marked by the harder one

**Toolmark:** The mark produced on the softer of two objects by a harder object coming into contact with it

**Cast:** The reproduction of a toolmark or the surface of a tool made with a molding material such as silicone rubber or Forensic Sil™

### 10.2 GENERAL PRINCIPLES OF TOOLMARK EVIDENCE COLLECTION

Below are some general principles and methods of toolmark evidence collection and crime scene analysis:

- Never place a suspect tool into a toolmark as it could destroy markings or transfer trace evidence
- Collect the toolmark evidence for laboratory analysis, if possible, rather than creating a cast at the crime scene
- Depending on the security situation and potential damage to property, toolmarks on large objects might be cut out
- Protect the toolmark area by covering it carefully before packaging as appropriate
- The use of a soft brush or compressed air may be helpful to remove dirt before casting a toolmark as casts will duplicate foreign material in the stamped characteristics
- Fully document (notes, photographs, sketches as appropriate) potential toolmark evidence
- Consider that friction ridge examination and/or DNA analysis may be needed on a suspected tool
- Package tools in a manner to protect the working end of a tool
- If friction ridge impressions are of interest, immobilize the tool to reduce contact with packaging material
- Recover shavings or any other possible debris associated with the tool and/or toolmark
- Package broken parts (tools, bolts, knives, screwdriver blades, etc.) to be examined in a manner that protects the edges of the items to be physically matched

### 10.3 CASTING TOOLMARKS

Forensic Sil™, or similar silicone rubber casting material, is available in various colors (including brown, white, black and, clear) and can be used to create a reproduction of toolmark impressions.

### **Document the Impression**

A photograph of the area to be cast should be taken in a manner that shows the impression in relation to its surroundings. Additional close-up photographs that provide detail of the impression should also be taken with scales. The location where each cast was recovered should be documented in the written notes.

### **Preparation**

Use casting material in accordance to manufacturer's recommendations.

### **Packaging**

Package casts separately, in a small box or envelope, or in such a manner that multiple casts do not come into contact with each other.

## 11.0 LATENT PRINT AND FRICTION RIDGE IMPRESSION EVIDENCE

Latent prints can be divided into two categories:

- **Invisible prints** - those made by perspiration and other substances on the skin surface and which require development by physical or chemical methods
- **Visible prints** (Plastic/Patent) - those made in soft pliable substances such as putty, modeling clay, etc. (Plastic), and those made by contamination of the skin with such substances as blood, paint, ink, etc. (Patent)

### 11.1 LATENT PRINT RECOVERY

Where possible, individual evidence items that require latent print processing should be collected for analysis in the laboratory.

The crime scene analyst shall make the following considerations in determining the processing sequence for each item or surface to be processed on-scene:

1. Generally, move from the least invasive technique to the most invasive technique
2. Consider the surface of the item (porous, semi-porous, or non-porous) to establish suitable processing techniques
3. Consider the color of the surface to determine which technique will provide suitable contrast for the detection of impressions
4. Consider the texture of the surface to determine whether developed impressions will require imaging for preservation. In such a case, use a technique that will provide the best contrast
5. Consider which matrix (sweat, blood, dirt, oil, amino acids, lipids, etc.) may have been deposited or will best be developed on the surfaces of the item
6. Avoid techniques which may compromise other forensic analyses which may be required

A visual examination shall follow each technique employed. Some techniques may require the use of an ALS for examination. Impressions that are suitable for further analysis shall be preserved via lift or digital image once detected and also if enhanced in any way by subsequent techniques. If the analyst is unsure of the suitability, preserve the print for further analysis by the Latent Print Section.

### 11.2 PROCESSING GUIDELINES

The aforementioned considerations will work in conjunction with the following general processing sequence guidelines to allow the analyst the flexibility to determine the best course of action.

Non-Porous Surfaces: substrates that do not absorb the latent print residue, (i.e. glass, metal, plastic)

1. Visual examination
2. Cyanoacrylate\*
3. Powder processing and/or dye stain (not necessarily in that order)

If a print is contaminated with blood, use Amido Black after processing the surrounding surfaces with powder.

Semi-Porous Surfaces: substrates that may absorb some of the latent print residue (i.e. some treated wood or cardboard)

1. Visual examination
2. Cyanoacrylate\*
3. Powder processing

\*Cyanoacrylate processing may not be necessary or feasible, depending on the nature of the scene and evidence. Also, large objects (exterior of vehicles, windows, etc.) might not be conducive to safe, effective cyanoacrylate processing.

Porous Surfaces: substrates that absorb the latent print residue (i.e. paper, untreated wood, cardboard).

In most cases, porous items should be collected at the scene for processing in the laboratory.

Adhesive Surfaces (i.e. tape, stamps)

In most cases, adhesive items should be collected at the scene for processing in the laboratory.

Items with Biological Contaminants

In general, the item may be visually examined, fumed with cyanoacrylate, and dusted with a clean powder and brush prior to swabbing or packaging the item for DNA analysis. Developed impressions should be photographed and not lifted if the same area requires DNA analysis. Chemical reagents or techniques that require a wash may be completed after the biological evidence has been collected. If needed, consult with the appropriate regional DNA and latent print sections to determine sequencing order for any item possibly contaminated with blood or other biological contaminants.

### 11.3 DOCUMENTATION OF FRICTION RIDGE IMPRESSION EVIDENCE

A description of the evidence item(s) as well as all examinations, pertinent observations, and results shall be documented in the analyst's case notes.

Record the sequential order of the processing techniques used. If the evidence is not processed in accordance with the above general processing sequence guidelines, document the variance and the reason.

Throughout the sequence of processing, any impressions deemed suitable for further analysis will be preserved prior to any additional processing techniques. Case notes shall indicate the item and/or location from which each lift and/or photograph was generated from. Digital image file numbers for each examination quality image will be recorded in the notes.

### 11.4 COMMON PROCESSING TECHNIQUES FOR CRIME SCENES

#### 11.4.1 AMIDO BLACK

Amido black is an enhancement technique for use on faint, bloody impressions and is especially useful for nonporous surfaces, such as glass, plastic, and vinyl. It reacts with proteins present in blood and results in a blue-black color, typically increasing the contrast of the impression on the substrate.

Amido black can be used to enhance latent prints contaminated with blood on a cadaver. The standard technique for amido black should be used.



#### 11.4.2 CYANOACRYLATE ESTER (SUPERGLUE) FUMING

Fuming with cyanoacrylate will cause latent print residue on non-porous and some semi-porous surfaces to sometimes appear white in color. Latent prints developed this way are not easily damaged. See the **Latent Prints Technical Manual** for a description of the procedure for conducting superglue fuming.

#### 11.4.3 POWDER PROCESSING

Powder development techniques are used to develop friction ridge skin impressions on non-porous and semi-porous items. Powder development makes friction ridge detail visible and improves the contrast of already visible detail. This development technique facilitates preservation via imaging and lifting the impression. See the **Latent Prints Technical Manual** for a description of the procedure for powder processing.

### **LIFTING TECHNIQUES**

When using lifting tape to remove a developed friction ridge impression, care should be taken in unrolling the tape from a roll so that hesitation creases do not occur. The unrolling should be performed in one smooth, continuous action.

The application of the lifting tape (or other lifting device) to the surface should also be in one smooth motion. The tip of a gloved finger or a rounded object may be pressed to the tape during application to preclude air bubbles and to ensure good contact with the lifting surface. Some bubbles can be eliminated effectively (without damaging the friction ridge impression) by applying pressure with a gloved finger (or other smooth, rounded object) to force the air pocket out at the edge of the tape. The lifting of the friction ridge impression away from the surface should also be in a smooth continuous motion.

The lift shall be marked with the following:

- Date of lift
- Location lift taken from
- Name or initials of person making the lift
- Unique lift number

Suggestion: The exam quality image number(s) of an impression(s) may be recorded on the back of the corresponding lift card.

A diagram of the lift location on the object is recommended. An arrow indicating the direction of the lift is also valuable for determining the orientation of the impression(s) and how an object was touched or handled.

Any latent impressions appearing on the perimeter of the lift, deposited by the individual making the lift, shall be crossed-out and initialed.

#### 11.4.4 SMALL PARTICLE REAGENT

Small Particle Reagent (SPR) is a suspension of fine Molybdenum Disulfide particles in detergent solution. This process can be used on wet, or previously wet, non-porous surfaces. SPR adheres to fatty constituents of latent prints to form a gray deposit.

### **CONTROL TEST**

Deposit a sebaceous rich print onto a white lift card or substrate similar to the evidence being processed and process with SPR. A positive test will result in a gray/black print against the background.

Spray method (If being used outside during rain, shelter the area to be treated from direct rainfall.): Shake the container of working solution and fill the spray bottle, shake well and adjust the nozzle to give a cone-shaped jet. Spray the area to be examined starting at the top and working downwards. If signs of latent print development appear, continue spraying just above the relevant area until there is no further buildup of gray deposit. If it is necessary to remove excess powder from developed prints, spray water gently above developed prints with a second spray bottle. Allow the surface to dry.

Preservation Method: Photography

#### 11.4.5 LIFT TRANSFER METHOD:

For live victims, a piece of black plastic or RC photo paper developed as black can be held against areas suspected as possibly bearing latent prints. Other nonporous surfaces such as a mirror, glass, or metal plate may be used instead of photo paper. A sponge or soft pad should be placed between the analyst's hand and the photo paper to improve contact with the victim's skin.

Hold the transfer surface against the skin for 15 to 20 seconds. The nonporous transfer surface should then be cyanoacrylate fumed to develop any friction ridge detail that may have transferred. Condensation on the body is acceptable as any water in the latent print residue will aid polymerization with cyanoacrylate fumes.

After cyanoacrylate fuming, further development of the nonporous transfer surface should include luminescent dye stain, alternate light source excitation, and (lastly) powder rubbing.

For deceased victims, the body's skin surface should be between 72 and 80 degrees for optimal fatty/waxy impression transfer. Warm the lift card or other transfer medium just before lifting.

#### 12.4.6 CYANOACRYLATE FUMING CADAVERS:

Ideally, the body should not be refrigerated prior to fuming because moisture can destroy impressions that might otherwise be developed. If already refrigerated, permit all condensation moisture to evaporate upon removing the body from the cold locker/drawer.

An airtight plastic tent can be assembled over the body and fumed with cyanoacrylate. A small, battery powered fan may be used to help with fume distribution.

After fuming, dust the body using a contrasting color powder. Developed impressions shall be imaged for preservation.

## 12.0 TRACE EVIDENCE

Trace evidence analysis is, in part, based on Locard's Principle of Exchange where an individual or object leaves behind and/or picks up traces of materials from another person or an environment, however brief and slight the contact.

Types of trace evidence can include, but are not limited to, impressions from footwear and tires, soil, building materials, vomit, glass, physical matches, hairs, fibers (including fabric and cordage), paint, vehicle lamps, botanical, and general chemical unknowns.

### 12.1 GENERAL PRINCIPALS AND METHODS

The following general principals apply to identification, collection, and processing of trace evidence from the crime scene:

Trace evidence may be either visible or not visible to the naked eye. Some things to consider may be:

- There are a wide variety of methods available for collecting trace evidence which will be dependent on a number of variables including the nature of the crime scene, established priorities for evidence collection, evidence type, and substrate type
- Avoid using tools that are difficult to clean thoroughly and keep contamination-free such as serrated tools
- It is important to collect an adequate number of samples of many types of trace evidence to ensure the ability of the laboratory to account for variations in characteristics from one area or region of an object to another
- For items such as glass, carpet, paint, etc., take a control sample from an unaffected area to have for comparison, should it be necessary
- In labeling trace evidence, it is important to identify the region(s) of an object from which the trace evidence was obtained, provide a narrative identifying other trace evidence that may or may not be present in the same region, and utilize photography protocols that adequately describe the content and context of trace evidence

### 12.2 GENERAL DETECTION, COLLECTION AND PRESERVATION TECHNIQUES FOR TRACE EVIDENCE

Techniques and procedures for detecting, collecting, and preserving trace evidence at the crime scene will vary in each situation. Variables to consider include the nature of the crime scene, ambient conditions, the need to preserve or collect other types of evidence, and the discriminatory power of the different techniques.

Analyst's notes should include descriptors of the techniques used for collecting and preserving trace evidence.

Trace evidence can be detected using:

- General visual searches
- Searches enhanced by different types of illumination such as ALS and/or oblique lighting
- Visual searches enhanced by magnification
- It may not always be possible to see trace evidence and therefore it is advisable to collect an entire item, if possible, for examination in the laboratory

Below are the various types of methods that may be used to recover trace materials in the field. Not every method is appropriate for an item or a type of material. Please review the Trace Evidence Collection and Packaging chart to determine which methods would be best for a type of material or item of evidence.

