

LFU02- LFU Evidence Processing

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1. Scope

- 1.1. The following standard operating procedures are to be used to outline the chemical and physical processing methods employed within the Latent Fingerprint Unit (LFU) for the examination of physical evidence. Scientists employed by DFS shall be able to recognize the types of evidence submitted into the laboratory for examination and the methods described for the development and collection of latent print evidence. LFU members shall also recognize and collect secondary forms of evidence for additional examination by other sections of DFS and outside agencies. These standard operations and maintenance of laboratory equipment, maintaining inventory of laboratory supplies, and procedures of digital imaging with the LFU will be utilized at all times.

LFU personnel are required to follow these procedures during their examinations within the laboratory setting. Procedures regarding the use of chemical reagents and physical powders may also be employed in a field setting. Proper PPE and safety considerations must also be followed as described in this document.

2. Background

- 2.1 To establish the practices for documenting the examination of evidence to conform to the requirements of the Department of Forensic Sciences (DFS) Forensic Science Laboratory (FSL) *Quality Assurance Manual*, the accreditation standards under ISO/IEC 17025:2017, and any supplemental standards.

3. Safety

3.1 Scope

- 3.1.1 This procedure is used to establish the general guidelines for the quality control of laboratory procedures, reagents, and equipment utilized by the Latent Fingerprint Unit.

3.2 Background

- 3.2.1 In order to ensure that the procedures performed in the laboratory are reliable, certain quality control guidelines must be adhered to. Quality control refers to the everyday activities and techniques used to fulfill the requirements of accurate laboratory practices and protect laboratory personnel from hazardous conditions and exposure limits. These conditions are defined by laboratory accreditation bodies, occupational health and safety standards, and additional organizational practices.

3.3 Guidelines

3.3.1 Use of Personal Protective Equipment

When handling evidence for examination purposes, appropriate proper personal protective equipment (PPE) should be employed at all times. Proper PPE to be utilized may contain, but is not limited to:

- Proper lab coats
- Nitrile gloves
 - Gloves shall be changed between cases, and items when DNA collection is a consideration of the examination process
- Face Mask/Shield
- Hair Net
- Proper Protective glasses/goggles

3.3.2 Use of Controls

During a particular procedure, various controls are used to ensure that reliable results are obtained. When applicable, negative controls, positive controls, substrate controls, and reagent blanks are all used to verify the reliability of equipment and reagents. Chemical controls will be

maintained in the Chemical Inventory Database, and appropriate log information will be recorded. All chemical lot numbers will be validated prior to use in laboratory examinations.

3.3.3 Decontamination Control of Working Areas

Decontamination control of the working area is routinely performed to ensure:

- Contamination does not occur from material transfer from individual to evidence during the examination process.
- Contamination does not occur from material transfer between physical items and between cases during the examination process.

Work surfaces, tools and writing instruments shall be cleaned with a 10% sodium hypochlorite (Bleach) and 70% ethanol rinse before starting an examination, between cases and following the completion of the examination process, ensuring proper decontamination to include cases requiring DNA collection. The decontamination process for smaller examination tools and writing instruments may also be done through the use of the UV Crosslinker.

The decontamination process for the 10% hypochlorite and 70% ethanol solutions is as follows:

- Spray the 10% hypochlorite solution onto a Kimwipe® or absorbent towel.
- Thoroughly clean the surfaces and tools with the moistened towel.
- Spray the 70% ethanol solution onto a Kimwipe® or absorbent towel and thoroughly clean the surfaces and tools.

Laboratory brown craft paper should be used at all times when examining evidence, both on a laboratory bench area and photography station. This paper shall be changed following the cleaning process and between cases.

4. Materials Required

4.1 Chambers

- Foster + Freeman MVC 3000 and MVC 5000 Cyanoacrylate fuming chambers
- Misonix humidity chamber
- Air Science Safedvelop chambers
- VWR DFO Oven

4.2 Downdraft station

4.3 Digital Imaging

- Foster + Freeman DCS 4 and DCS 5
- Nikon D5, D800, D810, D7100 digital camera systems
- SPEX RUVIS
- Epson V800 Photo Scanners

4.4 Alternate Light Sources

- SPEX CrimeScope
- Foster + Freeman DCS
- Bright Beam Forensic Laser

4.5 Sequential Processing

- Chemical reagents
- Traditional powders and suspensions

5. Standards and Controls

5.1 Decontamination Control of Equipment

- 5.1.1 Laboratory equipment, to include, but not limited to: biological and fume hoods, cyanoacrylate and humidity chambers, downdraft powder stations, digital imaging stands, and flatbed scanners should be cleaned with 10% hypochlorite followed by 70% ethanol before and after each use to prevent contamination. Note if examination circumstances warrant single use tools. All routine equipment checks, filter replacements and maintenance shall be recorded in the equipment log, located at:

[M:\Latents\\$\Databases\Evidence Processing Database_FE.accdb](M:\Latents$\Databases\Evidence Processing Database_FE.accdb)

All equipment, to include software applications utilized in the laboratory, shall be recorded and maintained in the equipment list, located at: [M:\Latents\\$\Databases\Evidence Processing Database_FE.accdb](M:\Latents$\Databases\Evidence Processing Database_FE.accdb)

5.1.1.1 Smaller hand tools, rulers, and instruments may be decontaminated using the UV Cross linker for a 3 minute cycle. In addition, some of the Foster Freeman CA Chambers are equipped to have regular UV Decontamination cycles run.

5.1.1.2 All fume hoods should be serviced annually by an outside contractor to ensure that they are functioning properly. Such maintenance shall be recorded in the appropriate Equipment Maintenance Log.

5.1.2 Filters

5.1.2.1 A quarterly inspection will be performed on the downdraft station. The pre-filter and HEPA filter will be changed as needed.

5.1.2.2 The Foster Freeman cyanoacrylate fuming chambers monitor the filter status through an automated process, and the carbon filters should be changed when indicated.

Any ductless hoods will also require monitoring and replacement of the carbon and HEPA filters. The date of replacement shall be noted on the filter units.

5.1.2.3 If any piece of equipment appears to be malfunctioning, notify the Technical Leader or Unit Manager immediately so a service call can be placed for repair. The equipment should be taken out of service immediately and notation placed on the equipment. Notification will be made when the equipment is placed back into service and recorded in the equipment log upon conformity. The Unit Manager, Technical Leader, and Quality Assurance Unit will assess any effects the non-conformity may have had on casework in accordance with laboratory procedure.

5.1.3 Quality Control of Reagents

Quality control testing of reagents is performed to establish the reproducibility of a batch/lot of a particular reagent. In order to avoid unnecessary retesting of samples due to reagent failure, quality control procedures are completed prior to testing. In instances where a reagent is dependent on variables presented by equipment (i.e. heat and/or humidity), a quality control sample must be tested concurrently with the evidence to

ensure functionality of the equipment. Any expirations dates will be in accordance with manufacturer specifications. Unless specified, all reagents will be stored in the secured Evidence Processing Laboratory areas.

The laboratory receives and prepares a number of reagents for the purpose of testing physical evidence. All chemicals that are received in the laboratory shall be given a lot number entered into the chemical inventory database. In addition, when a LFU member prepares a batch of a reagent for use, the prepared batch will also be immediately entered into the database and given a lot number. The format for all received chemicals will be assigned a lot number in the following format: Year-Sequential number (e.g. the 10th bottle of a stock solution received in 2017 will become Lot 17-10). Any reagents received from a vendor that were commercially made will follow the designation of a stock solution, as previously described. Prepared reagents by LFU members will have an identifier assigned before the year to designate the reagent. The following table will be used to designate the prepared reagents:

Prepared Reagent	Precursor identifier
1,2 Indanedione	IND
1,8-Diazafluoren-9-one	DFO
70% Ethanol Solution	ETH
Acid Yellow 7	AY7
Amido Black- Methanol	ABM
Amido Black- Methanol Rinse	ABMR
Amido Black-Aqueous	ABA
Ardrox	ARD

Bi-Chromatic Powder	BCP
Black Fingerprint Powder	BP
Bleach (Sodium Hypochloride)	BL
Blood Fixative Solution	SSA
Bluestar	BS
Cyanoacrylate	CA
Disposable Bi-Chromatic Powder	DBCP
Disposable Black Powder (Single Use)	DBP
Disposable Magnetic Powder (Single Use)	DMP
Fluorescent Fingerprint Powder	FP
Gentian Violet/Crystal Violet	GV
Gray Fingerprint Powder	GP
Hungarian Red	HR
Iodine	I
Leucocrystal Violet	LCV
Magnetic Fingerprint Powder	MAGP
Methanol	M

Ninhydrin	NIN
Oil Red O	ORO
Phloxine B	PB
RAM (R6G, Ardrex, M.B.D.)	RAM
Rhodamine 6G- Aqueous	R6GA
Rhodamine 6G- Methanol	R6GM
Rhodamine 6G- Methanol Rinse	R6GR
Silver Latent Spray (Silver Nitrate)	SN
Small Particle Reagent- Black	SPRB
Small Particle Reagent- Fluorescent	SPRF
Small Particle Reagent- White	SPRW
Sudan Black	SB
WetWop- Black	WB
WetWop- White	WW
White Fingerprint Powder	WP
Zinc Chloride	ZC

The chemical inventory database shall record the following information for every chemical received by LFU and prepared by LFU members within the laboratory:

- Lot Number
- Chemical Name
- Vendor
- Date Received
- Date Opened (Active for casework use)
- Received by (Person entering record)
- Expiration date
- Consumption Information
- Storage Location, if not stored in the Evidence Processing laboratory areas
- Link to SDS
- Quality control test data
- Personnel preparing reagent/Opened by
- Additional Notes as needed

All reagents used by LFU for the examination of evidence will be validated for functionality prior to approval for casework and documented using the Validation Monograph located in Qualtrax. The validation will utilize an appropriate standard for the testing of samples (latent print standard pad or known blood sample). All reagent lots, whether commercially prepared or by LFU members, must successfully pass a positive and negative control before being approved for use in casework. Any reagents that do not successfully pass quality assurance measures are not to be utilized and will be subject to a quality review to determine the cause for the negative function check.