- A. **Entire Object**: collection of the entire object is the easier and best way to preserve trace materials. This includes clothing and bedding as well as larger objects such as a baseball bat or a couch pillow.
- B. **Dismantled Object**: collection of a large part from an object by removal of screws or other fasteners. This method is good for transfer of materials that are unlikely to be lost by wind. Examples include the hood of a car, a vehicle bumper, a vehicle side mirror, interior door panel of a vehicle, and a residential door. YouTube has great videos on how to dismantle parts, especially vehicles.
- C. **Picking**: the trace material is picked up and placed directly into a paper packet, plastic bag, or other packaging. The materials may be picked up with a clean gloved hand (new glove that hasn't handled anything else) or a hand tool (e.g. clean forceps, spatula, hand shovel, pipettes, or other hand implements). Avoid using hand tools with serrated edges. Hand tools should be cleaned with a damp, new, kimwipe (solvent of choice, could be water, methanol, bleach, acetone).
- D. **Lifting**: An adhesive-bearing substrate is used to collect loosely adhering trace evidence. This is a method good for preserving trace that may become wind borne. There are subcategories of lifting:
- a. **Sticky Note** – the adhesive portion of a sticky note is gently touched to a small amount of material. The note is then folded over to protect the adherent trace. The folded note is then placed in a coin envelope.
  - b. **Tape lift** – a clear tape (such as Book Tape) is firmly patted or rolled onto the item (such as upholstery) and then placed onto a transparent sheet to protect the adherent trace. The sheets are then placed in a large envelope. Caution should be used not to overload the tape.
- E. **Cutting**: a portion of the item is removed by using a clean, sharp bladed tool. There are subcategories to cutting:
- a. **Manual** – a razor blade, scalpel, or scissors may be used to cut the substrate. Disposable single use implements (such as razor or scalpel blades) are preferred. Scissors or other implements that may be re-used need to be cleaned with a damp, new, kimwipe (solvent of choice, could be water, methanol, bleach, or acetone).
  - b. **Power** – use of a power tool to cut the substrate. The cutting blade portion of a power tool may be cleaned by running tape or a lint roller against the blade surface, using a damp, clean white cotton cloth (solvent of choice, could be water, methanol, bleach, or acetone), or a combination of these methods. When using a power tool, cut further away from the region(s) of interest. Consider placing a protective covering around the area of interest prior to cutting.

- **NOTES:** We do not recommend vacuuming, swabbing, or scraping for trace materials. Vacuuming is limited by the filter size, often causes breakage of materials and static issues, and collects large amounts of trace materials unrelated to the crime (below the surface layer). Swabbing generally loses or dilutes the material of interest. Scraping (e.g. a brush down) is not recommended for field use. This method requires a controlled laboratory setting.

**Preservation:**

- The item of evidence should not be packaged in a container made of the same material (such as glass packaged in glass or plastic packaged in plastic)
- Secondary packaging should be considered to preserve the evidence

Collection methods and special considerations for handling trace evidence are summarized in Table 2.

### **12.3 GLASS**

Glass evidence may be relevant to a number of different categories of analysis including:

- Identification of material as glass
- Physical matches of glass
- Comparison of questioned glass particles to known glass samples
- Point of impact determination
- Direction of impact determination
- Sequence of impact determination

#### **12.3.1 GENERAL PROCEDURES FOR GLASS**

- Adhesive material such as clean post-it notes can be used to collect glass samples
- Collect samples of all broken glass sources on the scene including samples from all panes of a multi-paned window
- All questioned items should be packaged separately from known broken glass sources
- With tempered glass, recover as many larger-size pieces as possible when point of impact, direction of impact, or sequence of impact analysis is required, since this type of analysis can only be done on tempered glass through reconstructing the broken pane
- Microscopic analysis of clothing and other items may reveal glass trace evidence that is not visible to the naked eye. In crime scenes where glass was broken and clothing recovered, clothing may be submitted even though glass particles are not readily visible

#### **12.3.2 GLASS FRACTURES**

Window glass is manufactured in different ways to provide various features with different levels of safety. Flat glass refers to normal window glass that is annealed and typically breaks with very sharp edges and pointed fragments. Tempered glass (sometimes called safety glass or toughened glass) has been manufactured in a way that makes the glass more resistant to breakage and, when broken, will break into small cubical fragments. Laminated glass is two layers of glass bonded

together with a thin plastic layer. The glass used in laminated windows can be annealed or tempered.

Based upon the type of glass that is broken, it may be possible that some determinations may be made as to the type of force that produced the break, where the breaking force was applied, the direction of force that broke the glass and the sequence in which multiple forces were applied.

#### 12.3.2.1 DETERMINATION OF BREAKING FORCES

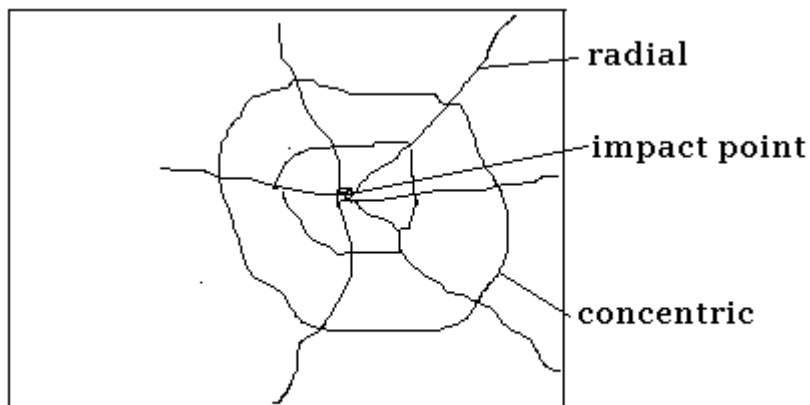
##### Thermal Fractures

Thermal fractures are characterized by the wavy appearance of the fractures that occur in window panes. Additionally, the fractured edge surface will typically appear as a mirror finish. These characteristics can readily distinguish fractures produced by the heat of a fire from those fractures produced by mechanical force. This type of analysis is performed in the laboratory from glass collected at the scene.

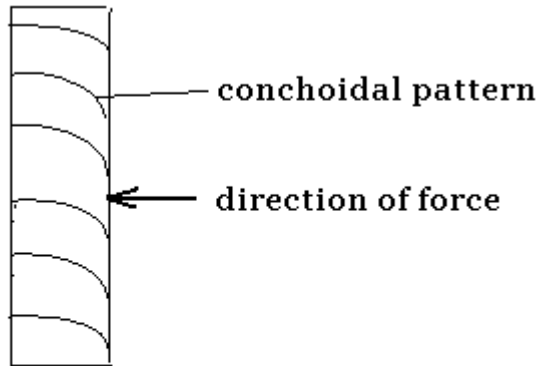
##### Mechanical Fractures

When an annealed glass windowpane is fractured by an applied force, characteristics are produced in the fractures that are indicative of the location and direction of the force that produced the break.

- Identify the two major types of fractures, radial and concentric first (see fig. 1)
- Examine the fractured face for the arcing conchoidal pattern and their orientation to the surface of the glass pane (see fig. 2)
  - The first fracture that occurs in a mechanical breakage is the radial fracture. It is this fracture that starts at the point of impact and radiates away from the impact point.
  - The fractured surface of this radial is what is examined for direction of force determination. This examination is performed in the laboratory from glass collected at the scene. The concentric fractures are typically the opposite in direction of force features although they can be misleading as the concentric fracture could occur while the pane is rebounding in the opposite direction.



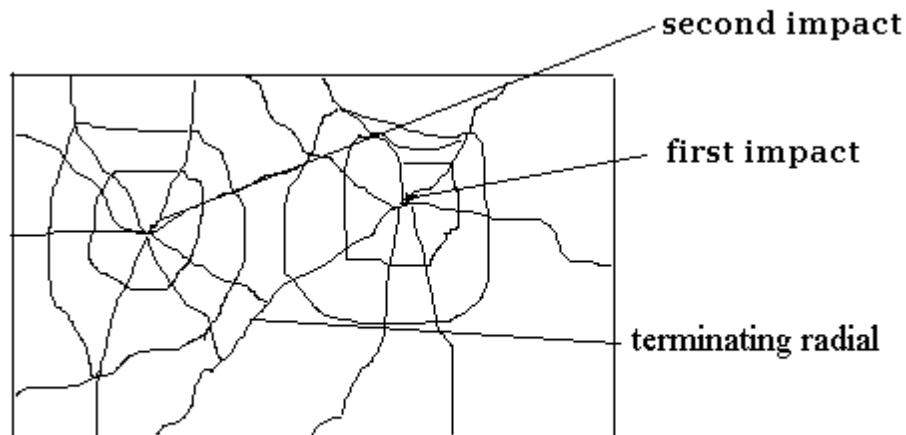
**fig. 1 impact fracture**



**fig. 2**

### **broken edge of a radial fracture**

- When multiple impacts occur to a pane, it may be possible to determine the sequence of impacts
- A fracture, radial or concentric, will not cross a previously existing fracture. If the radial of a second impact meets a previously existing fracture it will terminate at that point (see fig. 3)



**fig. 3**

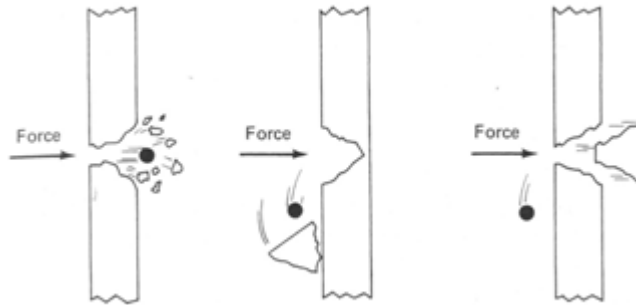
### **sequence of fractures**

- Impact fractures in tempered glass are often not possible to evaluate due to the numerous small glass cubic fragments produced.
- The point of impact may be determined by the general alignment of the fracture lines that tend to radiate from the impact point.
- If a second impact occurs in the same pane and does not cause complete failure of the pane, that second impact is marked by a significant loss of glass at the impact point.

#### **12.3.3 DIRECTION OF FORCE DETERMINATIONS**

Glass fractures when the limits of its elasticity are reached. The fractures propagate in a predictable manner and result in features that are reproducible under similar conditions. Examination of these features will allow the analyst to determine which side of the glass the force originated from.

Glass that is struck by a high-velocity projectile will produce a coning or cratering effect on the side of the glass opposite the force (the exit side).



The diagram depicts three events when glass is struck by a projectile:

- A perforating projectile that causes cratering on the exit side of the glass
- A projectile that does not perforate (one of a lower velocity) may cause broken glass to fracture on the side towards the force. Such low velocity projectiles, such as a thrown stone, may leave a crater on either side of the glass so these instances must be interpreted with caution
- A third possibility involves a projectile that causes the appearance of complete perforation of the glass and cratering on the exit side; however, the projectile itself does not penetrate and falls on the side where the force originated.



**Photograph of cratering on the exit side of the windshield.**

- Laminated glass, because it is two sheets of glass sandwiching a laminate material, may bulge and remain bulged in the direction of force. This may assist the analyst to determine direction of force.
- The laminate material may also protrude in the direction of the force.



#### 12.3.4 IMPACT LOCATION DETERMINATION

When a large hole is created in glass by a projectile, it may be possible to determine the impact location using the radial fractures. Strings may be aligned along radial fractures across the hole, attempting to locate corresponding fractures at ~180 degrees. The intersection of these strings will indicate the approximate impact location.

#### 12.3.5 INTERPRETATION

In tightly held glass window panes with the impact point close to the window frame and in small windows, the interpretation of direction of force is not possible due to artifacts induced by the frame holding the glass.

It is best to examine broken glass that is still held in the window frame. This will allow determination of the “inside” and “outside” of the window and eliminate the potential of secondary breaks produced on the ground. This will also allow for a ready determination of a radial fracture.

- Locate a radial fracture and its origin
- Examine the broken edge of the radial to determine direction of force
- Avoid examining a concentric fracture as the potential exists that such a fracture was made after the initial breaking impact
- Since fractures will not traverse an existing fracture, the sequence of multiple impacts can be determined by examining the location of terminating radials and from which impact the radial was produced

#### 12.4 **PHYSICAL MATCHES**

Physical matches involve reconstructing fractured material that was once part of a single unit back into a single unit by fitting the fractured items back together. A positive physical match is conclusive evidence that fractured materials were once a portion of a single unit. Physical and chemical analysis of materials may support a physical match, or may be conducted in cases where a physical match cannot be made. Physical matches can be made of numerous materials including glass, plastics, vehicle parts, paint, tapes, fabric and paper.

When collecting items for a physical match, protect the broken items from further damage by cushioning fragile items and packaging them in crush-proof containers. Cardboard “sandwiches” may be used with larger pieces of cardboard to protect the item from further breakage.

Do not attempt to conduct a physical match at the crime scene.

#### 12.5 **HAIRS AND FIBERS**

Hairs and fibers may be transferred when two objects come into contact with each other or into proximity with each other. Submission of questioned hairs and fibers as well as known hair and fiber samples to the laboratory allows for comparison of physical, chemical, and optical properties and a determination if there is a significant association.

The crime scene analyst will look for human hairs that might be suitable for DNA testing. Hairs can also be collected for investigative information including human versus animal and somatic origin.

Potential areas of deposit and/or sources of hairs and fibers that might be significant to the investigation, include, but are not limited to the following:

- Victim and/or suspect clothing, personal effects, and the person

- Carpeting and floors
- Furniture
- Vehicle upholstery, floor mats, and seats
- Points of entry and exit from the crime scene

#### 12.5.1 GENERAL PROCEDURES FOR HAIR AND FIBERS

- Hairs and fibers may or may not be visible to the naked eye
- Generally hairs and fibers are collected with clean forceps or gloved fingers
- Products with low-tack adhesives (such as clean post-it notes or footwear impression lifts) may be used for hair and fiber collection
- Tape lifts can be performed on large areas such as vehicle seats
- Collect clothing items and linens when they may contain significant trace evidence of hairs or fibers and package separately for submission

#### 12.6 **GENERAL PROCEDURES FOR LIGATURES AND TAPE EVIDENCE**

The analyst may have to cut the rope, twine or cordage when collecting it from the scene. Prior to cutting, tape should be adhered to the section that is to be cut to prevent the rope, twine, or cordage from unravelling. The newly cut ends should be labeled so the item can be reassembled as it was found. Leave existing knots undisturbed, and package appropriately.