The Chemical Inventory database will be maintained under
[M:\Latents\\$\Databases\Evidence Processing Database_FE.accdb](M:\Latents$\Databases\Evidence Processing Database_FE.accdb)

6. Calibration

- 6.1 Latent Fingerprint Unit (LFU) equipment used for critical measurement will be calibrated or approved prior to use as deemed necessary. Documentation of calibration will be supplied in accordance to ISO 17025:2017. Non-critical equipment used as part of the examination process will be monitored for accuracy within parameters when in use according to specific requirements of the reagent or purpose. Any non-conforming equipment will be taken out of service per 5.1.2.3.

7. Procedures

7.1 General Examination Procedures

7.1.1 Scope

Latent Fingerprint Unit (LFU) personnel shall follow the guidelines listed below to collect and package evidence in order to maintain the integrity of each piece of evidence and minimize loss and degradation due to handling and environmental conditions.

7.1.2 Background

To establish the practices for collecting and packaging of evidence recovered during evidence processing in the confines of the LFU laboratories. Generally accepted practices are dictated by the need to eliminate cross-contamination between items of evidence and between cases. Evidence handling and packaging requirements are also discussed in the Department of Forensic Sciences (DFS) Departmental Operation Manuals (DOM) and DFS evidence submission policy.

7.1.3 Safety

LFU members shall wear personal protective equipment (PPE) that is appropriate for the type of evidence examination in progress, (e.g., lab coat, hair net, gloves, mask, eye protection), when carrying out standard operating procedures during the examination of evidence in the laboratory. Following the collection of potential DNA swabs, PPE deemed necessary for safety purposes will be used using best practices. When personnel encounter possible blood, body fluids, and samples suspected of containing body fluids/tissue, or other potentially hazardous materials, universal precautions must be taken. If during the course of examination, any PPE has been potentially contaminated, it must be changed as soon as possible, and disposed of properly. All personnel shall be familiar with the Safety Data Sheets (SDS) to determine the safety hazards for chemicals and reagents used in the standard operating procedures. The SDS can be located through the chemical

inventory database through the lot number of the reagent in question. If any chemical reagents are being utilized in field operations, LFU members shall adhere to the safety considerations and utilization as described in this document.

7.1.3.1 Firearms received by the Latent Fingerprint Unit shall utilize the following:

- Firearms must always be handled in a safe manner.
- Firearm must include a ziptie to ensure safety in accordance with current Central Evidence Unit procedures.
- The outer packaging the evidence is received in must include a label indicating that the firearm was unloaded, by whom, and on what date. Firearm evidence may be received in a sealed gun box, PD-14, or plastic bags in accordance with CEU submission procedures.
- Ammunition shall be packaged separately from the firearm.
- Firearm must be visually verified that it is safe for handling. Upon discovery of any live ammunition within the firearm, or uncertainty as to safety, analysts must notify the Firearms Examination Unit and the LFU Manager, Lead Scientist, and/or Technical Lead.
 - Any firearms that cannot be visually verified for safety, or the analyst has any concerns regarding safety shall notify the LFU Manager or Technical Leader and may notify FEU regarding the circumstances.
 - In the event a firearm is submitted and discovered to be loaded by the LFU Analyst. The Analyst is to notify the FEU Unit Manager, or designee, immediately upon discovery. LFU Analysts will assist FEU in the handling of the evidence to ensure safety. This may include transfer to FEU, transfer to the loaded firearm safe, or other instructions as deemed appropriate.
 - In the event the firearm is transferred to the loaded firearm safe, LFU Analysts shall notify the FEU Unit Manager, LFU Unit Manager, and Central Evidence Unit. An entry will also be added to the case activities area within LIMS.

- In the event LFU personnel may need to physically verify safety or remove any live ammunition within the laboratory, a clearing barrel shall be utilized.
- Upon completion of the examination, firearms shall be repackaged in accordance with current CEU procedures for submission either to the Central Evidence Unit or Firearms Examination Unit as appropriate.

7.1.4 Materials

LFU personnel shall utilize all available PPE when examining evidence. The use of PPE not only protects personnel from any potentially hazardous conditions, but also safeguards the integrity of the evidence being examined. When examining evidence in the laboratory setting, LFU members may be required to utilize the following PPE measures:

- Lab-coat
- Hair net
- Eye-protection
- Face mask
- Gloves
- Color filters/safety glasses

7.1.5 Procedures

During the course of their examination process, LFU personnel shall ensure the use of proper procedures regarding the utilization and application of laboratory equipment and reagents as dictated by Department of Forensic Sciences procedure. Deviations from approved laboratory procedure may be necessary to ensure preservation of evidence and to prevent contamination between items of evidence and between cases. In those instances, deviations shall be noted and reported by the analyst, and approved by a supervisor or designee, recorded and reported by the Latent Fingerprint Unit Scientist prior to use in casework.

7.1.5.1 Evidence Collection Methods

Prior to any collection efforts, perform a visual exam of the evidence prior to any of the application processing methods. Evidence should not be handled or collected until sufficient documentation has been completed for each sample. This

documentation includes the itemization of the collected sample, and may include photographic documentation of the secondary sample evidence.

Trace

- If necessary, based on case synopsis, examine item using an ALS and an appropriate filter combination to locate possible trace evidence.
- Collect transient trace evidence that may be lost during the course of the examination, using sterile, single use, tweezers.
- If sterile tweezers are not available, use tools that have been cleaned with 10% bleach followed by 70% ethanol.
- Dispose of single use tools after use, or clean reusable tools with 10% bleach followed by 70% ethanol.
- Based on the nature of the item examined and/or trace substance encountered, other collection methods may be employed such as, but not limited to: gel lifters, tape lifts, and vacuum collection methods.

Biological

- If necessary, based on case synopsis, examine item using an ALS and appropriate filter combination to examine item for biological stains.
- All stains on the item must be documented to note location, size and color.
- Take a documentary photograph prior to collection.
- Do not alter the stain during the labeling process.
- Collect the stain or swab for potential touch DNA using the swabbing method.
- Change gloves in between swabbing different evidence items.

Stain Collection

- Determine if a stain can be excised or swabbed based on the composition of the substrate.
- Consider further forensic testing of the substrate before excising a stain.
- Use sterile tools if the stain will be excised.
- If the stain will be swabbed, determine whether the stain is wet or dry and use appropriate techniques based on the condition of the stain.

Wet/dry swab method

- Wet a new, sterile cotton swab with 2-3 drops of sterile water.
- Swab by applying gentle pressure to the area of interest, rotating the swab to evenly distribute the sample.
- Use a dry swab to replicate the above listed step, collecting any moisture left on the item in the process.
- If practical, collect a representative sample of the stain(s) based on case synopsis.
- Small stains should be completely collected to ensure a sufficient amount for laboratory analysis.
- Proper PPE must be worn during the swab collection process. Following collection, only PPE deemed necessary for safety purposes is required.

Dry swab method for wet stains

- Swab the wet stain using dry swabs.
- If practical, collect a representative sample of the stain(s) based on case synopsis.
- Small stains should be completely collected to ensure a

sufficient amount for laboratory analysis.

Sampling

- Individual biological stains, despite size, should not be combined. This includes stains taken from blood stain patterns. A representative sample should be collected from bloodstain patterns. There is no need to collect every stain if it is a part of a recognizable pattern.

7.1.6 Overall examination sequences

During the processing of evidence for the potential presence of latent prints, the following sequences should be referenced as a general guideline. LFU Scientists should utilize all available techniques, based upon the type and condition of the item, as well as the requested examination(s).

Recommended sequence of examination for non-biological items:

Porous Evidence
• Visual
• Inherent Fluorescence via Laser / ALS
• Iodine Fuming
• DFO / 1,2 Indanedione
• Ninhydrin
• Zinc Chloride/Oil Red O
• Silver Nitrate Spray / Physical Developer

Recommended sequence of examination for non-biological items:

Non-Porous Evidence
• Visual
• Inherent Fluorescence via Laser / ALS
• Cyanoacrylate Fuming
• RUVIS
• Chemical Dye(s)
• Powder(s)

Recommended sequence of examination for biological stained items:

Porous Evidence
• Visual
• Inherent Fluorescence via Laser / ALS
• DFO / 1,2 Indanedione
• Ninhydrin
• Zinc Chloride

Recommended sequence of examination for biological stained items:

Non-Porous Evidence
• Visual
• Inherent Fluorescence via Laser/ALS
• Cyanoacrylate Fuming
• LCV/Amido Black / Hungarian Red / Acid Yellow 7/Phloxine B
• Chemical Dye(s)
• Powder(s)

Non-sequential examination for special surfaces:

Reagent	Common Applications
Crystal (Gentian) Violet	Adhesive surfaces, surfaces with oils/grease
Wetwop	Adhesive surfaces, gloves (latex/nitrile)
Small Particle Reagent	Non-porous surfaces that have been wet
Sticky Side Powder	Adhesive surfaces
Sudan Black	Non-porous and semi-porous substrates containing grease, oils, or sticky substances.

7.1.7 Field Applications

The procedures described in this manual may be applied to the use of the specified reagents, equipment and documentation in the field or at a crime scene. Analysts must follow the application, visualization and safety

information specified within the procedure for each sequential reagent or technique, to include photographic documentation.

7.2 Visual Examinations

The initial phase of the evidentiary examination of physical items shall be a visual examination. During this phase, LFU personnel shall conduct a visual examination of evidence, which may include: ambient light, oblique light sources, laboratory light sources, and alternate light sources. The main purposes for the visual examination is to ascertain the presence of any visible friction ridge detail, possible biological staining, indented writing, secondary impressions, or possible trace evidence for collection purposes. If any potential impression, trace, or biological evidence is visualized, the examiner shall document their findings and collect the evidence, considering the best practices of the evidentiary value of the item. Any samples shall be collected in compliance with the procedures outlined in Section 7.1.5.1 and packaged appropriately for submission to the CEU. If an Alternate Light Source was utilized in the visualization of any form of secondary evidence, the settings utilized shall be documented within the case notes.

7.3 Alternate Light Sources

7.3.1 Scope

This procedure outlines the quality control measures instituted for testing the working condition of the Alternate Light Sources (ALS) for LFU field and laboratory operations.

7.3.2 Background

In order for a piece of equipment to function accurately and reliably, it is essential that proper maintenance is performed. This maintenance may include calibration based on a specified time period, routine cleaning, or placing service calls to outside contractors for calibration and maintenance.