Tapes may be found at a variety of crime scenes, such as wrapped around improvised explosive devices (IEDs), used to bind victims, or on threatening letters or envelopes. Based on the types of cases in which they are involved, tape pieces and tape rolls are generally easy to find. The examination of tape can provide investigative leads, corroborate statements or events, and associate scenes or a person to a scene.

##### **Collection of tape evidence:**

- When possible, submit tape still adhering to the substrate to minimize loss of trace evidence, latent fingerprints, or contact impressions.
- If unable to submit substrate, do not distort or tear the tape during removal.
- If the tape is cut during removal, mark cut ends accordingly.

##### **Packaging of tape evidence:**

Pieces: Individual pieces should be placed on clear transparency film. An alternative is the fire debris plastic bags.

- Do NOT place pieces of tape on paper because the paper is hard to remove from the adhesive.
- Do NOT place pieces of tape on plastic document protectors because they contain chemicals that interfere with analysis of the adhesives.
- Do NOT fold the tape onto itself.

Rolls: Tape rolls can be placed in a cardboard box or paper bag.

Wrappings or Bindings: Place in a plastic fire debris bag. Do NOT wash if at all possible.

## 12.7 PAINT EVIDENCE

Painted surfaces encountered at a crime scene might range from vehicle paint to building paint, tools, and painted artifacts. Painted surfaces may be repainted over time and paint evidence may reveal characteristic history of layers of paints.

In certain cases, where the paint is suitable, paint trace evidence can be searched against the Paint Data Query database and vehicular information provided as to the possible make, model, and year range of the vehicle from which the questioned paint was transferred.

### 12.7.1 GENERAL PROCEDURES FOR PAINT EVIDENCE

- If possible, an item containing suspected paint evidence should be collected in its entirety, or a representative sample containing that suspected paint evidence should be cut out and collected
- Paint evidence may be visible or invisible to the naked eye. A magnifying glass may be needed to detect small paint transfers, such as paint on a tool or weapon
- Use a clean scalpel, razor blade, or cutting instrument to collect paint samples from surfaces. Do not use tape when collecting paint. Avoid, if possible, scraping which may contaminate or lose evidence
- Collect all layers of paint down to the substrate. Cutting a representative sample of the material ensures all layers of paint have been collected
- Paint smears are typically fragile and, when practical, the object containing the smear should be collected as evidence
- When collecting an item with paint transfer, protect the area with suspected transfer by wrapping the area in paper prior to packaging, if appropriate
- Adjacent automotive panels or adjacent areas of a building (i.e. doors and door jambs) may commonly be painted differently. It is important to collect paint samples from as close to the area of interest or damage as possible and be alert for variations in paint, even on the same surface
- Always collect a control sample near the area of interest or damage ensuring the original area isn't affected and the control area is marked appropriately to distinguish it from the damaged area

## 12.8 VEHICLE LAMPS

Properly collecting and submitting lamps from vehicles involved in a collision or hit and run requires specific procedures. Note: there is currently no known procedure for the analysis of LED lights by the WSP.

It is important to collect all vehicle lamps that may have bearing on a case. This includes the lamps in the area of the vehicle that was damaged by impact. Consider the necessity of submitting headlamps, parking lamps, front side marker lamps, tail lamps, rear side marker lamps and the backup and license plate lamps as appropriate to the circumstances.

Remove the entire headlamp or taillight assembly, if possible. Package smaller lamps and exposed filaments by nesting the base in a protective enclosure to cover fragile filaments or portions of broken lamp filaments.

Undamaged lamps may help the laboratory analyst in the comparison process. Notes should include the area of a vehicle from which lamp(s) were removed, whether the lamps are from driver's or passenger's side of the vehicle, the position in the assembly housing by denoting what side was up or down, as well as the make, model, and year of the vehicle.

Note whether the switch that controls a particular lamp was in the on or off position.

Alert the requesting agency to hand-deliver vehicle lamps to the laboratory for further analysis.

## 12.9 EXPLOSIVES AND EXPLOSIVE MATERIALS

Crime scene analyst(s) may encounter a diversity of devices and containers of chemical or materials associated with the manufacture of explosive material. If, at any time, a crime scene analyst feels that they have encountered explosive material within a crime scene they are to contact the appropriate agency such as the Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) or local law enforcement explosive unit to collect and render safe any suspected explosive device or material prior to proceeding with the processing of the crime scene.

## 12.10 GENERAL CHEMICAL MATERIALS

Crime scene analysts may encounter a wide variety of chemical materials of known or unknown substances. Focus will be on collecting trace evidence useful for identification of specific chemicals or chemical types and for comparison of questioned materials to known sources.

General chemical materials may be toxic, poisonous, or caustic and may be dangerous in a liquid, gas, or solid form. Assume that any unknown chemical material is hazardous and make personal safety the highest priority. Refer to SDS sheets for safety precautions with known chemicals and Section 2.0 Precautions and Safety, of this manual.

Any hazardous or unknown chemical that has the potential for becoming hazardous and needs to be collected at a crime scene should be done by someone that specializes in hazardous materials such as a Hazmat Team.

#### 12.10.1 GENERAL PROCEDURES FOR CHEMICAL MATERIALS

- Treat any unknown chemical as hazardous and handle with extreme care using appropriate PPE. Identify potentially hazardous materials on the outer packaging
- Provide as much information as possible about the questioned sample including location the substance was found, the condition of the substance as found, properties of the substance (i.e. odor, color, irritant, greasy/oily texture, sticky, etc.)
- Document the nature of any injuries resulting from exposure of the victim to the chemical(s) and any known information about pathways of exposure
- Document the method of application of the chemical if known (i.e. brushed, poured, or sprayed)
- Document container labeling before sampling
- Package non-liquid, potential volatiles and inhalants into leak-proof vapor-tight containers as soon as possible (e.g. metal cans or vapor-tight/"fire debris" bags no more than 2/3 full) – Freezer storage recommended
- Large containers of liquids (e.g. household products, gasoline, charcoal starter, etc.) should be sampled if lab analysis may be desired
- If sampling is necessary, pour or pipette (~5 to 10 mL\_ into a secured glass container with a Teflon lid; be careful not to disrupt the cap or lid of the original packaging to preserve potential DNA evidence. These glass containers should then be packaged in leak-proof air-tight, metal cans with padding to avoid glass breakage
- Avoid metal containers for liquids and be aware that some plastic containers may be dissolved by certain chemicals. Glass containers should be used
- Use extreme caution when handling acids or bases and ensure they are packaged in glass containers with Teflon lids
- Seals for containers holding liquids should be checked on scene prior to packaging to ensure the container does not leak during transport or storage
- Place inhalants into airtight containers as soon as possible
- Avoid collection of trace chemical evidence with swabs
- Collect unknown materials with a plastic or wood spatula and package into glass vials/containers

The following tables exhibit general guidelines for the collection and handling of trace evidence

Item/Material	Collection Methods (In Order of Preference)	Packaging	Additional Notes
Botanicals	1. Picking	Package in a paper packet inside a coin envelope (taped shut) or a larger paper envelope with paper padding. Insert a piece of cardboard to keep the envelope flat. If the material does not fit inside an envelope, place in a pasteboard box (taped shut) and seal inside a paper bag.	Botanicals need to dry out.
Fibers – Embedded in Plastic or Paint	1. Intact Object 2. Dismantled Object 3. Cutting – Manual	Place object or dismantled object in paper. Support with a rigid container if needed.  If cutting, use scalpel or razor blade to cut around a region of interest. Place cuttings inside a white paper packet, inside a coin envelope (taped shut), sealed inside a larger paper envelope.	Painted or plastic objects that appear to have “abrasions” are good sources for fibers.
Fibers – Loose	1. Lifting – Sticky Note 2. Lifting – Tape Lift	Fold sticky note over to protect the fibers, place inside a labeled coin envelope (taped shut), sealed inside a larger paper envelope.  Place tape onto laser transparency film. Label film and seal inside a larger paper envelope.	
Fibers – On Clothing	1. Intact Object	Place inside a paper bag (sealed).	
Fibers – On Rope	1. Intact Object 2. Dismantled Object 3. Cutting – Manual	Place rope inside a paper bag (sealed).	If the rope must be cut, then choose an area away from any knots, if possible. Wrap this area of the rope with tape. Cut through the tape and mark the tape with the initials of who cut it and the date. If multiple cuts are made, mark each cut (on both sides) with the number of the cut such that the pieces can be placed back together in the proper order.

Item/Material	Collection Methods (In Order of Preference)	Packaging	Additional Notes
Fibers – Tuft	<ol style="list-style-type: none"> <li>1. Lifting – Sticky Note</li> <li>2. Lifting – Tape Lift</li> </ol>	<p>Fold sticky note over to protect tuft, place inside a labeled coin envelope (taped shut), sealed inside a larger paper envelope.</p> <p>Place tape onto laser transparency film. Label film and seal inside a larger paper envelope.</p>	
General Chemical Analysis – Bank Dye	<ol style="list-style-type: none"> <li>1. Intact Object</li> <li>2. Dismantled Object</li> <li>3. Cutting – Manual</li> </ol>	<p>Wrap clothing or items suspected of containing transfer bank dye in paper, separating clothing layers, and seal inside a paper bag.</p> <p>Place expended dye pack in antistatic plastic bag inside a rigid container.</p>	<p>Textiles include upholstery, and carpeting.</p> <p>Do NOT collect unexpended dye packs - they are incendiary devices.</p>
General Chemical Analysis – Liquid Substance	<ol style="list-style-type: none"> <li>1. “Picking”</li> </ol>	<p>Remove liquid substance from original container using pipette (plastic or glass). Pipette 1-5 mL of liquid into a glass vial with a Teflon-lined screw top cap. Place the glass vial inside a plastic zip-locked bag inside a metal can with absorbent material (preferably spill pads, if not available then kitty litter or paper towels).</p>	<p>The hand tool to be used for “picking” in this instance is a pipette (glass or plastic).</p> <p>Liquid substances of interest may be adulterated drinks or solvents.</p>
General Chemical Analysis – Unknown Solid Nonsticky Substance	<ol style="list-style-type: none"> <li>1. Picking</li> </ol>	<p>Collect 2 separate samples with stainless steel or plastic spatulas. Package each sample separately. Each sample should be placed inside a glass vial with a Teflon-lined screw top cap. Place the glass vial inside a plastic zip-locked bag inside a metal can with absorbent material (preferably spill pads, if not available then kitty litter or paper towels).</p>	<p>The hand tool to be used in this instance is a spatula. A cleaned stainless steel spatula is first choice. Second choice is to create a plastic spatula by making an angle cut to remove the bulb end of a polyethylene or polypropylene pipette.</p>
General Chemical Analysis – Unknown Solid Sticky Substance	<ol style="list-style-type: none"> <li>1. Picking</li> </ol>	<p>Collect 2 separate samples with plastic spatulas. Package each sample separately. Each sample should be placed inside a glass vial with a Teflon-lined screw top cap. (If the sample does not easily come off the spatula, then place the spatula inside the glass vial.) Place the glass vial inside a plastic zip-locked bag inside a metal can with absorbent material (preferably spill pads, if not available then kitty litter or paper towels).</p>	<p>A plastic spatula may be created by making an angle cut to remove the bulb end of a polyethylene or polypropylene pipette.</p> <p>If possible, collect and package a separate sample of the substrate (without the sticky material) for a reference.</p>

Item/Material	Collection Methods (In Order of Preference)	Packaging	Additional Notes
General Chemical Analysis – Volatiles	<ol style="list-style-type: none"> <li>Intact Object</li> <li>Cutting – Manual</li> <li>Swab</li> </ol>	<p>Clothing should be collected intact. A cutting may be taken of textiles (e.g. upholstery, carpeting) if unable to package the intact object.</p> <p>Package in a vapor-tight container (metal can or an approved and properly sealed fire debris bag).</p> <p>Packaging should not be more than 2/3 full.</p>	<p>Volatiles include pepper spray, bear spray, perfumes, or any other sample where the “odor” is coming from the chemical of interest. Reference samples of pepper or bear sprays are not needed for analysis.</p> <p>Do not reuse cutting tool without proper washing first</p>
General Criminalistics-Ignitable Liquids (volatiles on immovable objects)	<ol style="list-style-type: none"> <li>Cheap unscented, non-clumping kitty litter</li> <li>Gauze pads</li> </ol>	<p>A comparison of the absorbent material should also be collected and packaged separately.</p> <p>Package absorbent material in a vapor-tight container (metal can or an approved and properly sealed fire debris bag).</p>	<p>Kitty litter should be left on the surface for 1 hour.</p> <p>Gauze pads should be mopped across the surface.</p> <p>To properly seal a fire debris bag without a heat sealer, roll three times and seal with sturdy tape such as duct tape or packing tape.</p>
General Criminalistics – Bullet	<ol style="list-style-type: none"> <li>Intact Object</li> </ol>	Place in a box or suitable packaging material	Do not try to pry anything out of the nose. If the bullet is dug out of a substrate (i.e. drywall, wood, etc.), then collect a reference sample of the substrate separate from the bullet.
General Criminalistics – Carpeting	<p>Questioned Samples:</p> <ol style="list-style-type: none"> <li>Intact Object</li> <li>Dismantled Object</li> <li>Lifting – Tape Lift</li> </ol> <p>Known Samples:</p> <ol style="list-style-type: none"> <li>Intact Object</li> <li>Dismantled Object</li> <li>Cutting – Manual</li> </ol>	<p>Package carpeting in paper bags or wrap in paper and place in a box.</p> <p>Package transparency films with tape lifts in larger paper envelopes.</p>	The foreign fibers on the upholstery will be the questioned sample. The fibers that comprise the upholstery fabric will be the known sample. Collect the Questioned sample first (before the known sample) if the intact object is not possible.
General Criminalistics – Clothing	<ol style="list-style-type: none"> <li>Intact Object</li> </ol>	Package shoes separate from other clothing. Place inside a paper bag (sealed).	The foreign fibers on the clothing will be the questioned sample. The fibers that comprise the fabric will be the known sample.



Item/Material	Collection Methods (In Order of Preference)	Packaging	Additional Notes
General Criminalistics – Miscellaneous Object	<ol style="list-style-type: none"> <li>Intact Object</li> <li>Dismantled Object</li> <li>Cutting – Manual</li> </ol>	Place object inside a paper bag or wrap in paper and place inside a box.	
General Criminalistics – Rope	<ol style="list-style-type: none"> <li>Intact Object</li> <li>Dismantled Object</li> <li>Cutting – Manual</li> </ol>	Place rope inside a paper bag (sealed).	If the rope must be cut, then choose an area away from any knots, if possible. Wrap this area of the rope with tape. Cut through the tape and mark the tape with the initials of who cut it and the date. If multiple cuts are made, mark each cut (on both sides) with the number of the cut such that the pieces can be placed back together in the proper order.
General Criminalistics – Shoes	<ol style="list-style-type: none"> <li>Intact Object</li> </ol>	Package shoes separate from other clothing. Place inside a paper bag (sealed).	The soles of the shoes may have a wide variety of embedded trace materials. These materials should not be removed, especially if Impressions analysis is also desired.
General Criminalistics – Tools	<ol style="list-style-type: none"> <li>Intact Object</li> </ol>	Place inside paper then secure inside a sealed box or other rigid container.	Tools can have broken glass, paint from a transfer, paint from overspray, wood chips, and other trace materials.
General Criminalistics – Upholstery	<p>Questioned Samples:</p> <ol style="list-style-type: none"> <li>Intact Object</li> <li>Dismantled Object</li> <li>Lifting – Tape Lift</li> </ol> <p>Known Samples:</p> <ol style="list-style-type: none"> <li>Intact Object</li> <li>Dismantled Object</li> <li>Cutting – Manual</li> </ol>	<p>Package carpeting in paper bags or wrap in paper and place in a box.</p> <p>Package transparency films with tape lifts in larger paper envelopes.</p>	The foreign fibers on the upholstery will be the questioned sample. The fibers that comprise the upholstery fabric will be the known sample. Collect the Questioned sample first (before the known sample) if the intact object is not possible.

Item/Material	Collection Methods (In Order of Preference)	Packaging	Additional Notes
General Criminalistics – Vehicle Parts	<ol style="list-style-type: none"> <li>1. Dismantled Object</li> <li>2. Picking</li> </ol>	Package in a paper or antistatic plastic zip-locked bag.	<p>Vehicle parts are good sources of paint, plastics, and glass and may be used for physical matches or investigative leads.</p> <p>Remember that headlights and mirrors may be sources of glass.</p> <p>See Vehicle Lamps (separate document) if interested in determining if the lamp was on/off.</p>
Glass – Broken in Frame	<ol style="list-style-type: none"> <li>1. Intact Object</li> <li>2. Dismantled Object</li> <li>3. Picking</li> </ol>	<p>Tape over glass to keep still in frame where possible. The frame will often also have additional types of trace materials. Place inside paper inside a rigid container (typically a cardboard box).</p> <p>If can't collect intact or dismantled, then collect fragments. Place large fragments wrapped in paper (for cushioning) inside a rigid container such as a cardboard box or a metal can.</p> <p>Collect smaller fragments in a metal tin or a paper packet inside a pasteboard box (taped shut). Place tin or box inside a paper or plastic bag.</p>	<p>If interested in direction of force (e.g. low velocity - baseball bat or high velocity - bullet) on a window or door of non-tempered flat glass, collect all the glass from the broken frame – preferable still in the frame and taped to prevent falling out. Mark “inside” and “outside” faces of the pane. The glass on the ground on the “inside” and “outside” should be collected separately.</p> <p>If any fibers or hairs are observed on the glass, these should be collected with a sticky note prior to collecting the glass.</p>
Glass – Clothing	<ol style="list-style-type: none"> <li>1. Intact Object</li> </ol>	Place inside a paper bag (sealed).	
Glass – Loose Fragments	<ol style="list-style-type: none"> <li>1. Picking</li> <li>2. Lifting</li> </ol>	<p>Place large fragments wrapped in paper (for cushioning) inside a rigid container such as a cardboard box or a metal can.</p> <p>Collect smaller fragments in a metal tin or a paper packet inside a pasteboard box (taped shut). Place tin or box inside a paper or plastic bag.</p> <p>Very small fragments may be picked up with sticky notes. Fold sticky note over to protect fragments, place inside a labeled coin envelope (taped shut), sealed inside a larger paper envelope.</p>	If the fragments are too small to collect by picking, then they might be too small for comparison. Such small glass fragments may still be suitable to identify the type of glass.

Item/Material	Collection Methods (In Order of Preference)	Packaging	Additional Notes
Glass – Soles of Shoes	1. Intact Object	Place shoes inside a sealed paper bag.	Do not package with other clothing items.
Hairs- Clump	1. Picking	Use a gloved hand or a tool to pick up a clump of hair and place inside a coin envelope or small paper bag. Seal inside a larger outer paper packaging.	Clumps of hair are typically either a large dust bunny, which will include large amounts of other types of trace materials, or a large quantity of hairs removed from the same person and therefore likely to have forcibly removed root morphology.
Hairs – Loose	1. Lifting – Sticky Note 2. Picking	Fold sticky note over to protect the hairs, place inside a labeled coin envelope (taped shut), sealed inside a larger paper envelope.  Place hair in paper packet inside a coin envelope (taped shut) sealed inside a larger paper envelope.	Long hairs are difficult to remove from tape lifts. Please use sticky notes instead of tape lifts.
Hairs – On Clothing	1. Intact Object	Place inside a paper bag (sealed).	
Hairs- Tuft	1. Lifting – Sticky Note 2. Picking 3. Lifting – Tape Lift	Fold sticky note over to protect tuft, place inside a labeled coin envelope (taped shut), sealed inside a larger paper envelope.  Place tape onto laser transparency film. Label film and seal inside a larger paper envelope.	Long hairs are difficult to remove from tape lifts. Please use sticky notes or picking if long hairs are present.
Paint- Loose Chips	1. Picking	Place inside a white paper packet, inside a coin envelope (taped shut), inside a large paper envelope (sealed).	If paint chips are found on the ground, you can use a spatula to collect multiple paint chips. Additional debris collected along with the loose paint chips will not be a problem.
Paint- On Clothing	1. Intact Object	Place inside a paper bag (sealed).	

Item/Material	Collection Methods (In Order of Preference)	Packaging	Additional Notes
Paint – On Tools	1. Intact Object	Place inside paper then secure inside a sealed box or other rigid container.	Paint on a tool may come from the crime scene. It may also be used to associate the tool with a suspect's house due to "overspray" or "drips" related to other tools or materials at the suspect's house.
Paint – On a Vehicle	1. Intact Object 2. Dismantled Object 3. Cutting – Power 4. Cutting – Manual	Intact Object – place inside paper bags or paper sealed inside a large box (e.g. skateboards, bikes).  Dismantled Object – place inside a paper bag or paper sealed inside a large box (e.g. bike parts, side mirror). Alternatively, seal the region of interest with paper and evidence tape.  Power Cutting – place inside a paper bag sealed inside a box.  Manual Cutting - Place inside a white paper packet, inside a coin envelope (taped shut), inside a large paper envelope (sealed).	Typical Samples (one item may have two samples) <ul style="list-style-type: none"> <li>Questioned – scene chips, foreign paint on Victim's vehicle, clothing</li> <li>Known 1 – Suspect's Vehicle, suspected panel(s) and/or part(s)</li> <li>Known 2 – Victim's Vehicle (near Questioned sample)</li> </ul> Paint varies from car part to car part, be sure to sample enough areas on suspect vehicle to cover potential region that the paint could have originated from.  Peeling paint on suspect vehicle may lead to physical match to questioned paint chips.
Tape- Ligature	1. Dismantled Object	Mark any cuts made in order to remove from victim. Place laser transparency film (not report covers) on any loose adhesive faces and then place in a paper bag.	The ends of wrappings are excellent candidates for physical match to the end of a tape roll.  Tape is generally of interest for DNA, Latent Prints, and Trace.
Tape- Rolls	1. Intact Object	Place inside a paper bag. If the sides of the roll are sticky, place transparency film (not report coves) on the sides and then place in a paper bag.	The end of the tape roll may be used for physical match. The sides of the roll may have other trace materials of interest.  Tape is generally of interest for DNA, Latent Prints, and Trace.

Item/Material	Collection Methods (In Order of Preference)	Packaging	Additional Notes
Tape – Small Pieces	<ol style="list-style-type: none"> <li>Intact Object</li> <li>Dismantled Object</li> <li>Picking</li> </ol>	Individual pieces of tape are typically adherent to some object. It would be best to leave intact on the object and package the object or a dismantled portion of the object. If not, remove with a metal tool and place on a laser transparency film (cellulose acetate). Label the film and place it inside a paper envelope.	<p>Do NOT use report covers for tape or adhesives. Report covers have a chemical that may found in some adhesives. The direct contact of the adhesive surface on the report cover can result in extraction of that chemical into the adhesive.</p> <p>Tape is generally of interest for DNA, Latent Prints, and Trace.</p>
Tape – Wads	<ol style="list-style-type: none"> <li>Intact Object</li> </ol>	Don't wad tape, leave it on the object if at all possible. If someone else has already wadded the tape, then place transparency film over the most exposed adhesive areas and place in a large paper bag.	Tape is generally of interest for DNA, Latent Prints, and Trace.
Tape – Wrappings	<ol style="list-style-type: none"> <li>Intact Object</li> </ol>	Tape used to wrap an object as part of crime should be left on the object (e.g. tape on bed sheets, plastic bags, tarps). Package the object in paper. If extensive areas are present with the adhesive face exposed (such that it would stick to the paper bag), then place transparency film on those faces.	<p>The ends of wrappings are excellent candidates for physical match to the end of a tape roll.</p> <p>Tape is generally of interest for DNA, Latent Prints, and Trace.</p>

## 13.0 RECOVERY AND PROCESSING OF HUMAN REMAINS

The crime scene analyst may be involved in locating, collecting, preserving and documenting evidence from bodies and human remains at a crime scene. Procedures for processing evidence from bodies and human remains will vary widely, depending on the nature of the crime scene and the evidence. The investigator may be required to coordinate efforts with medical personnel, the Medical Examiner/Coroner, a Forensic Anthropologist, the District Attorney and/or other agencies before or during body processing.

### 13.1 SEARCHING FOR HUMAN REMAINS

Cadaver dogs, search teams, and/or individuals trained in the use of underground/underwater detection equipment may be involved in searching for human remains depending on the circumstances. If cadaver dogs are to be used, it is preferable to use this method before the scent of too many human searchers obscures their effectiveness.

For scattered or buried remains, a specialist in buried body processing may assist in collecting evidence or a Forensic Anthropologist may be considered as a resource. Most law enforcement agencies do not have the resources for a large search and recovery effort, so coordination of resources among agencies is often necessary and appropriate. When remains from multiple bodies are involved, a numbering and unique identification system is required to identify a body part as originating from a particular victim if possible.

Visual cues may lead investigators to the site of a clandestine grave. Initially scan the landscape to discern common or baseline features of the topography and aid in the identification of irregularities. Irregularities in both the ground surface structure and the vegetation may provide clues.

In searching for clandestine graves, look for:

- Surface irregularities such as broken ground, fresh surface soil, or disruption of strata
- Inconsistencies with the environment such as tire tracks, garbage, animal burrows, clumps of hair or fiber, cigarette butts, etc.
- Broken vegetation or unnatural vegetation changes. This might include disruption of root balls, unusual plant locations, or staged appearance to natural vegetation. Withered vegetation may indicate recently transplanted vegetation
- Sunken soil, changes in soil density, and/or primary or secondary burial depressions
- A metal probe can be used to detect possible soil densities due to recent disturbance and potentially bring decaying odors to the surface to assist cadaver dogs and outline the burial trench.