7.3.3 Safety Precautions

- Wear appropriate personal protective equipment when carrying out standard operating procedures.
- Read Material Safety Data Sheets to determine the safety hazards for

chemicals and reagents used in the standard operating procedures.

- Wear appropriate safety glasses based on the wavelength of light being tested.
- Exposure to alternate light source wavelengths may be harmful to the eye; proper eyewear protection must be worn at all times.
- The RUVIS operates on shortwave UV light. While utilizing this equipment, personnel must take additional precautions, in accordance with manufacturer recommendations, to reduce exposure to hazardous conditions.
- The Forensic Laser utilizes an intensified light source. LFU members must be cognizant of utilizing proper protective eyewear and for other persons in the immediate area.

7.3.4 Procedure

- The ALS must be checked, at a minimum, every 6 months to ensure the unit is in proper working condition. The tests are performed to check the mechanical integrity of the unit, to verify the correct fluorescence filters/goggles are available and fit for use, and to verify that the optical system is performing to specification. Positive and negative controls should be tested, if applicable on designated standards. Results to be recorded in the equipment log.
- Refer to the manufacturer's recommendations for test and inspection guides of performance checks.
- All maintenance performed must be documented on the Equipment Log.
- If one of the ALS units appears to be malfunctioning, notify the Equipment Manager and Quality Assurance specialist so that a service call may be placed to the manufacturer or outside contractor for repairs.

7.4 Documentation Procedures for Laboratory Examination of Evidence

7.4.1 Scope

The purpose of this procedure is to provide LFU with general guidelines for recording observations and activities during the processing of evidence in the confines of the DFS laboratory.

The procedures introduce the concept of examination quality photographs but are not meant to serve as the lone protocols for examination quality photographs.

7.4.2 Background

The documentation produced in the course of evidence analysis will serve as a permanent record to preserve the integrity of the evidence and the events that transpired during the examination of the evidence.

Notes, sketches, if applicable, and photographs are an integral part of the documentation process. They provide perspective and description of evidentiary items. They also aid in the recollection of events that transpired during the examination process.

Documentation photographs serve as a tool for recording the current condition of evidence as seen by the analyst. They serve as a visual representation to show the state of an item at the time of processing and the result of the processing.

Evidentiary photographs are also known as examination quality photographs. These photographs are used for comparison purposes, and are also meant to be treated as individual items of evidence once captured.

7.4.3 Safety

Wear personal protective equipment, PPE, (e.g., lab coat, hair net, mask, eye protection, gloves), when carrying out standard operating procedures.

Read Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedure.

7.4.4 Materials

- Digital camera
- Ruler/Scale
- PPE

- DFS Documentation
- Light Sources/Alternate Light Sources

7.4.5 Standards and Controls

When using reagents, positive and negative controls must be documented, when applicable.

7.5 Deviations

7.5.1 Deviation from the following procedures may be dictated by the circumstances of the case. Variations in the documentation are acceptable and will be noted and reported by the Latent Fingerprint Unit Scientist.

7.5.2 Any deviations will be approved by a supervisor or designee, recorded and reported by the Latent Fingerprint Unit Scientist in accordance with the FSL Quality Assurance Manual.

7.6 Note-Taking:

Notes are not optional.

Document contemporaneous actions taken on LFU worksheets or in narrative form. Notes and photographs are to complement to each other.

7.7 Photographic Procedures

7.7.1 Scope of Macro Photography:

Macro photography is the capture of impressions or items in a “close-up” setting that will be utilized for an examination. These images require special equipment and techniques and must be of the highest quality and contrast for subsequent examination purposes. These images must be re-sized to obtain a 1:1 calibration, and must be captured in a lossless compression format.

Documentation photographs shall be taken to designate the location of impressions captured through macro photography.

Refer to camera specific operating manuals for the proper use of the camera.

7.7.2 Documentation Photographs:

- Capture images in parameters corresponding to the appropriate camera.
- D7100 or D7000 - Set image quality to "JPEG Fine."
- Do not delete images once photographed.
- Photograph items of evidence using an overall perspective.
- Capture the item(s) of evidence with a scale and a unique identifier.
- The unique identifier must include a case number, item number, analyst initials and date.
- Close-up documentary photographs should also be taken of certain items of evidence following the overall perspective.
- The close-ups will document items and the condition of the items not fully captured with an overall photograph. These items include but are not limited to: cartridges, cartridge casings, glass, hairs, fibers, etc.
- If trace evidence is observed on an item of evidence being processed, its location should be noted and photographed prior to collection.
- Close-up photographs should include identifying information of the evidence at a minimum but not limited to: manufacturer, model, serial number, etc.
 - Ring lights, off camera flash or oblique lighting may be employed to capture this information.
- Capture the close-up photograph with a scale and unique identifier.
- Items of a similar nature, within the same case (tape, glass, cartridges, cartridge casings, etc.), may be grouped so that one photograph will capture sufficient information for all items.
- When composing the frame, ensure that each item in the grouping can be clearly identified with an item number.
- Verify the image quality prior to each subsequent photograph and re-capture if necessary.
- A tripod or copy stand can be used to capture documentation

photographs, or for photographs requiring an extended exposure or controlled lighting environment.

- Overall images will be imported into the Mideo Caseworks database for retention.
 - Analysts will be responsible for ensuring the creation of a case folder for their assigned request by using the locator feature within Mideo Caseworks.
 - Analysts will create a case folder through the DFS case number in LIMS
 - Overall documentary photographs will be uploaded into the "Overall Images" folder and retain the original file name as assigned by the capture device during the examination.
 - Refer to Mideo SOP for additional information. These images may be used during subsequent examinations and shall be reviewed during the technical review process.

7.7.3 Evidentiary Photographs:

The primary goal of LFU members in capturing evidentiary photographs is to ensure that the optimal impression has been photographed. Through use of the camera settings, lighting, and filters, LFU members shall strive to obtain optimal contrast and resolution for subsequent examinations.

The following guidelines apply to LFU cameras and the DCS4/DCS5 camera systems:

7.7.3.1 Capture images in parameters corresponding to the appropriate camera.

- D810, D800, D5 - Set image quality to "TIFF". Set Lossless compression to "On" and RAW bit depth to "14-bit."
- D7100 or D7000 - Set image quality to "NEF". Set Lossless compression to "On" and RAW bit depth to "14-bit."
 - D7100 or D7000 - A remote shutter release or delayed timer should be utilized for all macro photography.
 - Evidence quality photographs should be taken at a minimum of 1000ppi when re-sized 1:1.

- Use a Macro lens to capture evidentiary photographs.
- Cameras shall be in “Manual” mode during this type of photography, and the ISO setting should be at ISO 200 or less. The scientist should control the aperture and shutter settings in order to obtain an optimal image.
- Use a camera mounted to a tripod or a copy stand.
- If possible, the camera lens should be at a 90° to the surface of the substrate.
- Fill camera frame with the subject matter to include a scale and unique identifier including any additional photograph designations.
- The unique identifier must include at a minimum: case number, item/impression number, analyst initials and date.
- The scale should be in the same plane as the evidence.
- Document and/or sketch the location of the subject matter being photographed within the context of the evidence.
- Some imaging stations may use Camera Control Pro 2 in order to remotely control the camera. This software will save the images to the specified location for import into the Mideo database.
- Evidentiary images shall be recorded in LIMS.
- Use different lighting techniques to aid on the visualization of the subject matter, as necessary:
 - Oblique illumination.
 - Specular illumination.
 - Dark field illumination.
 - Episcopic coaxial illumination.
 - Polarized light.
 - Fluorescence.
 - Transmitted light

- Bounce light
- Alternate Light Sources
- Direct reflective light

7.7.3.2 Upon capture, all evidentiary images shall be imported into the Mideo database in the Lift Cards/Photos folder within the case folder.

7.7.4 Capturing images using flatbed scanner:

7.7.4.1 Developed or visualized impressions may be captured using the Epson V800 flatbed scanner, if applicable. The scanner may be used to capture developed prints on flat objects, such as paper. To utilize the scanner, the following steps should be followed:

7.7.4.1.1 All scans must be performed through the utilization of the Epson scanner software.

7.7.4.1.2 Appropriate areas shall be boxed and scanned.

7.7.4.1.3 The scanner shall be set for a minimum of 1000ppi for impression evidence, and a lossless compression format. Impression images will be transferred to the DCS network folder upon acquisition.

7.7.4.1.4 All acquired impression evidence images shall include a scale with appropriate case information.

7.7.4.1.5 Evidentiary images shall be recorded in LIMS.

7.7.4.1.6 All evidentiary images shall be imported into the Mideo database under the Lift Cards/Photos folder within the case folder.

7.7.5 Procedures for Evidentiary Quality RUVIS Photography

7.7.5.1 Scope

The following procedures are general guidelines when taking examination (evidentiary) quality photographs of physical evidence using a RUVIS system.

7.7.5.2 Background

- The purpose of photography is to permanently document evidence, details, and observable material from crime scenes and physical evidence.

- Examination quality photographs are used for comparison or interpretation purposes and must be of a sufficient quality.
- The SPEX camera is used to locate, capture, and enhance high resolution photographs in the laboratory setting using alternate light sources including RUVIS.
- The RUVIS mode uses the SPEX camera equipped with a 254nm band pass filter attached to a 78 mm fixed focal length lens which allows images to be captured in a 1:1 scale.
- Safety
 - Wear personal protective equipment (e.g., lab coat, gloves, mask, eye protection), when carrying out standard operating procedures.
 - RUVIS PPE includes covering exposed skin with an appropriate lab coat and face shield as well as proper eye protection.
 - Read Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedures.
- Materials
 - Digital Camera
 - Lens filters
 - Copy stand
 - Light source
 - Scale(s)
 - PPE
 - Correct safety glasses
- Standards and Controls
 - Camera should be set to a lossless file format.
 - Positive and negative control test prints placed on a similar substrate, processed using the same methodology,

as the evidence should be tested under the illumination system to ensure proper ridge detail enhancement.