### 13.2 PROCESSING OF HUMAN REMAINS AT THE CRIME SCENE

The following guidelines will vary depending on the nature of the crime scene. In general, these principles apply for dead body processing at the crime scene:

- Take all appropriate cautions for biohazards and utilize all appropriate PPE
- Take overall, evidence establishing, and close up photographs before and during the processing of remains at the crime scene
- Photographs and notes will document the position and location of the body/remains at the scene. 3D scanners, Unmanned Aerial Vehicles (UAV's), and Global Navigation Satellite Systems (GNSS) may be useful for documenting location.

- General measurements from two or more reference points at the scene can be used to locate the body's hands, feet, and head (assuming the body is intact). This can be useful for sketching the position of the victim in a diagram. If there are no useful reference points, stakes (preferably metal) can be pounded into the ground as reference points and their locations recorded using a GNSS (or other GPS system). All measurements can then be taken from these reference points.
- Do not move the body until it has been considered whether moving the body would destroy or contaminate evidence and only move the body in conjunction with the Medical Examiner or Coroner
- Evaluate the body/remains with the Coroner/Medical Examiner and should any evidence on the body be in jeopardy of being lost during transfer to the Coroner/ME's office, consult the Coroner/ME about recovering that evidence beforehand or otherwise preserving it
- Bindings and ligatures are not to be disturbed, unless they attach the body to the scene. Minimize the number of cuts necessary to release the body from the scene, and document these cuts. Label ends of ligatures or bindings that were cut by investigators

### 13.2.1 SKELETAL RECOVERY

Locating, recognizing, and recovering skeletal remains provides important forensic evidence in determining the identity of the individual. The crime scene analyst locating and recovering skeletal remains will use diligence to retrieve as many of the human bones as possible. This increases the probability of positive identification based on the anomalous features unique to the individual.

Consider consulting with a Forensic Anthropologist in the investigation of possible sites of skeletal recovery. Be aware of jurisdictional issues, and issues that may pertain to recovery of Native American skeletal remains or disturbance of burial sites of historical, cultural, or religious significance (see section 13.2.3 of this manual).

### 13.2.2 BURIAL CLASSIFICATION

#### **Surface scatter**

Surface scattered refers to remains that are left to decompose above ground. These types of scenes may be large in scope and may encompass a large amount of corresponding physical evidence. In addition, carnivorous scavengers may have relocated a large number of skeletal elements over a large area. General procedures to conduct a surface scatter site recovery are as follows:

- If scavengers appear to have disturbed the remains, be cognizant of where animals take food to feed (underneath trees, in burrows, where they can see danger approaching, along game trails, etc.)
- Locate fixed points in the landscape to perform the appropriate measurement technique(s) when appropriate. 3D scanners, UAV's, and GNSS may be helpful in this documentation.
- Locate with flags or other identifying markers any unusual item found in the field, including clothing, bones, garbage, debris, etc.
- Determine which items previously flagged are of evidentiary value
- Place number or letter placards next to each item of forensic value, photograph, and diagram its general location when applicable
- Note the quantity of skeletal remains
- Identify what skeletal elements have been found when possible

- Identify what skeletal elements are still missing when possible
- Perform an additional search of the area, or expand the search area to recover as many elements as possible
- Collect additional items of evidence and package accordingly
- Collect and release all human remains to the Coroners/Medical Examiner's Office or to the investigating agency with permission from the Coroners/Medical Examiner's Office
- Collect and release all other items of evidence to the investigating agency

### **Interred Remains**

General procedures to conduct a burial site excavation are as follows:

- Remove excess leaf litter and vegetation from the grave surface
- Examine the leaf litter and vegetation for trace evidence (hair, clothing, jewelry) in a location away from the burial site
- Stake out a work area around the burial area for diagramming and measuring purposes
- Locate fixed points in the landscape to perform the appropriate measurement technique(s). 3D scanners, UAV's, and GNSS may be helpful in this documentation.
- Consider using a metal detector to look for any metallic objects that may be in the immediate vicinity of the burial site
- Work horizontally:
  - Sift the soil layer by layer
  - Orient the shovel blade so that the ground is scraped away horizontally
  - Document all changes in soil density, color or texture
  - Stop and document as each item of evidence is discovered
  - Stop when the skeletal remains are first discovered
  - Remove enough dirt to determine the orientation of the body
  - Remove as much soil around the skeletal elements without disturbing their position and document
  - Disinter the remains and all associated evidence
  - Continue excavating after remains are recovered to look for evidence under the burial level

#### **13.2.3 NATIVE AMERICAN SKELETAL REMAINS DIVISION POLICY**

Special consideration is required if, during the processing of skeletal remains, it is suspected or becomes evident that the analyst is unearthing Native American remains. The following protocol will be followed:

Notify the lead investigator of your suspicions that the skeletal remains may be Native American.

1. Advise that the recovery process should stop and notifications per [RCW 68.50.645](#) shall be made.
2. Document in the case notes
3. Notify the CSRT Manager.



## 14.0 ENTOMOLOGY EVIDENCE

With the proper collection of entomological evidence, a forensic entomologist may be able calculate the time of infestation (which could in turn lead to a time of death estimate), whether or not a body has been moved, and other forensically significant information. In addition to the insect evidence, the entomologist also requires thorough documentation of the scene itself including temperature documentation. The time required for insects to undergo their life cycle development is determined largely by the temperature and relative humidity associated with those species present in a particular environment. The entomologist can only work with the information provided. It is crucial that the investigating personnel learn and follow the steps outlined here and as recommended by the entomologist.

### 14.1 SUGGESTED EQUIPMENT

- Aerial and/or sweep insect net
- Kill jar (a jar with an absorbent material in the bottom such as Plaster of Paris or cotton)
- Collecting vials
- Plastic forceps (tweezers)
- Plastic containers
- Paper to use as labels for the collection containers
- Pencil (ink will run on labels submerged in liquids)
- Scissors for cutting paper labels to size
- Apple corer or trowel for soil sampling
- Plastic zip-style bags
- Thermometers, electronic and/or mercury
- 95% Ethyl alcohol
- Ethyl Acetate (nail polish remover)
- Styrofoam coolers
- Shipping containers
- Wet liver cat food or beef liver

### 14.2 PREPARATION

As important as the collection of specimens at the scene, documentation is a critical element of the interpretation process. An analyst should note observations and photograph the scene and insects present. Before proceeding with collection, all materials needed should be prepared and ready.

### 14.3 DOCUMENTATION

The notes taken at a scene with insect evidence should be provided to the entomologist who will be analyzing the insect evidence to give them as much information as possible since they are not able to be present at the scene. Before beginning collection, the analyst should record in their notes the following

- Site description
  - Rural, urban, aquatic, etc.

- Description of the types of plants, buildings or whatever else is in the microenvironment
- Current weather conditions and temperature; sunny, overcast, rainy, etc.
- Status of the body
  - Position of body
  - Clothed or nude
  - On the surface of the ground or buried
  - In an enclosure or out in the open. If in an enclosure, describe the enclosure
  - Apparent injuries to the body
  - State of decomposition; fresh, bloat, decay, skeletal, etc.
  - In the sun or shade at the time of examination. Would these conditions be different at different times of the day
- General observations about insects
  - Approximate number of flying and crawling insects that are immediately visible
  - General locations of major insect activity (note: forensically significant insects typically lay their eggs in natural body openings and open wounds)
  - Is there insect activity within 10 – 20 feet of the body; describe/photograph flying, resting or crawling insects present
- Note any unusual naturally occurring, manmade, or scavenger-caused phenomenon, which could alter the environmental effects on the body, example: mutilation of the body, burning, covering or enclosing of the body, burial, movement, or dismemberment

#### 14.4 COLLECTION OF SPECIMENS BEFORE BODY REMOVAL

To prepare for collection of insects, have a sweep net ready, “charge” the kill jar by pouring ethyl acetate into the absorbent material; pour 95% ethyl alcohol into glass vials or jars. Labels that accompany the live and preserved specimens should look like the following and be cut to the size of the container.

Date
Case #
Sample number
Brief description of sample and location on or around the body (ex. Maggots from right eye socket)
Collector

- Approach body slowly to avoid disturbing the flies
- Carefully lower sweep net over area with greatest concentration of flies. As flies move to the closed end of the net, sweep quickly and flip net to create a fold preventing escape of flies
- Carefully transfer insects from the net into the kill jar and secure the lid (insects by nature move up so by putting the jar upside down over the trapped end of the net and then inverting the net into the jar will decrease the likelihood of insects escaping)

- a) Wait several minutes until flies have stopped moving before transferring dead insects into a vial with 95% ethyl alcohol
- b) Add a label, in pencil, to the sample
- Wait several minutes for flying insects to return and continue sweeping and collecting in the same manner until a representative sample of all flying insects present has been collected
- Collect ~30 maggots, if possible and place into vial of 95% ETOH. If there are several sizes of maggots, all sizes should be included in the sample, collecting ~30 of each size, if possible. Include a complete label with the vial. Repeat with all maggot masses, collecting representatives from each mass into separate vials
- Collect a “companion sample” of the maggots from the same area the preserved maggots were collected from. Do this by collecting representative maggots into a plastic food container along with soil (or substrate) surrounding the remains. Add some liver cat food or beef liver. Place damp paper towels on top of and around the liver. Pack firmly but not too tightly. Do not put holes in the container. Include a label with the live specimens and in addition to the standard information that goes on this label, include the sample number of the corresponding preserved maggots
- If the maggot masses have converged, collect live and preserved maggots from the head, torso and genitals
- Collect, by hand, any non-flying insects noticed on the surface of the body and indicate the area of the body they were collected from. Put these insects in 95% ETOH. It is okay to mix different kinds of insects in the same vial if from the same part of the body if they are in ETOH. Note: some insects present on a body may actually be predators of those feeding on the body so avoid mixing different types of live insects in the same container

#### 14.5 COLLECTION OF SPECIMENS AFTER BODY REMOVAL

Soil listed below are for entomological purposes only. If soil analysis is required additional specimens shall be collected separately. In instances where bodies are outdoors and heavily infested, many insect adults, larvae and pupae as well as other arthropods will remain on the ground after the body is removed.

- A number of specimens should be collected and preserved, while a second sample should be collected alive for rearing
- Collect litter samples (leaves, grass, bark, etc.) or any material on the ground surface close to or under the corpse
- Look for larvae moving away from the body approximately 3 feet in all directions. Collection of these maggots includes preserved and live. Include the distance and compass direction from the body. If the remains are on a hard surface you may need to look farther than 3 feet.
- Look for and collect puparia out 3 feet from the body (open and closed) but **do not** preserve them. If none are found, make a note of the distance you looked. If the body is outdoors and on an artificial surface like cement, begin an additional 3 foot search at the nearest protected spot (grass, under rocks or debris). Place them live for rearing without liver, but with a paper towel packing over them to protect them from damage during shipment.
- Soil samples from areas associated with the different body regions (head, torso, extremities) should be collected (approximately 4 inch cube in volume). About six samples total from under, adjacent to, and up to 3 ft. from the body, noting the origin of each sample in reference to the position of the body and recorded in the same manner as the insect vials. Save in ziplock bags with a label including the location and depth.

- With older (advanced decomposition, dried or skeletal) remains when the entire skeleton is present, collect soil samples (approximately 4 inch cube in volume) and indicate the compass direction and distance from skeleton. Collection should be ~18 soil samples
  - Samples 1 – 6 will be at body contact from head clockwise
  - Samples 7 – 12 are three feet from the edge of the body beginning at the head-end and moving clockwise
  - Samples 13 – 18 are at six feet from the edge of body beginning with the head-end and moving clockwise
  - If only a portion of the body or skeleton is present, note this and modify collection of soil samples to include collection at the same distances as above but not necessarily the same number of samples if there aren't a large number of remains present (i.e. only the skull)
- If an obstruction exists in the area where a sample should be taken from, note this and continue collecting remaining soil samples

**IMPORTANT:** If the victim is transported to the morgue prior to an analyst collecting the larvae, follow the above procedures as closely as possible at the scene and at the morgue. Soil sample collection in the location of where the body had been removed from will be critical at this step. Follow the procedure for collecting soil samples above.

The analyst should attempt to find out the temperature of the cooler the body was kept in along with how long the victim has been in the cooler. Also, the temperature of the maggot mass should be recorded when the body is removed from the cooler. Although missing the collection at the scene will diminish the value of the entomological evidence, later examination of the larvae could still yield valuable information.

#### 14.6 SHIPMENT OF LIVE SPECIMENS

It is important that the entomologist have entomological evidence shipped to them immediately so the larvae can be reared. Once it is known that the analyst will be investigating a scene with insect evidence, a call should be put in to the entomologist to pre-arrange shipment methods.

All live and preserved specimens should be packed in a Styrofoam cooler and hand delivered, or placed in a shipping box and shipped via next day service (or same day, if possible) to the entomologist. This will be coordinated through the requesting agency and the insect evidence will be turned over to them prior to shipping.

#### 14.7 PACKAGING OF BURNT REMAINS

Special care is required when collecting and packaging burnt remains due to the fragile and brittle nature of the material. Packaging multiple burnt bones together can result in significant and mixing of the remains

When collecting burnt remains, individual bones should be wrapped (paper towels, toilet paper etc.) for stability and packaged separately in a ridged container such as box.

#### 14.8 COLLECTING CLIMATE DATA

It is important to have accurate climate data from the scene when estimating PMI from entomological evidence. The time required for insects to undergo their life cycle development is determined largely by the temperature and solar radiation influence associated with those species present in a particular environment.

- Ambient air temperature readings should be taken in close proximity to the remains at heights of 1 foot (30 cm) and 4 feet (1.3 meters)
- Measure the ground temperature by placing a thermometer directly on the top of the surface ground cover nearby.
- Measure the body and ground surface interface temperature by sliding a thermometer between the underside of the remains and the ground surface
- If a maggot mass is present measure the temperature by inserting a thermometer directly into the center of each mass.
- Measure the body temperature by placing a thermometer directly on the skin surface
- Soil temperatures should be taken immediately following the removal of the body in an area that was directly below the body using a digital probe thermometer that is inserted into the soil to a depth of approximately 2 inches. Also, take soil temperature readings at a second point 3 – 6 feet from the body at a depth of 4 inches. A large nail or screw driver can be used to create a hole to insert the thermometer (so you don't break the thermometer).
- If present, water temperature should be obtained by holding a digital thermometer 4 inches below the surface if possible

Always shade the thermometer from direct sunlight when taking all temperature readings. Direct sunlight will cause readings far in excess of the true environmental temperatures.

## 15.0 VEHICLE PROCESSING

The types of evidence that should be searched for in a vehicle will be dependent on the type of crime being investigated. It is important for the analyst to establish a specific and organized approach to processing a vehicle.

### 15.1 DOCUMENTATION

- Document the vehicle as it is upon arrival. Note make, model, color, license plate number, state of issue, Vehicle Identification Number (VIN), and any other information that may be appropriate
- In some cases, the specific location of the vehicle may be of important evidentiary value. In these cases, specific measurements to place the vehicle at the scene should be collected or the scene scanned
- Exterior/interior damage (if related)
- Any transient details regarding the condition of the vehicle should be noted when appropriate, for example:
  - Windows down/up
  - Exterior wet/dry/condensation
  - Odors present in the vehicle
  - Position of the gear shift
  - Tire conditions (including manufacturer, size, and DOT number)
  - Steering column intact/damaged
  - Ignition switch intact/damaged
  - Lights on/off
  - Mileage and trip meter reading

### 15.2 EVIDENCE OBSERVATION AND COLLECTION

After consultation with the agency as to what type of processing is necessary, evaluate the vehicle from the exterior in being mindful of processing-order (friction ridge impressions, DNA, trace, etc.) and environmental conditions.

- Divide the evaluation of a vehicle into sections to ensure all relevant areas of the vehicle are searched. This could include underneath the exterior of the vehicle, under the hood, inside the trunk, underneath the seats, along the sides of the seats, inside all compartments (glove box, interior door side map compartments, center console, ashtrays), and behind visors
- Exercise caution when searching underneath seats or in difficult to see areas. Avoid blindly reaching into areas to avoid being punctured by a contaminated needle or injured by a hidden weapon. A small mirror and a flashlight will allow the analyst to search these areas more carefully
- Follow the procedures described in this manual for the evaluation and collection of evidence in and around a vehicle

For vehicles involved in a collision, special consideration should be given towards airbags and abrasions within the vehicle

### 15.3 SQUARING OF VEHICLE (Optional if not scanning)

#### Shots into vehicles

Shots into vehicles can be problematic due to the many curved and irregular surfaces. The design features of vehicles can also make it difficult to locate useful reference points and measure from them.

#### Establishing an Internal Baseline for Vehicles

Vehicles often have a logo, inside rear view mirror, or a rear inside brake light that are engineered to be at the centerline of a vehicle. These engineered landmarks can be used as reference baselines to record the position(s) of bullet damage.

A string anchored between these engineered landmarks at the vehicle's front windshield and back window will allow the vehicle to be divided into a left and right side. This will allow measurements to be taken relative to this base line. An example would be a bullet impact was located five feet from the back windshield, two feet to the right of the center baseline and three feet up from the level of the floor.

#### Establishing an External Baseline (squaring) for Vehicles

To provide external reference lines around a vehicle, one must first find two relatively parallel positions along one of the sides of the vehicle. A fixed measure, for instance 3 inches out from the center of the hub of the front and back wheels, can be marked on the ground. Connecting these two points constitutes a straight baseline that represents the side of the car. Once these two points have been defined, a tape measure or string can be used to construct a straight line with these two points and allow for easy measurements from the front or back of the vehicle.

Next, hang a plumb from the center of the front or back of the vehicle and mark that position. Connect the plumb position to the side baselines by extending a line all the way across the front and/or back of the vehicle. Use of a carpenter's square or something similar may be helpful to ensure the lines intersect at 90 degrees. Two sides of a rectangle should be defined on the ground – one across the front and/or back and one along one of the sides. If needed, the other two sides of the vehicle can be referenced in the same manner described completing a reference line around the vehicle.

Once the baselines have been established, measurements of bullet defects on the exterior of the vehicle can be identified by measuring "x" inches back and "y" inches over, relative to the external baselines. The height relative to the floor/ground will also need to be recorded.

## 16.0 QUESTIONED DOCUMENTS

A questioned document is any material substance bearing visible or invisible marks or symbols, handwritten or printed, whose authenticity or origin is under scrutiny, and may appear on paper, walls, items of clothing, or on the human body.

### 16.1 TYPES OF QUESTIONED DOCUMENTS

Examples of questioned documents that may be collected by the crime scene analyst include, but are not limited to:

- Robbery/demand notes
- Threatening letters
- Suicide notes
- Checks
- Credit Card receipts
- Counterfeit documents
- Currency
- Torn and cut paper
- Altered and/or obliterated documents
- Photocopies
- Forged signatures
- Forged documents
- Blank notepads or documents

### 16.2 GENERAL HANDLING AND PACKAGING OF QUESTIONED DOCUMENTS

Some general principles and methods for forensic examination and analysis of questioned documents are:

- Questioned documents are often fragile evidence and need to be handled accordingly
- Questioned and known documents should be packaged separately
- Label evidence packaging prior to putting questioned documents in the package
- Indicate "Do not fold/bend" on the packaging
- Evidence containers should be large enough to hold document evidence without folding
- Never staple, fold, or bend questioned documents



**Table 3: Collection Methods and Special Considerations in Handling Questioned Documents Evidence**

ITEM	METHOD	SPECIAL CONSIDERATIONS
Indented Writing	Collect documents or notepads and place in a folder or sandwich between rigid cardboard to protect from additional indentations. Place in a pre-labeled evidence container	Indented writing should be processed before latent prints. Indented writing cannot be recovered from items processed for latent prints
Charred Documents	If the evidence is found in a fireplace or wood stove, close the damper before recovering the charred material. Slide a piece of heavy paper under the charred paper and carefully place on a cushion of tissue paper in a rigid box. Instruct the requesting agency to hand-carry to the laboratory as soon as possible	Be sure to mark the top of the box and indicate THIS SIDE UP. Package to prevent air currents from impacting the documents. Treat as exceptionally fragile and label as such
Water-soaked Documents	Package documents so the moisture content is maintained. Instruct the agency to hand-carry to the laboratory as soon as possible. Do not attempt to separate any of the layers at the crime scene	
Crumpled Documents	Do not try to straighten the documents. Simply package in a rigid container	
Typewriting, Typewriters, Printers, and Scanners	Submit the suspected typewriter, printer, or scanner along with any known standard samples of extra wheels or typing elements	Submit with ribbon(s) still on the machine.
Torn Documents	Do not attempt to piece back together. Carefully place all pieces in an envelope	Excessive handling may destroy important information. Physical matches may be possible
Matches and Other Torn Paper	Package the match book separately from any partially burned or unburned matches. Send to the laboratory for physical matches and possible latent print examination	Keep away from heat. Consider any torn item(s) to be fragile evidence
Paper (Stock) Products	Collect known and suspected samples. Package separately and submit for comparison analysis	Dimensions, weight, color texture, watermarks, composition and other characteristics may be significant for comparison
Graffiti	Cut out, remove the surface, or photograph the writing	Take photographs perpendicular to the writing with a scale and without the flash

## 17.0 SOIL, GEOLOGICAL, AND BOTANICAL MATERIALS

Soil consists of loose aggregates of rock, mineral, and botanical material. Due to its widespread occurrence and tendency to adhere to most materials, soil is commonly present on physical evidence. Botanicals evidence typically involves small, often incomplete fragments of leaves, woody and non-woody fibers, needles, grass, stems, thorns, weeds, flowers, tobacco, seeds, diatoms, pollen and spores which are found as associative evidence on or in clothing, vehicles and soil.

### 17.1 COLLECTION

- Examine clothing or other materials for stains, smears or clumps of soil. Soil may fall from clothing as it dries; therefore collect clothing as soon as possible. Do not remove the soil from clothing; it may contaminate the evidence.
- Lumps of soil with distinctive layers can be found in or on vehicles. Do not vacuum samples; this will result in a mixing of different soil.
- Examine the exterior and undercarriage of vehicles for areas of missing soil. The shape of such gaps can be compared to soil found at the scene for a physical match.
- Tools and weapons may have lodged soil adhering to them. Do not attempt to remove the soil, submit the entire tool or weapon. Tools with soil must be protected to avoid loss or contamination of the questioned soil. The area containing the soil should be covered and protected. Each tool should be packaged securely into an appropriate container (i.e., box)
- If botanicals are suspected to be on clothing or embedded in the soles of shoes, do not attempt to remove them at the scene. Handle the clothing/shoes carefully so that the fragments are not lost or transferred to other items. Wrap each article of clothing/shoes in clean paper and package them in separate paper bags. Do not vacuum botanicals; many are very brittle
- Large pieces of plant material caught under vehicles should be carefully removed and packaged into suitable containers i.e., cardboard boxes, paper envelopes

### 17.2 PACKAGING

- Each of the collected soil samples must be packaged separately in suitable containers such as lined paint cans and zip-sealed bags.
- Containers must be sealed to ensure that no leakage occurs
- If the soil is moist or wet upon collection, the assisted law enforcement agency should completely air dry the collected samples prior to final packaging. This should be done in a secure location and covered with a breathable material so as to prevent environmental contamination of the sample
- Soil clumps can be gently wrapped in tissue paper and placed into small cardboard boxes of a size that the clump will not freely move within the box
- Do not place moist botanicals in plastic or glass containers. If the botanical material is moist or wet upon collection, the assisted law enforcement agency should completely air dry the collected samples prior to final packaging

### 17.3 CONTROL/REFERENCE SAMPLES

- To collect a soil sample, use any suitable tool to scrape about 2 – 4 tablespoons of soil from a surface area of about 6 by 6 inches into a container. Wipe the tool clean between each sample collection or use a new tool for each sample.
- Do not scrape below a depth of ½ inch except when there is an indication that the questioned sample may have come from a deeper layer of soil
- When there is a footwear impression at the scene, collect a sample directly from it after all photographs are taken. If the impression is to be cast, collect soil adjacent to the cast.
- Where there are several footwear impressions over a distance, collect a sample from each different soil (using color as a guide in determining a change from one type of soil to another)
- Additional samples should be collected from any location where the suspect may have been, or claims to have been during the time of the crime
- Collect control samples from botanical sources observed along suspected paths leading to and from the crime scene
- Sample whole specimens if possible, including the root, leaves, seeds, etc.
- To collect vegetation along a path, obtain a clean fabric material such as a bath towel or blanket of similar size and drag it through the pathway along the ground. Small thorns, seeds, etc. will adhere to the fabric material. Package the fabric material in a suitable container such as a paper bag.
- Living specimens (i.e., leaves etc.) that are collected need to be either submitted as soon as possible to the crime laboratory, or placed between clean paper, such as newspaper, to dry prior to submission to the laboratory.

## 18.0 3D LASER SCANNING FOR CRIME SCENE DOCUMENTATION

3D laser scanning is a versatile and accurate 3-dimensional laser scanning technique which uses a high-speed laser and a built-in or external digital camera to measure and photograph objects at a scene. It can be used indoors and outdoors, in bright sunlight or total darkness, and adverse weather conditions. The crime scene data that is captured is preserved for later examination and reconstruction, and can be used to create extremely accurate 2-dimensional as well as 3-dimensional scene diagrams.

### 18.1 APPARATUS AND EQUIPMENT

Trimble X7 Scanners - operated by WSP CSRT personnel

Unmanned Aerial Vehicles (UAV) and Global Navigation Satellite Systems (GNSS) - controlled and operated by WSP CID personnel (see CID Division Procedure Manual)

Trimble Perspective, Trimble RealWorks, and Trimble Forensics Reveal software

Leica Geosystems Cyclone software

### 18.2 ADVANTAGES, LIMITATIONS, AND QUALITY ASSURANCE

The 3D laser scanner is an objective tool where everything in the field of view is assigned a unit of measure. A large quantity of measurements can be made in a relatively short time frame. The overall quality (accuracy and precision) of measurement is far better than that of manual methods of the past. The scanner is a line of sight device meaning that anything not in the direct line of the laser will not be captured. For this reason numerous scans may be required to capture the scene in its entirety.

The scanner is fully operational between bright sunlight and complete darkness; however, accompanying photographs require sufficient lighting. Should scanning in darkness be required the data may be collected without photographs but the final work product(s) may be limited. Adverse weather conditions may increase noise in a scan, or preclude the use of an imaging scanner altogether.

Trimble X7 Scanners have the following 3D point accuracy: 2.4 mm @ 10 m, 3.5 mm @ 20 m, 6.0 mm @ 40 m. These specifications are given as 1 sigma when the instrument is leveled within +/- 10 degrees.