- Procedure

- Ensure that the camera sensor (back of the camera) is plane parallel to the subject. A level can be used to position the camera if needed.
- Open the ImaQuest program, if applicable, and log in.
- Open the J-Quest program through the camera drop down in ImaQuest. Turn on the camera and UV lights.
- Click the Select/Connect button and press the play button (▶).
- Select the radio button next to 'Search' and place the evidence to be examined under the camera.
- The Search mode should be used with a very open aperture (f/stop 5.6 or wider), with exposure around 200 ms. This function is designed to allow the item to be searched for ridge detail.
- Use the copy stand crank to raise or lower the camera as necessary.
- Once an area of ridge detail has been identified for photographing, switch to the 'Fine Focus' mode.
- This mode zooms in on the ridge detail and should be used to focus the camera. Arrows can be used to navigate through the area to ensure the proper focus.
- When the image is focused and properly composed switch to 'Capture' mode. Adjust the f/stop to a smaller aperture (ex. f/11) and adjust the exposure and amplify option as necessary.
- Amplify is equivalent to the ISO and should be set to 500 or lower.
- To capture the image click the camera icon in the lower left corner. Click the To ImaQuest when it lights up.

- If the 'Save as TIFF' button appears, close JQuest and re-open through ImaQuest.
- Navigate to the open ImaQuest screen to review the image.
- Enhancements can be made at this point.
- Save the file using the CCN (YYYY-XXX-XXX) and item number.
- Images will be archived in the appropriate database.
- Record evidentiary photographs in LIMS.

7.7.6 Foster Freeman DCS4/DCS5

7.7.6.1 Scope

- Analysts should follow the guidelines listed below when capturing examination quality photographs of fingerprints using the DCS4/DCS5.

7.7.6.2 Background

- The DCS4/DCS5 is a fingerprint imaging system from Foster + Freeman® used to capture, enhance and print high resolution photographs.
- The DCS4 uses a Nikon D800 camera and the DCS5 uses a Nikon D5 camera equipped with a Micro Nikkor 105mm fixed focal length lens which allows images to be captured in a 1:1 scale. In photography 1:1 has a specific meaning: the size of subject in real life is the same size as its projection onto the camera sensor.

7.7.6.3 Safety

- Wear personal protective equipment (e.g., lab coat, mask, eye protection, hair net, gloves), when carrying out standard operating procedures.
- Wear glasses of the appropriate color to properly visualize a developed print and to protect the eyes from the alternate light source.

- Read Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedures.

7.7.6.4 Materials

- PPE
- Lab coat
- Mask
- Eye-protection
- Hair net
- Gloves
- Digital camera
- Macro lens
- Scale(s)
- Crime-lite® 8X4 MK2 light source, auxiliary light sources.
- DCS filters
- Copy stand
- Personal Computer system, DCS4/DCS5 imaging systems
- Colored safety glasses

7.7.6.5 Standards and Controls

- Positive and negative control test prints placed on a similar substrate as the evidence should be tested under the illumination system of the DCS4/DCS5 to ensure proper ridge detail enhancement.
- The positive and negative controls should be processed using the same methodology as the evidence.

7.7.6.6 Calibration

- If the focus mark on the Nikon 105mm Micro Nikkor lens is set to 0.33m, a 1:1 image can be produced without further image calibration. This only occurs if the decimal point of 0.33m is aligned with the focus mark.
- The DCS4/DCS5 uses specific lens focus presets set at the factory.
- If the focus distance on the barrel of the camera lens can be accurately read, the equivalent distance presets can be selected in the calibration dialog box at Image Capture.
- The DCS4/DCS5 also allows for a “Calibrate Later” option.
- Select “Calibrate Later” if the focus distance cannot be accurately read, or if a manual calibration is preferred.

7.7.6.7 Procedures

- Process evidence in accordance with the LFU standard operating procedures for the development of latent fingerprints.
- Turn on DCS4/DCS5 light source or Alternate Light Source.
- Turn on camera and remove lens cap.
- Log into the DCS4/DCS5 program on the PC.
- Position the evidence on the copy stand base. A protective barrier such as butcher paper should be used.
- Ensure the evidence is plane parallel to the camera sensor plane when possible.
- Ensure the frame is filled with the developed print. This can be accomplished by raising or lowering the camera using the height adjustment knob on the column of the copy stand.
- A scale with the case information should also be included.
- The label should include: case number, item number, analyst

initials, and date.

- Position the scale in the same plane as the evidence being photographed.
- Ensure that the image quality is maximized by adjusting the appropriate camera settings.
- Images should be recorded in a lossless “TIFF” format.
- The resolution dialog box on the DCS4/DCS5 is set to medium resolution.
- Depth of field is maximized by selecting an appropriate f-stop.
- Low ISO (200 or lower) is recommended.
- Ensure that the image is in sharp focus. Once the frame is filled the focus ring can be adjusted to achieve sharp focus. Alternatively, if the focus mark is set to 0.33m, focusing can be achieved by raising or lowering the camera.

7.7.6.8 Image Capture

- For alternate light source imaging select the appropriate waveband and filter combination. ALS imaging should take place in darkened environment, turn off the lights or use the bellows attachment to reduce ambient light.
- Various lighting techniques can be employed to maximize image contrast, such as but not limited to polarized light, ring lights, oblique lighting, and coaxial illumination.
- Lighting techniques and filter combinations must be recorded in case notes.
- The program wizard can be used as a guide for selecting useful lighting and enhancement techniques.
- Click the preview icon.
- With the depth of field set, the shutter speed can be adjusted as necessary to obtain a proper exposure.

- Adjust the white balance if necessary to obtain the proper color temperature.
- In the “Capture Image” dialog box enter the case number (CCN) YYYY-XXX-XXX (Or submitting agency equivalent). This creates a case folder in the “DCS 4 working folder” located on the D: drive for the DCS4 and in the “DCS 5 working folder” located on the D: drive for the DCS5. The file name will reflect the unique identifier for the latent impression being captured.
- Any images captured by a camera outside the DCS imaging systems will rely on file transfer through a SD card to the appropriate network drive.
- Required Field boxes are highlighted in yellow in the capture image dialog box.
- Additional information can be recorded in the “Audit Notes” dialog box.
- Click Capture.
- Archive the images to the appropriate electronic database(s).
- Images shall be imported into the Mideo Caseworks case folder created for each case.
- Analysts should open their case folder, as created for the overall images.
- Evidentiary images shall be saved in the “Lift Cards-Photos” folder and retain their original file name. Files may also be saved within the DCS Working Folder, located on the laboratory network.
- Refer to the Mideo SOP for additional information.
- Upon request, images will be transferred to a DVD. Itemize the DVD using the prefix of DS (Digital storage). Ex. DS1 (for 1 DVD), DS1 and DS2 (if multiple DVDs are created). The DVD shall be treated as evidence, adding to the chain of

custody, and submitted to CEU. Treat the DVDs as evidence.

- Shut down and save all work. Exit the programs and return all filters to storage and close down the DCS hardware.

7.7.7 Procedures for Using an Alternate Light Source

7.7.7.1 Scope

- This procedure describes the use of an alternate light source (ALS).

7.7.7.2 Background

The alternate light source is commonly used in the forensic setting to visualize evidence that may be difficult to detect with the naked eye. An ALS can be used for ultraviolet reflected, fluorescence, infrared reflected or infrared luminescence photography. Evidence is illuminated with filtered light and observed through a barrier filter creating contrast.

Alternate light source techniques can be used to induce photoluminescence in a wide variety of forensic evidence to help locate material for additional testing and identification. The ALS can also be used to provide contrast on difficult backgrounds by taking advantage of the selective absorption/reflective characteristics of the background and sample. Applications include, but are not limited to the following:

- Fibers
- Gunshot residues
- Physiological fluids
- Pigments and inks
- Fingerprint development
- Petroleum products
- Bone/teeth
- Minerals

7.7.7.3 Safety

- Wear personal protective equipment (PPE) based on laboratory and fieldwork requirements.
- Refer to the appropriate Material Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedures.
- Barrier filters should be worn when viewing items under the ALS to protect the eyes. Refrain from looking directly into the light.

7.7.7.4 Materials

- Alternate Light Source (ALS)
- Barrier filters (colored goggles)
- DSLR camera equipment
- Macro and/or quality variable focus lens
- Copy stand or sturdy tripod
- Selection of photographic filters
- Approved scales

7.7.7.5 Procedures

- For specifications, maintenance, and general guidelines consult the specific light source manual.

7.7.7.6 Relative Guide for Wavelength and Barrier Filter Combinations

Wavelength Barrier Filter

300 – 400 nm (UV) UV reflectance/UV transmitting (VIS blocking)

300 – 400 nm (UV) UV fluorescence: clear (UV absorbing) or yellow

410 – 450 nm Yellow

455 – 520 nm Orange

530 – 575 nm Red

600 – 700 nm None: Use Caution

700 – 1100 nm (IR) IR transmitting (UV/VIS blocking)

Note: There may be instances where visualization is best observed outside of this range and/or filter combination. In those instances the LFU Scientist shall document the equipment and circumstances utilized in the case notes.

7.7.7.6.1 After selecting the appropriate filter/goggle combination, direct the radiation onto the area to be examined. Changing filter/goggle combinations may alter the contrast. The substrate will play a role in determining which filter/goggle combination to use for optimum contrast. Experimentation may be required.

7.7.7.6.2 Document any observed physical evidence as thoroughly as possible with photography.

7.7.7.6.3 If optimal visualization occurs outside of the ranges and combinations listed in 7.7.7.6, the variation must be documented in the case notes. It is understood that instances will occur where best visualization may occur outside these listed ranges.

7.7.7.7 Photographic Considerations:

- Documenting evidence under wavelength specific radiation often requires manual control of the camera functions with careful consideration for depth of field in the image. Additionally, working with narrow bands of radiation can lead to long exposure times. The use of a tripod or copy stand, and a shutter release cable is often required under these conditions.
- The manufacturer supplied goggles do not necessarily correspond to the same optical density as photographic filters of the same or similar color. A proper photographic barrier filter must be selected to prevent light contamination from the instrument that may reduce the contrast between the sample and its background in the photograph.

- For most applications it is required that the photography be conducted in a darkened environment.
- Ensure photographs are imported to the appropriate image database.

7.7.7.8 Limitations

- It should be noted that there are a variety of substances which fluoresce under the alternate light source. This procedure is an effective tool for locating and documenting physical evidence. This by no means suggests that a substance can be identified solely based on the observed fluorescent (or absorptive) properties.

7.7.7.9 Procedures for Using a Forensic Laser

7.7.7.9.1 Scope

- This procedure describes the use of the Forensic Laser.

7.7.7.9.2 Background

The forensic laser is commonly used in the forensic setting to visualize evidence that may be difficult to detect with the naked eye. The laser can be useful in detecting faint impressions that react within the specified wavelength and filter combinations. Evidence is illuminated with filtered light and observed through a barrier filter creating contrast.

Forensic laser techniques can be used to induce photoluminescence in a wide variety of forensic evidence to help locate material for additional testing and identification. The laser utilized a highly focused wavelength of light to excite substances within a specific range of radiant fluorescence, or to improve the contrast of developed impressions. Applications include, but are not limited to the following:

- Trace Evidence
- Biological Stains
- Inherent fluorescence
- DFO
- 1,2 Indanedione
- RAM
- Rhodamine 6G
- Hungarian Red
- Acid Yellow 7
- Ninhydrin

7.7.7.9.3 Safety

- Wear personal protective equipment (PPE) based on laboratory and fieldwork requirements.
- Refer to the appropriate Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedures.
- Barrier filters should be worn when viewing items under the forensic laser to protect the eyes. Refrain from looking directly into the light.

7.7.7.9.4 Materials

- Forensic laser
- Barrier filters (colored goggles)
- DSLR camera equipment
- Macro and/or quality variable focus lens
- Copy stand or secure tripod
- Selection of photographic filters
- Scale(s)

7.7.7.9.5 Procedures

- For specifications, maintenance, and general guidelines consult the specific light source manual.

7.7.7.10 Relative Guide for Wavelength and Barrier Filter Combinations

Wavelength Barrier Filter

The forensic laser operates at 532nm. Under this wavelength, optimal visualization for fluorescent impressions and/or stains may require the use of an orange or red barrier filter. Under certain circumstances, the use of the forensic laser may improve the contrast of a visually developed impression. In these instances, a filter may not be required for best visualization.

Note: There may be instances where visualization is best observed outside of this range and/or filter combination. In those instances the LFU Scientist shall document the equipment and circumstances utilized in the case notes.

- After selecting the appropriate filter/goggle combination, direct the radiation onto the area to be examined. Changing filter/goggle combinations may alter the contrast. The substrate will play a role in determining which filter/goggle combination to use for optimum contrast. Experimentation may be required.
- Document any observed physical evidence as thoroughly as possible with photography.
- If optimal visualization occurs outside of the ranges and combinations listed in 7.7.7.6, the variation must be documented in the case notes. It is understood that instances will occur where best visualization may occur outside these listed ranges.

7.7.7.8 Photographic Considerations:

- Documenting evidence under wavelength specific radiation often requires manual control of the camera functions with careful consideration for depth of field in the image. Additionally, working with narrow bands of radiation can lead to long exposure times. The use of a tripod or copy stand, and a shutter release cable is often required under these conditions.
- The manufacturer supplied goggles do not necessarily correspond to the same optical density as photographic filters of the same or similar color. A proper photographic barrier filter must be selected to prevent light contamination from the instrument that may reduce the contrast between the sample and its background in the photograph.
- For most applications it is required that the photography be conducted in a darkened environment.
- Ensure photographs are imported to the appropriate image database.

7.7.7.9 Limitations

- It should be noted that there are a variety of substances which fluoresce under the forensic laser. This procedure is an effective tool for locating and documenting physical evidence. This by no means suggests that a substance can be identified solely based on the observed fluorescent (or absorptive) properties.

7.8 Illicit Drug Procedures

7.8.1 Scope

- Analysts should follow the guidelines listed below for the collection, packaging, and processing of illicit drug/controlled substance evidence.

7.8.2 Background

- There are a wide variety of materials considered to be illicit drugs, including prescription drugs, abused drugs, steroids, and chemicals. The definition of an illicit drug shall include any substance as listed in the Federal Controlled Substances Act (21 U.S.C. 812) and the District of Columbia Official Code, Title 48. Food and Drugs, Subtitle III. Illegal Drugs.
- Upon request, Latent Fingerprint Unit (LFU) personnel will process illicit drug evidence for latent print development and/or collection of potential touch DNA.

7.8.3 Safety

- Acquire the necessary information from the first responders regarding the biological, chemical and environmental conditions of the scene in order to prepare for the evidence examination. All LFU evidence processing personnel shall have access to NARCAN and receive training on the administration process from Health & Safety Personnel in the event of an exposure situation.
- Wear personal protective equipment (PPE) based on laboratory and field-work requirements.
- Read Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedures.

7.8.4 Materials

- PPE
- Heat sealer
- Heat seal evidence bags
- Evidence exam utensils
- Sterile swabs
- Latent print reagents

- Documentation materials

7.8.5 Procedures

7.8.5.1 Collection:

7.8.5.1.1 Illicit drug evidence should be collected when latent print processing and/or the collection of potential touch DNA is required from the original packaging materials that were associated with the evidence when recovered.

7.8.5.1.2 The evidence should be weighed as received on the laboratory scale. A documentary photograph of the weigh should be taken and imported into the Overall Photos folder in the Mideo database with the remaining documentary images in the appropriate case folder.

7.8.5.1.3 LFU evidence processing personnel may coordinate with the Forensic Chemistry Unit (FCU) in situations involving the separation of potential drug evidence and the packaging prior to evidence processing. In cases involving potential powder drug evidence, FCU shall be consulted in order to ensure proper removal of the drug evidence prior to the examination of the packaging.

7.8.5.2 Processing post collection:

7.8.5.2.1 Proceed with latent print development and/or touch DNA collection upon request from the appropriate authority.

7.8.5.2.2 Whenever possible, process for latent print development and potential touch DNA collection on the illicit drug packages *in situ*.

7.8.5.2.3 Individual bags/packages should not be emptied of contents, unwrapped, or unpackaged unless latent print processing methods would be significantly compromised, or if the contamination of the bag/package contents with latent processing chemicals/reagents is likely to occur.

7.8.5.2.4 Follow appropriate LFU SOPs for latent print and touch DNA recovery.

7.8.5.2.5 If the illicit drug contents must be removed, the contents of individual bags/packages should be packaged within a new container and returned to each original container upon completion of the latent processing/recovery examination, if possible.

7.8.5.2.6 If the removed contents are tablets or pills, count the items and note such information in the worksheets.

- The counting is to be witnessed by a second LFU staff member.
- The worksheet must then be initialed by both the examining scientist and witness.

7.8.5.2.7 If the contents cannot be returned to the original container, package both the original container and contents in a new container.

- Document such an event in case notes and reports.

7.8.5.2.8 Proceed to packaging following evidence processing.

7.8.6 Packaging:

7.8.6.1 Prior to packaging, count the number of tablets or pills collected (as applicable) and note such information in worksheets and in the report.

7.8.6.2 Syringes shall be packaged in appropriate sharps tubes/containers and labeled appropriately.

7.8.6.3 Place collected evidence in a clear heat seal bag and label appropriately.

7.8.6.3.1 Syringes, inside of sharp tubes, shall also be placed in heat seal bags.

7.8.6.4 Place illicit drug evidence that is of a different composition, e.g., loose marijuana cigarette and a piece of "crack-cocaine", in separate heat seal evidence bags.

- 7.8.6.4.1 These can then be placed in one larger heat seal evidence bag if they are from the same case.
- 7.8.6.5 Use as many heat seal bags as required in order to clearly see every item submitted within a particular bag. Make sure each bag is large enough to ensure that the evidence can be resealed in the original evidence bag.
- 7.8.6.6 Heat seal the plastic bag.
 - 7.8.6.6.1 Heat sealed bags must have the examining scientist initials/signature and date across the heat seal. The initials/signature and date should be placed inside the bag along the seal edge prior to sealing rather than on the outside of the bag.
 - 7.8.6.6.2 When sealing evidence allow sufficient room for opening, analysis, and resealing after analysis.
- 7.8.6.7 Clearly mark all packaging with any hazard associated with the evidence, such as a biohazard, when the evidence has been in contact with a body fluid or has been recovered from a body cavity or from fecal matter.
- 7.8.7 Illicit Drug Processing via CEU:
 - 7.8.7.1 Illicit drug evidence may be submitted through CEU for additional forensic analysis, including, but not limited to, latent print processing and/or the collection of potential touch DNA.
 - 7.8.7.1.1 Most illicit drug evidence is received in heat-sealed bags.
 - 7.8.7.2 Examine the condition of the evidence container prior to opening.
 - 7.8.7.2.1 Document actions in appropriate worksheet(s).
 - 7.8.7.2.2 Indicate if the bag is sealed and the type of seal.
 - 7.8.7.2.3 Indicate whether or not an evidence label is present and contains the appropriate case information.
 - 7.8.7.3 Weigh the heat sealed evidence bag on a laboratory balance prior to opening. The weight and calibrated balance identifier will be recorded on the worksheet.

- 7.8.7.3.1 The worksheet must then be initialed by both the examining scientist and witness.
- 7.8.7.3.2 A documentary photograph shall be taken of the display on the scale to record the weight and imported into the overall photos folder within the appropriate case folder in the Mideo database.
- 7.8.7.4 When opening the heat seal bag, do not disturb any previous seals, if possible.
- 7.8.7.5 Proceed with latent print development and/or touch DNA collection.
 - 7.8.7.5.1 Follow appropriate LFU SOPs for latent print and touch DNA recovery.
- 7.8.7.6 After completion of the latent print processing/collection of potential touch DNA, repackage and reseal the evidence in a manner as similar as possible to the way it was submitted.
 - 7.8.7.6.1 To reduce the need to open the package to view the contents, all evidence items and identifying marks should be clearly visible through the repackaged heat sealed bags.
 - 7.8.7.6.2 Heat sealed bags must have the examining scientist initials/signature and date across the heat seal. The initials/signature and date should be placed inside the bag along the seal edge prior to sealing rather than on the outside of the bag.
- 7.8.7.7 Re-weigh the heat sealed evidence bag on a calibrated balance. This weighing is to be witnessed by a second LFU staff member. The weight will be recorded on the worksheet.
 - 7.8.7.7.1 The worksheet must then be initialed by both the examining scientist and witness. A second documentary photograph should be taken and imported into the overall photos folder within the appropriate case folder in the Mideo database.