Trimble X7 Scanner specifications are outlined on the X7 datasheet, located on the CSRT SharePoint.

The Trimble X7 scanner automatically checks the calibration prior to each scan and re-calibrates if needed to ensure the instrument is operating within specification in current environmental conditions (see the X7 datasheet for instrument specifications). If for any reason the calibration fails, a notification will appear and the scan will not start. A Field Calibration Report and a Diagnostic Report will be produced when the project for a scene is created. These reports will be retained as part of the case record.

Each Trimble X7 scanner comes with a Certificate of Compliance, located on the CSRT SharePoint.

### 18.3 3D LASER SCANNING DATA AND WORK PRODUCT

The 4-minute scan setting should be utilized for the majority of scene scans, although other scan settings can be utilized at the Forensic Scientists discretion. The 7-minute scan setting should be utilized when scanning trajectory rods (see Module 9.0, section 9.5).

The scene project, exported from the Trimble Capture software, containing the original scan data will be archived onto the secure Digital Imaging System (ADAMS) upon return to the laboratory (or as soon as practical) as part of the case record. A copy of the data can then be processed to produce deliverables at the discretion of the Forensic Scientist. These deliverables can include, but are not limited to, annotated Reveal scene diagrams, pointcloud snapshots, Trimble Scan Explorer Viewer files, and Trimble ShowCase files.

Deliverables that have not been annotated can be sent to the requesting agency at the scientists discretion, following a review by the scientist. Annotated deliverables included in the report and/or provided to the requesting agency will be technically reviewed prior to release. All deliverables will be archived onto ADAMS as part of the case record.

#### **Analyzing Trajectories in Leica Geosystems Cyclone Software (also see Module 10.0 Firearms Evidence, section 10.5)**

For scenes that require 3D scanning of trajectory rods, an .e57 file(s) of the registered scan data will be used to measure the trajectory angles in Cyclone. At the completion of trajectory analysis, the .imp Cyclone file (database) will be uploaded onto ADAMS as part of the case record. The angle measurements will be reviewed in the Cyclone database during Technical Review.

When reporting vertical and azimuth angles from trajectory rods fitted to bullet defects measured following the outlined 3D laser scanning methodology (see Module 9.0, section 9.5) an Expanded Uncertainty (k=2) of  $y \pm 2.6$  degrees will be reported for a level of confidence of approximately 95%, assuming a normal distribution.

Expanded Uncertainty can be represented visually in the scan data in Cyclone and/or Reveal diagrams by applying 2.6 degree cones to the virtual trajectory rods.

### 18.4 UAV AND GNSS WORK PRODUCT

The WSP CID will be utilized for scene documentation using their UAV's and/or GNSS systems at the request of the WSP CSRT or the requesting agency.

Deliverables provided by the WSP CID can be sent to the requesting agency at the forensic scientist's discretion, following a review by the scientist. If the deliverables are further edited and annotated by the forensic scientist, they will be technically reviewed prior to release. All UAV and GNSS work product and deliverables provided by CID, and deliverables edited/annotated by the forensic scientist, will be archived onto ADAMS as part of the case record.

The CSRT Manager is responsible for enacting a procedure for the actions that will be taken arising from evaluations, monitoring of performance and re-evaluations of scene responses and associated work product received in partnership with the CID. Any drawings received with missing information or inaccurate representations of the scene dimensions or layout will be returned to CID for correction. Records associated with these actions will be retained by the CSRT Manager.

## 19.0 OTHER FORENSIC TOOLS AND EQUIPMENT

All equipment will be transported to and from a crime scene in a designated CSRT response vehicle (or a WSP pool vehicle). All equipment will also be stored either in a designated CSRT response vehicle or at one of the WSP's Crime Laboratories or other secure facilities.

### 19.1 METAL DETECTOR

In addition to a visual exam, a metal detector may be employed to assist in the search for metallic items of evidence including, but not limited to: firearms, fired bullets, cartridge cases and live cartridges or ammunition components.

Refer to the product manual for operation of the metal detector being used.-Prior to a new metal detector being placed into service a performance verification will be completed.

Prior to use at a scene, the operator will test the unit by placing a known bullet on the ground and the metal detector must audibly sound a "beep" when passing over the bullet. This quality control check will be documented in the case notes.

If a metal detector becomes defective for any reason it will be immediately removed from service and marked as appropriate. The CSRT Manager will be notified and the manufacturer will be contacted if repairs require outside service. The metal detector will then be sent (if appropriate) for repairs as soon as practical. Once repaired and returned a performance check will be conducted to ensure the metal detector is working correctly.

### 19.2 ALTERNATE LIGHT SOURCE (ALS)

In addition to visual examinations and searches, an ALS may be employed to assist in the search for biological evidence. Fluorescence/absorption may indicate the presence of a biological fluid. However, further analysis (acid phosphatase test or phenolphthalein test) must be performed before the presence of a biological fluid is determined. The absence of a fluorescence/absorption result does not confirm the absence of a biological fluid.

Refer to the product manual for operation of the ALS being used. The ALS will be stored and transported in a hard protective case. Prior to a new ALS being placed into service, a performance verification will be completed.

Prior to use at a scene, the operator will test the ALS by illuminating a substrate with a known stain. Fluorescence in the expected area of the stain will ensure the ALS is functioning properly. This quality control check and the ALS serial number will be documented in the case notes.

If an ALS becomes defective for any reason it will be immediately removed from service and marked as appropriate. The CSRT Manager will be notified and the manufacturer will be contacted if repairs require outside service. The ALS will then be sent (if appropriate) for repairs as soon as practical. Once repaired and returned a performance check will be conducted to ensure the ALS is working correctly.

Any outside service/maintenance performed to an ALS must be recorded. This information will be stored on SharePoint.

### 19.3 INFRARED (IR) LIGHT

In addition to visual examinations and searches of bloodstains, an IR light may be employed to assist in the search of suspected bloodstains on dark surfaces. Bloodstains may absorb the IR light and will appear dark against the background if the background reflects the IR light. PHT testing will subsequently be performed on any suspected bloodstains.

Refer to the product manual for operation of the IR light being used. The IR light will be stored and transported in a hard protective case. Prior to a new IR light being placed into service a performance verification will be completed.

Prior to use at a scene, the operator will test the IR light by exposing a known bloodstain on an IR reflective surface to the IR light. Absorption of the IR light by the bloodstain will ensure the IR light is functioning properly. This quality control check and the IR light serial number will be documented in the case notes.

If an IR light becomes defective for any reason it will be immediately removed from service and marked as appropriate. The CSRT Manager will be notified and the manufacturer will be contacted if repairs require outside service. The IR light will then be sent (if appropriate) for repairs as soon as practical. Once repaired and returned a performance check will be conducted to ensure the IR light is working correctly.

Any outside service/maintenance performed to an IR light must be recorded. This information will be stored on SharePoint.

### 19.4 LASER DISTANCE DEVICE

A handheld laser distance measuring device may be used to capture measurements while on-scene. Measurements recorded by use of a handheld laser distance measuring device will be used only for the purpose of aiding in overall scene measurement, documentation, and sketching, and will be considered as approximations. No measurements recorded with a handheld laser measurement device will be reported as quantitative measurements.

Refer to the product manual for operation, maintenance and care of the laser measurement device.

Prior to use at a scene, the operator will test the laser distance measuring device by turning it on and pointing it at a surface to ensure a red laser beam is visible. If a red laser beam is visible, the equipment is functioning properly and can be used, but if no laser beam is visible the device will not be used and taken out of service.

If the laser distance measuring device becomes defective for any reason it will be immediately removed from service and marked as appropriate. The CSRT Manager will be notified and the manufacturer will be contacted if repairs require outside service.

Once repaired and returned, a performance check will be conducted, as described above, to ensure the laser distance measuring device is fit for purpose.

## 20.0 RECONSTRUCTION

The purpose of this section is to serve as a source of information for crime scene reconstruction procedures, evidence handling, and examination methods commonly utilized by the WSP CLD.

It is recognized that every crime scene is unique and as such, the scene may require various resources in the documentation, collection, and examination of the scene.

The sources and analyses outlined in this section are those that are recommended for crime scene reconstruction. Except as otherwise noted in the procedure, the sequence and choice of examination and/or analyses are at the discretion of the analyst.

Crime scene reconstruction is the process of determining the nature and/or sequence of events that occurred at a scene using information gained from the scene, scene examination, analytical testing, autopsy or emergency medical report(s), photographs and/or video(s), investigative summary reports (or law enforcement reports), crime laboratory reports, other investigative information/reports (or communications), and/or experimentation.

Crime scene reconstruction can include:

- 1) Bloodstain pattern analysis
- 2) Shooting incident reconstruction

### 20.1 INTRODUCTION

Crime scene reconstruction is the application of scientific principles to describe what events took place during the commission of a crime and the possible sequence of these events. Crime scene reconstruction is a dynamic process, and the process must be unbiased and is not intended to support or prove only one particular theory without considering others.

### 20.2 QUESTION AND THEORY

The question(s) and theory (or theories) that are to be addressed by a reconstruction may come from a variety of sources. The question(s) may be in regards to a single event or multiple, connected events. The theory (or hypothesis) is the first attempt to answer the question(s).

These sources can include:

- Law enforcement personnel
- Legal counsel
- Judges
- Pathologists
- Forensic examination

#### **Additional analysis**

During the reconstruction process, additional analysis may be required. This may include but is not limited to:

- Diagrams
- Photographs
- Experimentation/re-enactment
- Additional forensic examinations
- Visiting the crime scene
- Reviewing reports
- Physical evidence examination



- Other methods, as required

Any additional analysis must be properly recorded in the case file. Refer to the CLD QOM for information on note taking.

### 21.3 CONCLUSIONS

The conclusions(s) reached must be supported by the facts and physical evidence available at the time the reconstruction was conducted. Conclusions and supporting information will be included in the casefile.

## 21.0 CASEFILES, REPORTS AND THE RELEASE OF INFORMATION

Procedures for the release of case file information and reports are addressed in the CLD QOM.

### 21.1 CASEFILES

Scene notes can either be handwritten or electronically documented with the use of Microsoft Word. Annotated photographs can also be compiled with software such as PowerPoint. Once the casefile has been compiled and the report written they can be forwarded to the review process as outlined under the reports section and the CLD QOM.

#### Steps for handling electronic documents

- Upon return to the laboratory (or as soon as is practical) upload the RAW scene images onto the secure Digital Imaging System (ADAMS).
- Edit the electronic scene notes (Word documents) and images (with changes written to .XMP if using Adobe Lightroom). Create PowerPoint (if applicable), compile a PDF version of the casefile, and write the draft report.
- Send casefile and report for Secondary Review.
- When case is ready for Technical Review upload the original electronic scene notes (Word documents), the PowerPoint (if applicable), and the compiled PDF casefile onto ADAMS. These documents can be marked as draft/original. Additionally, upload the XMP files (if Adobe Lightroom was used) for the image edits and the 3D scanner files as outlined in section 18.3.
- During Technical Review track any changes to the electronic scene notes using the 'Track Changes' function in Microsoft Word and make any changes to the PowerPoint. Re-save these tracked and edited documents as i.e. 'edits'. Upload the finalized tracked and edited documents onto ADAMS for the technical reviewer to verify any changes, and re-compile the PDF casefile with the corrected pages.
- The Technical Reviewer confirms tracked electronic scene notes and PowerPoint are on ADAMS and verifies the changes to these documents. This check is automatically recorded on the chain of custody in ADAMS.
- Once technical review is complete the PDF casefile is printed and, along with the final printed draft report, is forwarded to Administrative Review.
- At the conclusion of Administrative Review upload the completed casefile and a copy of the signed report onto ADAMS as a scanned PDF.

#### Steps for handling handwritten documents

- With the exception of electronic scene notes, the steps outlined above for electronic documentation will be followed.
- A casefile will be compiled and a PDF version will be uploaded to ADAMS prior to Technical Review.
- All edits to handwritten notes are performed on the original documents. Corrections are initialed by the individual making the corrections (following the guidelines in the QOM) and these corrections are verified by the technical reviewer.
- At the conclusion of Administrative Review upload the completed casefile and a copy of the signed report onto ADAMS as a scanned PDF.

### 21.2 SIMPLIFIED CASEFILES

In certain instances, a simplified casefile may be assembled. Pertinent image numbers must be referenced in the notes if annotated images are not included.

Simplified casefiles may be used for simple vehicle searches (i.e. latent print and DNA processing only), evidence collection only scenes, certain no conclusion cases, and other cases as applicable. The CSRT primary should utilize best judgment and discretion when deciding to compile a simplified casefile.

Concerns with this case approach raised in Technical Review will be discussed with the Primary Responder. If a resolution cannot be reached, the concerns will be brought to the attention of the Technical Leads.

## 21.3 REPORTS

Any results released from the laboratory will be contained in a formal written report, and these reports will be prepared in accordance with existing CLD policy. The following reviews are required in order:

- Secondary review (if applicable) – a secondary/trainee crime scene responder shall review the report prepared by the primary responder for accuracy, completeness, and professional appearance. The case file should also be reviewed. Once completed this review will be documented in LIMS (Laboratory Information Management System) as a secondary review activity.
- Technical review – the casefile and report will be independently reviewed by a qualified primary CSRT member per technical review procedures outlined in the CLD QOM.
- Administrative review – will also be conducted prior to release of the report and work product and will be documented in LIMS and on the technical review check list.

In addition to the requirements outlined in the CLD QOM the following information will be included in all reports:

### Crime Scene Response Overview

- Date of response
- Assistance requested
- FLSB members present
- Address or location of scene (i.e. location of residence/where vehicle was examined)

### Observations

Results and conclusions (including any assumptions and limitations)

Disposition of any collected evidence

Disclaimers (if applicable)

Glossary (if applicable)

## 22.0 REAGENT PREPARATION

Use reagent grade chemicals, unless otherwise noted. Pre-made, reagent grade chemicals can be substituted for many of the recipes below. Prepare all solutions using deionized water (dH<sub>2</sub>O) when applicable. Wear appropriate PPE, such as gloves, and follow safety recommendations provided by the manufacturer for handling chemicals. Comply with any and all laws, regulations, or orders with respect to the disposal of any hazardous or toxic chemical, material, substance or waste. All reagents used by the WSP CSRT will be recorded on the west and east side reagent logs on SharePoint. The reagents used on scene will be recorded in the case notes.

### 22.1 2-NITROSO-1-NAPHTHOL (2NN)

Part A: Ammonia hydroxide solution (20 mL NH<sub>4</sub>OH diluted to a total of 50 mL with dH<sub>2</sub>O)

Part B: 0.2% 2NN in ethanol (0.2 g 2NN in 100 mL ethanol)

#### HAZMAT

Ammonium hydroxide is corrosive and will cause severe burns when contacting skin, eyes, and mucous membranes. Harmful if swallowed.

### 22.2 ACID PHOSPHATASE (AP)

The AP Spot Test (SERI) will be prepared following the manufacturer's directions.

Before use on samples, the working reagent shall be tested with a documented semen control each day of use. A negative control shall also be tested. The results of these tests shall be recorded in case notes.

### 22.3 AMIDO BLACK

#### 22.3.1 AMIDO BLACK (METHANOL BASE SOLUTION)

Developer solution:

2 g Amido black dye (Naphthol Blue Black)

100 mL Glacial acetic acid

900 mL Methanol

Combine and mix (may take approximately 30 minutes)

Rinse Solution (De-stain)

100 mL Glacial acetic acid

900 mL Methanol

Combine and mix.

Final Rinse

1 L of dH<sub>2</sub>O is preferred; however, if not available, tap water can be used.

#### 22.3.2 AMIDO BLACK (WATER BASED SOLUTION)

Amido Black water base formula consists of a fixative, citric acid stock, developer, and rinse solutions

Fixative solution:

20 g 5-Sulphosalicylic Acid  
1000 mL dH<sub>2</sub>O

Combine the above and mix on a stir plate until the acid is dissolved

Citric Acid stock solution:

38 g Citric Acid  
2 L dH<sub>2</sub>O

Combine the above and mix on a stir plate until the citric acid is dissolved

Developer solution:

1 L Citric Acid stock solution  
2 g Amido black dye (Naphthol Blue Black)  
2 mL Kodak Photo Flo 200 Solution

Place the liter of citric acid stock solution onto a stirring device. Slowly add 2 g of Naphthol Blue Black and stir for approximately 30 minutes. Add the Photo Flo 200 and stir lightly.

Rinse solution:

1 L Citric Acid stock solution

STORAGE: clear or dark bottles

SHELF LIFE: indefinite

## 22.4 BLUESTAR

Commercially purchased: Prepare according to manufacturer's recommendations.

## 22.5 DITHIOOXAMIDE (DTO)

Part A: Ammonium hydroxide solution (20 mL NH<sub>4</sub>OH diluted to a total of 50 mL with dH<sub>2</sub>O)

Part B: 2% DTO in ethanol (0.2g DTO in 100 mL ethanol).

### HAZMAT

Ammonium hydroxide is corrosive and will cause severe burns when contacting skin, eyes, and mucous membranes. Harmful if swallowed.

## 22.6 LEUCO CRYSTAL VIOLET

10 g 5-Sulphosalicylic Acid (SSA) in 500ml of 3% Hydrogen Peroxide  
4.4 g Sodium Acetate (NaAc)  
1.1 g Leuco Crystal Violet (LCV)

Mix the above chemicals until all of the components are dissolved.

The reagents can be adjusted accordingly to the amount needed.

Note: if the LCV crystals are yellow instead of white, do not use; this means the crystals are old.

## 22.7 LUMINOL (LAB PREPARED)

0.177 g luminol  
0.199 g NaOH  
0.340 g H<sub>2</sub>O<sub>2</sub> (Contained in one H<sub>2</sub>O<sub>2</sub>-Urea Adduct Tablet)  
200 mL dH<sub>2</sub>O

Combine and mix.  
Protect from light.

This reagent is QC checked each day of use.

## 22.8 LUMINOL

Commercially purchased: Prepare according to manufacturer's recommendations.

## 22.9 PHENOLPHTHALEIN

### 22.9.1 PHENOLPHTHALEIN STOCK SOLUTION

2 g Phenolphthalin CAS No. 81-90-3 (HAZMAT)  
20 g Potassium hydroxide (HAZMAT)  
100 mL dH<sub>2</sub>O

Place 20g of potassium hydroxide pellets into a 500 mL amber reagent bottle with zinc turnings and 2g of phenolphthalin powder.

Add 100 mL dH<sub>2</sub>O to the contents of the bottle and swirl until dissolved.

The stock solution shall be stored in an appropriate container in a cold dark place (i.e. refrigerator) with some zinc added to keep it in the reduced form.

This reagent expires 3 years after its preparation. A lot number shall be assigned. Each stock lot shall be QC checked and recorded in a Reagent Log. The lot number and expiration date shall be recorded on the bottle.

### 22.9.2 PHENOLPHTHALEIN WORKING SOLUTION

10 mL Phenolphthalein stock solution  
40 mL ethanol (EtOH)

Combine 10 mL of phenolphthalein stock solution and 40 mL ethanol.

Before use on casework samples, working reagent shall be tested with a positive blood control each day of use. A negative control shall also be tested. The results of these tests shall be recorded in the case notes.

#### DISPOSAL

Same as stock solution.

### 22.9.3 3% HYDROGEN PEROXIDE

3% Hydrogen Peroxide (1 ml)  
100 µl 30% H<sub>2</sub>O<sub>2</sub>  
900 µl dH<sub>2</sub>O

Combine and mix.  
Protect from light.  
Store in a cool dark place (i.e. refrigerated)

This reagent is QC checked with the phenolphthalein working solution each day of use. The six digit expiration date (either three years from preparation or supplied by the vendor) shall be recorded on the bottle.

Commercially purchased reagent, no preparation required

#### **22.10 SODIUM RHODIZONATE (NaRHO)**

Part A: 15% Acetic Acid (15 mL of concentrated acetic acid diluted to 100 mL with dH<sub>2</sub>O)

Part B: A small amount of Rhodizonic Acid, disodium salt (NaRho) is diluted with dH<sub>2</sub>O to create a dark colored solution.

Part C (optional): 5% Hydrochloric Acid (HCl) (5 mL concentrated HCl diluted to 100 mL with dH<sub>2</sub>O)

A small amount of Rhodizonic Acid, disodium salt (NaRho) is diluted with dH<sub>2</sub>O to create a dark colored solution.

## 23.0 GLOSSARY

This glossary contains terms and definitions not specifically defined in their respective sections above.

**Analyst** – An individual who conducts and/or directs the analysis of forensic casework samples, interprets data, and reaches conclusions

**Biohazard** – Any substance that may pose the risk of biological infection

**Biological Substances** – Body fluids such as blood, seminal fluid, saliva, or urine or biological material such as tissue (muscle, fecal material, etc.)

**Bullet** – A non-spherical projectile designed for use in a rifled barrel

**Cartridge** – A single unit of ammunition consisting of the cartridge case which contains a primer, propellant, and the bullet or projectile(s)

**Cartridge Case** – The container for all of the other components which comprise a cartridge

**Cast** – A term used in the forensic discipline of Toolmark Identification to describe the reproduction for evidence of a toolmark or the surface of a tool made with a molding material such as silicone rubber or made with a variety of products available commercially for this purpose such as Forensic sil. The name "Forensic sil cast" is often used descriptively to represent the reproduction of evidence in this manner

**Chain of Custody** – In WSP CLD Crime Scene Procedures, chain of custody evidence tracking begins at the crime scene and continues to final disposition

**Chemiluminescence** – (sometimes "chemoluminescence") is the emission of light as the result of a chemical reaction.

**Contamination** – The unwanted transfer of material from another source to a piece of physical evidence

**Convenience Packaging** – A container used primarily to aid in the transport of the evidentiary items contained within. Convenience packaging will not have an evidence seal

**Crime Scene** – An area, object, or person, external to a laboratory facility, from which evidence is identified, documented, collected, and/or interpreted

**Crime Scene Reconstruction** – The process of determining the nature of events that occurred at a scene from an evaluation of physical evidence and other relevant information

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

**Degradation** – Deterioration—either partial or complete—of a biological substance by chemical or physical means such as exposure to heat, moisture, or bacterial contamination

**Deoxyribonucleic Acid (DNA)** – The genetic material found in various body tissues (muscle, fetal tissue, skin, etc.) and body fluids (semen vaginal fluid, blood, saliva, etc.).

**Digital** – Information or graphical data that has been translated into a discrete numerical value and can therefore, be manipulated and reproduced without loss of quality



**Evidence** – A physical object, material or item believed to have some investigative or forensic significance and defined as such by law enforcement personnel or forensic analysts

**Evidence Packaging** – Packaging that contains an evidence seal

**Evidence Seal** – A seal on evidence packaging that is tamper proof or will reveal evidence of tampering and that in accordance with CLD Operating Manual must bear the initials of the person sealing the evidence, with the evidence marking extending across the evidence seal and onto the packaging

**Fabric Impression Transfers** – Impression evidence found on a crime scene caused by fabrics from an object transferred to another object through impact or sustained contact

**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

**Initial responding officer(s)** – The first law enforcement officer(s) to arrive at the scene

**Magazine** – A container for cartridges which has a spring and follower. The magazine serves to provide a new cartridge for loading into the chamber of the firearm during the firing cycle

**Measurement Scale** – An object showing standard units of length used in photographic documentation of the width and height of an items of evidence

**Nonporous container** – Packaging through which liquids or vapors cannot pass (e.g., glass jars or metal cans)

**Personal Protective Equipment (PPE)** – Articles such as disposable gloves, masks, eye protection, coveralls, and uniforms 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

**Pistol** – A repeating firearm requiring a separate pull of the trigger for each shot fired, and which uses the energy of discharge to perform a portion of the operating or firing cycle

**Plastic Prints** – Visible prints made in soft pliable substances such as putty, modeling clay, mud, etc.

**Policy** – Rules governing all the operation of the CLD laboratories, including but not limited to the scientific examination of physical evidence, collection and preservation of evidence, and expert testimony regarding the scientific examinations

**Porous container** – Packaging through which liquids or vapors may pass (e.g., paper bags, cloth bags)

**Presumptive Test** – A non-confirmatory test used to screen for the presence of a substance

**RAW (image file format)** – A file format that contains untouched “raw” pixel information straight from the digital camera’s sensor

**Revolver** – A firearm, usually a handgun, with a cylinder having several chambers so arranged as to rotate around an axis and can be discharged successively by the same firing mechanism

**Rigor Mortis** - Muscular stiffening following death. Also called postmortem rigidity

**Shot** – Pellets ranging in size, normally loaded into shotshells

**Shotgun** – A long gun designed to shoot from the shoulder, typically having a smooth bore and designed to fire shotshells

**Shotshell** – A unit of ammunition that may contain a single projectile or multiple projectiles/pellets. Generally shotshells are designed to be fired from shotguns

**Shotshell Case** – The shotshell container (paper or plastic) which is no longer filled with the components that originally comprise a shotshell

**Shotshell Wad** – The components of a shotshell, which typically separate the powder and projectiles, and are used to adjust the volume of the contents of the shotshell. Wads are made of a variety of material types, such as circular cardboard, fiber or felt disks, plastic one-piece or multi-piece shot cup and or shot columns

**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)

**Slug** – A term applied to a single projectile loaded into shotshells

**Three-dimensional Impressions** – Impressions at a crime scene such as footwear or tire impressions located in soil, snow, sand, mud, or a substrate that gives dimensionality to the impression

**TIFF (Tagged Image File Format)** – A standardized image file exchange format that has been adopted by many manufacturers that support high resolution graphics

**Tool** – A term used in the forensic discipline of Toolmark Identification to describe the harder of two objects, which when brought into contact with the other object gains a mechanical advantage and results in the softer object being marked by the harder one

**Toolmark** – A term used in the forensic discipline of Toolmark Identification to describe the mark produced on the softer of two objects by a harder object coming into contact with it

**Touch (DNA) Evidence** – Evidence resulting from casual contact (often by the hands) by an individual with a surface or material (such as a steering wheel, cigarette lighter, keys, gun grips, triggers, knife handles, item of clothing, etc.) that leaves DNA available for potential analysis and identification of a suspect

**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)

**Two-dimensional Prints** – Impression evidence found on a crime scene on a non-porous surface such as a footwear print on a vinyl or wooden floor or a tire print on a hard road surface

**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.

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