7.9 Non-Porous Processes

7.9.1 Cyanoacrylate Fuming Procedures

7.9.1.1 Scope

The following procedures are meant to outline the general acceptable principles for the development of latent friction ridge detail using cyanoacrylate fuming on non-porous and semi-porous surfaces.

7.9.1.2 Background

- Cyanoacrylate esters are the main ingredients in the commonly named superglue adhesives. The liquid adhesive will vaporize when heated. In an atmosphere of high humidity, the cyanoacrylate vapors will polymerize on eccrine components of friction ridge skin residues. The result is a visible white coating that helps stabilize the fragile ridge detail residue.
- Over-fuming or overexposure of the evidence to cyanoacrylate fumes can result in excessive deposition of white polymerized cyanoacrylate on the item, obscuring any ridge detail.
- Wet or moist items are not suitable for cyanoacrylate processing.

7.9.1.3 Safety

- Wear personal protective equipment based on laboratory requirements. Similar precautions must be followed if cyanoacrylate is utilized in a field setting.
- Read Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedures.
- Cyanoacrylate ester fumes are caustic irritants and inhalation of the fumes should be avoided. High heat volatilization of cyanoacrylate ester can produce cyanide gas, which is toxic even in small concentrations. Do not heat above 200°C (392°F).
- Repeated contact of moist eyes with cyanoacrylate vapors can result in polymerization on the eye. Contact

lens wearers are cautioned to avoid prolonged exposure. Proper eye protection is required.

7.9.1.4 Materials

- Cyanoacrylate
- Fuming chamber
- Disposable aluminum dishes
- Deionized Water
- Positive and Negative Control

7.9.1.5 Standards and Controls

- A positive and negative control shall be performed with each procedure performed in conjunction with laboratory equipment. A quality check will be performed on each lot upon opening. The results shall be recorded in the Chemical Inventory database. For a positive control, place a known latent print onto a suitable non-porous surface. The negative control shall lack the latent print.
- Proceed with evidence processing after the confirmation of a positive test print and a negative control.
- Positive and negative control results as well as reagent lots shall be recorded in notes and/or worksheets.

7.9.1.6 Procedures

Refer to cyanoacrylate chamber specific operating manuals for the proper use of the chamber. The following steps should be followed when using cyanoacrylate as a latent print development method:

- Place evidence and controls in fuming chamber by either suspending or standing, so the entire surface area is exposed.
- Distribute items carefully so that items do not touch each other.
- Ensure that the water reservoir is full.
- Add cyanoacrylate to an aluminum dish; approximately the size of a quarter of cyanoacrylate.

- Place the dish on the heating element of the chamber.
- Close the fuming chamber and select the auto treatment cycle.
- Monitor the reaction of the controls and the evidence items.
- Start the purge cycle when sufficient development has been observed or allow the automated cycle to complete if insufficient development is observed.
- Remove the evidence from the chamber and visually inspect the evidence for ridge detail.
- Various visual lighting techniques should be used to aid in the visualization of the ridge detail.
- Photograph prints, if any.

7.9.1.7 Cyanoacrylate chambers

In order to effectively purge the cyanoacrylate vapors, the filters on each unit need to be replaced periodically. The filters used are activated charcoal filters. The filters shall be replaced by Latent Fingerprint Unit personnel. The filters shall be replaced according to manufacturer's recommendations and user manual instructions and documented in the equipment log.

The following shall be performed by LFU personnel as part of routine casework:

- The cyanoacrylate residue that accumulates on inside chamber walls should be removed periodically. The residue can be removed using products containing citric acid (Ex: WypAll waterless wipes, Magic Eraser, glass cleaner, etc.) or acetone.
- Acetone should not be used on plastic parts.
- A razor blade scraper can also be used to remove residue from the inside surfaces of the windows and hot plate UV sterilization (shortwave Ultra-Violet 254nm) lamps can be used to provide DNA decontamination. The lamps will denature DNA adhering to the internal surfaces of the chambers.
- UV decontamination of the chambers should be performed and documented within the equipment log.

7.9.2 Powder Processing Procedures

7.9.2.1 Scope

The following procedures describe the development of latent fingerprints using powders on non-porous/semi-porous surfaces.

7.9.2.2 Background

- Contact between friction ridge skin and a non-porous/semi-porous surface will sometimes result in a transfer of the skin coating covered with moisture to that surface. The non-absorbent nature of the surface prevents penetration by the deposited moisture.
- Traditional Fingerprint powders are very fine particles with an affinity for moisture. Sweat, grease, oil and most contaminants that coat the surface of friction ridge skin possess sufficient moisture and viscosity to attract and bind the fine particles together.
- Powder application is the effort to produce or improve the appearance of latent prints for eventual preservation.
- Magnetic powders consist of fine iron filings mixed with various types of powders that are applied through the principles of magnetic attraction.
- Fluorescent powders are powders developed specifically to produce fluorescence upon excitation by a specific wavelength of light. Using an alternate light source and a particular barrier filter a fluorescent latent print can be identified and distinguished from a multi-colored background.
- Care should be taken to avoid moisture or other contaminants from entering the powder container. If clumping is observed within the container, the container and the contents shall be discarded.

- Developed latent prints must be properly preserved. Two methods of preservation are photography and lift recovery.

7.9.2.3 Safety

- Wear personal protective equipment, to include appropriate particulate masks when downdraft station is not being utilized.
- Read Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedures.
- Fingerprint downdraft stations should be used where available.
- Fingerprint brushes can be decontaminated by using the UV Crosslinker between cases.
- A quality check will be performed on each lot upon opening. The results shall be recorded in the Chemical Inventory database.

7.9.2.4 Materials

- Fingerprint brushes
 - Magnetic wand
 - Synthetic fiber brush
 - Feather brush
 - Camel hair brush
- Lifting tape/Hinge Lifts
- Fingerprint cards
- Gel Lifts
- Mikrosil/Accutrans
- Alternate light sources

7.9.2.5 Procedures

- The overall application of traditional fingerprint powders are applied through direct contact to a substrate with an appropriate brush
- If applicable, process the evidence with cyanoacrylate prior to the application of any powder.
- If applicable, use sterile techniques when the possibility of DNA collection may follow the powdering process.
 - Use an unopened bottle of single use powder per item.
 - Use single-use brush per item.
 - Discard single-use supplies after processing.
- Examine the item of evidence for developed prints
- Apply a small amount of powder onto the surface of the item being processed by rotating the brush in a spinning motion. Brush in the direction of any ridges that begin to appear.
- Latent prints should be photographed prior to lifting when the surface texture or condition may inhibit a proper lift.
- Textured surfaces may also pose a challenge in the use of lifting tape.
- Tape lift alternatives include but are not limited to: polyethylene lifting tape and silicone casting (polyvinyl siloxane casting material).
- Apply lifting tape over the developed prints and smooth the tape, taking care to avoid the formation of air bubbles.
- Gently remove the tape lift and transfer it to a latent print card of an appropriate contrast color.
- Place the item specific LIMS barcode on the back of the latent print card with the scientist's initials across the sticker onto the card.

7.9.2.6 Powder Specific Practices:

- Choose the appropriate powder based on availability, evidence composition and/or background colors of the evidence.

7.9.2.6.1 Non-magnetic powders.

- Choose a powder color that will contrast the surface to be processed.
- Select the appropriate brush.
- Dip a dry brush into the powder.
- Use sterile powder or a secondary container.
- Tap or spin to remove excess powder.
- Using light circular motions, brush the powder onto the surface of the item. Continue brushing in the direction of ridges that begin to appear.
- Clear the print by dusting or brushing any excess powder from between the ridges to enhance the detail.
- Lift and/or photograph latent print based on texture of evidence.

7.9.2.6.2 Magnetic Powders.

- Should not be used on items of evidence that contain iron. Select a magnetic wand and a powder color that will contrast the surface being processed.
- Place magnetic wand with magnet engaged into secondary container or sterile container of magnetic powder.
- This will produce a bristle-like effect at the end of the wand when withdrawn.
- Apply in a circular motion to the surface being examined.
- Ensure that only the magnetic powder touches the surface, not the wand.
- After the print has developed, hold the wand over the powder reservoir and withdraw the control rod. This will disengage the magnet and release the powder.
- Re-engage the magnet and pass the clean wand

over the developed print and the surrounding area to remove excess powder.

- Do not touch the surface of the item being processed with the wand.
- Lift and/or photograph latent print based on texture of evidence.

7.9.2.6.3 Fluorescent Powders:

- Check evidence for background fluorescence using an alternate light source.
- Select an appropriate color fluorescent powder that will provide the greatest contrast when illuminated with the ALS.
- Roll the edges of a feather brush into a secondary container or sterile container of powder.
- Tap or spin to remove excess powder.
- Brush the powder onto the surface of the item and continue brushing in the direction of ridges that begin to appear.
- Clear the print by dusting or brushing any excess powder from between the ridges to enhance the detail.
- Select the appropriate ALS and barrier filter combination to visualize the print and great contrast against the background.
- Lift and/or photograph latent print based on texture of evidence.

7.9.3 Fluorescent Dye Stains

7.9.3.1 Rhodamine 6G

7.9.3.1.1 Scope

The following procedures describe the development of latent fingerprints using Rhodamine 6G after cyanoacrylate fuming for non-porous and/or semi-porous items.

7.9.3.1.2 Background

Rhodamine 6G is a fluorescent dye stain used as a supplemental processing procedure designed to enhance latent prints developed by cyanoacrylate fuming.

Rhodamine 6G adheres to polymerized latent prints, and will fluoresce in the range of 490nm to 530nm, and 575nm. Prints should be visualized through an appropriate filter.

Rhodamine 6G is a reagent that is available for use with a methanol-based carrier as well as an aqueous carrier.

7.9.3.1.3 Safety

Wear personal protective equipment based on laboratory requirements.

Read Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedures.

Dye stains contain chemicals that are irritants and flammable.

Dye stains should be applied in a fume hood and away from an open flame or ignition sources.

7.9.3.1.4 Materials

- Pre-formulated Rhodamine Solution
- Rinse Agent
- Alternate Light Source
- Barrier filter/goggles
- Fume Hood
- Camera Equipment

7.9.3.1.5 Rhodamine 6G solution

Rhodamine 6G is available in commercially prepared reagents. A quality check will be performed on each lot upon opening, and the information shall be entered into the Chemical Inventory database. Application and visualization will be accordance with manufacturer specifications.

7.9.3.1.5.1 Methanol based reagent

Dissolve 0.01g of Rhodamine 6G in 1.0L of reagent grade solvent (methanol or isopropanol), and label appropriately.

7.12.3.1.5.2 Aqueous solution

Dissolve 0.01g of Rhodamine 6G in 1.0L of deionized water, and label appropriately.

7.9.3.1.6 Standards and Controls

A positive and negative control shall be performed with each procedure when utilizing a non-commercially prepared reagent. For a positive control, place a test latent print onto a suitable analogous surface. The negative control shall lack the latent print.

Expose the positive and negative control to the same procedure of the evidence.

Proceed with evidence processing after the confirmation of a positive fluorescent test print and a negative control.

Positive and negative control results as well as reagent lots shall be recorded in notes and/or worksheets.

7.9.3.1.7 Procedures

- Select the appropriate application method (immersion or spraying) depending on the size of

the evidence being processed.

- Choose the appropriate Rhodamine 6G formulation based on the composition of the evidence.

7.9.3.1.7.1 Methanol based solution

Use for non-porous and/or semi-porous items and/or items where methanol will not be detrimental to item.

7.9.3.1.7.2 Aqueous based solution

Use for general non-porous and/or semi-porous items where methanol will cause a deleterious effect on the composition of item; for example but not limited to: wood varnishes, plastics (not including bags)

Rinse the item with methanol or deionized water based on the formula of Rhodamine 6G.

7.9.3.1.7.3 Examine the item with an alternate light source using the appropriate wavelength range and an appropriate filter. Orange or red barrier filters are recommended based on the wavelength of the light source.

7.9.3.1.7.4 Photograph any developed latent prints using the appropriate visualization methods and laboratory procedures.

7.9.3.2 Ardrex

7.9.3.2.1 Scope

Ardrex is a fluorescent dye stain used to further visualize impressions that have been previously processed with cyanoacrylate.

7.9.3.2.2 Background

Ardrox is a highly fluorescent dye stain that is used after cyanoacrylate fuming. Ardrox is a viscous yellow liquid and it is recommended that it be diluted before using. When illuminated with an ultraviolet radiation or ALS, latent prints fluoresce brightly.

7.9.3.2.3 Safety

Wear a laboratory coat and non-porous gloves. Safety glasses or goggles will be worn if the potential of splashing chemicals exists.

The solution(s) can be stored at room temperature in an airtight dark container. Residual reagent may be allowed to evaporate in the hood or excess should be disposed of down the drain with excess water.

7.9.3.2.4 Materials

Pre-formulated Ardrox.

7.9.3.2.5 Standards and Controls

A positive and negative control shall be performed when opening a new lot. The results will be documented in the Chemical Inventory database. For a positive control, place a test latent print onto a suitable analogous surface. The negative control shall lack the latent print.

7.9.3.2.6 Procedures

- Application can be performed by spraying, immersing, toweling, cascading, or pooling.
- Semi-porous items such as leather, vinyl, or items that have a surface that may be damaged due to the carrier of the reagent, an aqueous processing reagent should be used.
- Excess reagent may be rinsed away using deionized water if background staining occurs.

- Examine the item with ultraviolet radiation (350nm - 415nm) or an ALS under various wavelengths while wearing yellow/clear filter goggles.

7.9.3.3 R.A.M.

7.9.3.3.1 Scope

R.A.M. is a mixture of three (3) fluorescent dye stains that are used to further visualize impressions developed with cyanoacrylate.

7.9.3.3.2 Background

Staining with fluorescent dyes can enhance and improve the quality of cyanoacrylate developed prints. The dye is absorbed by the cyanoacrylate and can be visualized with the ALS due to fluorescence. R.A.M. is a combination of Rhodamine 6G, Ardrex, and M.B.D. 7-(P-Methoxybenzylamino-4-Nitrobenz-2-Oxa-1,3-Diazole).

7.9.3.3.3 Safety

Wear a laboratory coat and non-porous gloves. Safety glasses or goggles will be worn if the potential of splashing chemicals exists.

The solution(s) can be stored at room temperature in an airtight dark container. Residual reagent may be allowed to evaporate in the hood or excess should be disposed of down the drain with excess water.

7.9.3.3.4 Materials

Pre-formulated R.A.M.

7.9.3.3.5 Standards and Controls

A positive and negative control shall be performed when opening a new lot. The results will be documented in the Chemical Inventory database. For a positive control, place a test latent print onto a suitable

analogous surface. The negative control shall lack the latent print.

7.9.3.3.6 Procedures

- Application can be performed by spraying, immersing, toweling, cascading, or pooling.
- Semi-porous items such as leather, vinyl, or items that have a surface that may be damaged due to the carrier of the reagent, an aqueous processing reagent should be used.
- Excess reagent may be rinsed away using deionized water if background staining occurs.
- Examine the item with an ultraviolet light or an ALS under 350nm-550nm wavelengths while wearing filter goggles.
- M.B.D. is best visualized under the following conditions:

Using orange filter: 415 nm to 505 nm range.

Using yellow filter: 415 nm to 470 nm range.

Note: Visualization can be achieved using the appropriate visualization techniques of the individual dye stain components.

7.9.4 Additional Non-Porous Reagents

7.9.4.1 Small Particle Reagent

7.9.4.1.1 Scope

The following procedures described are for the use of Small Particle Reagent (SPR) for the development of latent prints. It is available in black, white and fluorescent variations.

7.9.4.1.2 Background

- Small Particle Reagent, is a lipid-sensitive reagent used for processing wet items for latent prints. Both porous and nonporous surfaces that are wet at the time of latent print deposit or become wet after deposit seldom retain sufficient water-soluble material for conventional processing methods. Non-porous items that have been allowed to dry offer some potential if the deposit contains non water-soluble oily matter.
- SPR is useful in processing items where mud, dirt or heavy debris has covered prints making them difficult to develop with conventional means. Excess dirt or debris may be rinsed away by flowing water over the area, then applying SPR.
- SPR processed latents can be lifted and/or photographed for preservation. SPR lifts easily from dried, processed, nonporous surfaces, and the intense development color generally facilitates photographic preservation.

7.9.4.1.3 Safety

Wear personal protective equipment based on laboratory and field-work requirements.

Read Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedures.

7.9.4.1.4 Materials

- PPE
- SPR pre-mixed solution
- Trays or spray bottles
- Camera equipment

- Lifting materials

7.9.4.1.5 Standards and Controls

A quality check will be performed on each lot upon opening. The results shall be recorded in the Chemical Inventory database.

Positive and negative control results as well as reagent lots shall be recorded in notes and/or worksheets.

7.9.4.1.6 Application

Choose the application technique based on the item of evidence and/or the availability of resources for laboratory or field-work application. SPR can be applied via spray bottle or immersion.

7.9.4.1.7 Immersion Technique

- Shake the SPR solution well and place in a shallow tray. The tray should be filled until it will cover the item to be processed.
- Stir the solution again and before each item is placed into the solution.
- Place the item to be processed in the liquid so it is positioned as flat as possible in the tray.
- Allow the item to remain in the suspension and the particles to settle on the item for 30 seconds.
- Turn the item over and allow to settle for 30 seconds.
- Continue the procedure until all surfaces have been exposed to the solution.
- Place the item into a tray of clean tap water, or gently

rinse the item with deionized water.

- Rock the tray or a flow of tap water can be established in the tray.
- The excess SPR will readily be removed.
- Allow the item to dry.

7.9.4.1.8 Spray Bottle Application

- Spray a flow of SPR over the surface of the item.
- Wash the surface with a light to moderate flow of clean tap water.
- Allow the item to dry.
- Lift and/or photograph latent print based on texture of evidence.
- Latent prints should be photographed prior to lifting when the surface texture or condition may inhibit a proper lift.

7.9.4.2 Sudan Black

7.9.4.2.1 Scope

Sudan black is a sebaceous stain that develops impressions that may be left in grease, oils, or foodstuffs.

7.9.4.2.2 Background

Sudan Black is used to develop prints on smooth or rough, non-porous surfaces contaminated with greasy or sticky substances. It works best on glass, metal or plastic materials. It can be used on waxy surfaces, such as candles or wax-paper milk cartons. Sudan Black stains the fatty components of sebaceous secretions. Besides being sensitive to grease, oils and

sticky substances, it will also enhance cyanoacrylate developed latent prints.

7.9.4.2.3 Safety

Wear a laboratory coat and non-porous gloves. Perform processing in a well-ventilated area or a fume hood. Safety glasses or goggles shall be worn if the potential of splashing chemicals exists.

The Sudan Black solution can be stored at room temperature in an air-tight container. Excess solution may be disposed of down the drain with excess water.

7.9.4.2.4 Materials

Pre-formulated Sudan Black

7.9.4.2.5 Standards and Controls

A positive and negative control shall be performed when opening a new lot. The results will be documented in the Chemical Inventory database. For a positive control, place a test latent print onto a suitable analogous surface. The negative control shall lack the latent print.

7.9.4.2.6 Procedures

- Apply by **spraying** or **immersion**. Development by spraying will occur within approximately 30 seconds. Development by immersion will occur within approximately 2 – 3 minutes.
- Latent impressions will appear black in color.

Note: Sudan Black may interfere with blood and body fluid examinations, specifically recovery of DNA.

7.10 Porous Techniques

7.10.1 Iodine Fuming

7.10.1.1 Scope

The following procedures describe the development of latent fingerprints using Iodine Fuming on porous items.

7.10.1.2 Background

Iodine fuming is a technique used to develop latent impressions that have been deposited onto porous surfaces.

Iodine is effective on latent impressions that have been recently deposited, and targets the sebaceous components of the matrix to develop a reddish-brown colored impression that is readily visible.

Iodine fuming development is temporary and must be photographed quickly following development.

Iodine may be employed using an applicator or iodine fuming chamber.

7.10.1.3 Safety

Wear personal protective equipment based on laboratory requirements.

Read Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedures.

Iodine is an irritant, and care should be given to avoid exposure to the emitted fumes.

Iodine should be applied in a fume hood or in a well-ventilated area.

7.10.1.4 Materials

- Iodine crystals
- Fuming chamber or applicator
- PPE
- Fume Hood
- Camera Equipment
- Tripod/Copy stand

7.10.1.5 Iodine Fuming Reagents

Iodine is available in commercially prepared reagents. A quality check will be performed during each use, and the information shall be entered into the Chemical Inventory database. Application and visualization will be accordance with manufacturer specifications.

7.10.1.6 Iodine chamber

When utilizing an Iodine fuming chamber, ensure the chamber is operated underneath the confines of the fume hood within the laboratory. Visual monitoring must be done during the examination process.

7.10.1.7 Standards and Controls

- A positive and negative control shall be performed with each procedure. For a positive control, place a test latent print onto a suitable analogous surface. The negative control shall lack the latent print.
- Expose the positive and negative control to the same procedure of the evidence.
- Proceed with evidence processing after the confirmation of a positive test print and a negative control.

- Positive and negative control results as well as reagent lots shall be recorded in notes and/or worksheets.

7.10.1.8 Procedures

- The fuming chamber/applicator must be used under laboratory conditions within the confines of a fume hood.
- When turned on, the chamber's hot plate will activate. Place the iodine crystals in an aluminum tray, place on the hot plate and secure the chamber door.
- The applicator is applied via oral pressure. The ventilation generated by the analyst will force the iodine fumes to be emitted onto the surface.
- Visually monitor the development of any impressions on the evidence. Upon completion of the fuming process, turn off the chamber and open the door to vent.
- When impressions have been developed, they must be photographed under evidentiary conditions, as quickly as possible, as this development technique is temporary and will begin to fade.

7.10.2 DFO (1,8-Diazafluoren-9-one)

7.10.2.1 Scope

The following procedures describe the development of latent print impressions on porous surfaces using DFO (1,8-Diazafluoren-9-one).

7.10.2.2 Background

DFO (1,8-Diazafluoren-9-one) is a ninhydrin analogue. DFO is an effective reagent for latent print development on paper as well as other porous surfaces; such as but not limited to, cardboard,

raw wood, plasterboard, matte-emulsion painted surfaces and wall coverings.

DFO reacts with amino acids in perspiration and will also develop fingerprints in blood on most surfaces.

The DFO reaction results in a latent print that will fluoresce when illuminated with the appropriate wavelengths. Some fingerprints may have magenta or pink/purple coloration, but the use of an alternate light source is essential as most fingerprints developed with the reagent are not visible under normal lighting conditions.

DFO absorbs light over a wide range of wavelengths in the blue, green and yellow regions of the visible spectrum. The absorption spectrum is broad, rising to a maximum at about 568nm with smaller peaks at 450nm and 525nm.

Selection of excitation wavelength and barrier filters will depend on the fluorescence characteristics of the background and the type of light source used.

DFO coloration is not permanent, and while some developed prints may remain visible for years, other may fade in a matter of days. Photographic preservation is essential and should be accomplished as soon as possible. Contrasting fingerprint ridge detail is usually improved using a contrasting filter during image capture.

7.10.2.3 Safety

Wear personal protective equipment (e.g., lab coat, gloves, mask, hair net, eye protection), when carrying out standard operating procedures.

Read Material Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedures.

DFO applications should be performed within a fume hood.

7.10.2.4 Materials

- PPE
- Lab coat

- Mask
- Eye-protection
- Hair net
- Gloves
- DFO solution
- Fume hood
- Sterile tools
- Glass tray
- Drying oven
- Alternate light source
- Colored safety glasses
- Camera equipment

7.10.2.5 Standards and Controls

A quality check will be performed on each lot upon opening. The results shall be recorded in the Chemical Inventory database.

During each use in casework, a positive and negative control will be tested simultaneously with the evidence. For a positive control, place a known latent print onto a suitable analogous surface. The negative control shall lack the latent print.

Process controls and evidence simultaneously.

Positive and negative control results as well as reagent lots shall be recorded in notes and/or worksheets.

7.10.2.6 Procedures

DFO must be applied to the evidence prior to Ninhydrin.

Select the appropriate DFO formulation based on the composition of the evidence.

7.10.2.6.1 Petroleum Ether based DFO

Use for general porous surfaces.

1, 8-Diazafluoren-9-one (DFO)

Methanol
Ethyl Acetate
Glacial Acetic Acid
Petroleum Ether

Stock Solution

1. Combine 0.5 g of DFO, 100 ml methanol, 100 ml ethyl acetate and 20 ml acetic acid into a 250 ml beaker.
2. Using a stirring plate mix the solution for 20 minutes or until DFO crystals are dissolved.

Working solution

Dilute stock solution with 780 ml of petroleum ether for a total solution volume of 1 liter.

Storage Conditions

Amber glass bottles
Flammable cabinet

Expiration Information

Up to 3 weeks from date of preparation. Effectiveness may reduce post 3 weeks.

7.10.2.6.2 HFE-7100 based DFO

Use for documents where the preservation of ink is necessary

1, 8-Diazafluoren-9-one (DFO)

Methanol
Glacial Acetic Acid
HFE-7100

Stock Solution

1. Dissolve 0.25 g of DFO in 40 ml of methanol in a 250 ml beaker.
2. Add 20 ml of acetic acid to the beaker.

3. Using a stirring plate, mix until the DFO has dissolved into the solution.

Working solution

4. Transfer stock to 1 liter beaker.
5. Add 940 ml of HFE-7100 and stir.
6. Cover and allow solution to settle for 30 minutes.
 - a. A thick film may form on top of the solution. Film may contain undissolved matter. Remove film by skimming the solution using a pipette or using a separatory funnel.

Storage Conditions

Amber glass bottles
Flammable cabinet

Expiration Information

Up to 6 months from date of preparation.

7.10.2.6.3 Development procedure

Completely submerge the item of evidence in the working tray until the item is saturated. The item can be manipulated using tongs or forceps.

Remove and allow the item of evidence to dry completely.

Place item of evidence in a humidity free drying oven at 100°C for 20 minutes

Remove and examine evidence.

Latent prints may be visible to the naked eye but an alternate light source, ALS, examination must follow a white light examination.

Use the following parameters when employing an ALS and filter combination for DFO examination:

DFO Visualization Parameters

- Most Documents 450nm, 485nm, 525nm, 530nm with an Orange barrier filter
- Brown/yellow documents 570-590nm with a Red barrier filter

Photograph latent prints, if any and archive into appropriate database.

7.10.3 1,2 Indanedione

7.10.3.1 Scope

The following procedure describes the development of latent fingerprints on porous particularly thermal papers.

7.10.3.2 Background

Thermal paper is a heat sensitive paper most commonly used for point of purchase receipts. It is different from paper products that are typically encountered during latent fingerprint development. Thermal papers are made up of several layers, each with a functional purpose. The most important layers are the active coat, which contains the chemicals for the printed image, and the top and back coats that seal the paper on which latent fingerprints may be deposited.

Static Sensitivity is an industry index that is a measure of the temperature at which the paper starts to react. Typically thermal papers begin to darken when the temperature starts to exceed 60°C.

Polar solvent systems are known to be detrimental to the paper, turning the paper black. However, polar solvents are necessary to bring the amino acid reagent into solution. Modifications to amino acid based reagents have been developed to minimize the amount of polar solvent while causing minimal damage to the paper. The reagent 1,2-Indanedione is a ninhydrin analog that reacts with the amino acids present in latent fingerprint residue. The reaction between the amino acids and 1,2-Indanedione

results in a pale pink color that has an intense luminescence when excited with green light.

7.10.3.3 Safety

Wear appropriate personal protective equipment when carrying out standard operating procedures.

Read I Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedures.

7.10.3.4 Materials

- Pre-formulated 1,2-Indanedione
- PPE
- ALS/Forensic Laser
- Camera equipment
- Barrier filters/goggles
- 1,2-Indanedione
- Ethyl Acetate
- HFE-7100
- Fume hood
- Heat and humidity chamber
- Glassware

7.10.3.5 Standards and Controls

A positive and negative control shall be performed on each lot upon opening. The results will be recorded in the Chemical Inventory database. During use in casework, a positive and negative control should be performed simultaneously with the examination of evidence. For a positive control, place a known test print onto a suitable analogous surface. The negative control shall lack the latent print.

Place both controls in the humidity chamber with evidence and process simultaneously.

Positive and negative control results as well as reagent lots will be recorded in notes and or worksheets.

7.10.3.6 Procedures

Pre-formulated 1,2-Indanedione

Formula: 1,2-Indanedione (HFE-7100)

1g 1,2-Indanedione

35ml Ethyl Acetate

465ml HFE-7100

Directions

- Add 1g of 1,2-Indanedione to 35ml of Ethyl Acetate, and stir.
- After the 1,2-Indanedione has dissolved, add this solution to the 465ml of HFE-7100 and stir.
- Select the appropriate application method (spray, dip, or brush) depending on the size of the evidence being processed.
- The 1,2-Indanedione reagent should be applied while working under a fume hood.
- Allow the evidence to completely dry before placing in the humidity chamber.
- Misonix Humidity Chamber Operation (Note: The chamber conditions on the control panel appear in the red display while the set points appear in the green display):
 - Place evidence and controls in the chamber so the entire surface area is exposed and items do not touch each other.
 - Ensure that the water reservoir is full.
 - Turn the “Humidity Switch” to ON.
 - Set the “Temperature Fail Safe” as follows:
 - Minimum: 10°C

- Maximum: 50°C
- Enter the Temperature and Humidity set points:
 - Temperature: 50°C
 - Humidity: 70%
- Air Science Humidity Chamber Operation (Note: The chamber conditions on the control panel appear in the red display while the set points appear in the green display):
 - Place evidence and controls in the chamber so the entire surface area is exposed and items do not touch each other.
 - Ensure that the water reservoir is full.
 - Turn the unit to ON and designated the settings as designated on the unit.
 - Once the temperature and humidity levels have reached the desired settings, place the evidence in the chamber.
- The humidity level will drop very quickly once the door is opened, therefore, place evidence in the chamber in a quick and efficient manner and close the door as quickly as possible.
- Once the chamber has reached the humidity level, evaluate the evidence and controls after approximately 20 minutes of incubation in the Misonix chamber, and according to specifications for the Air Science chamber.
- Latent prints developed with 1,2-Indanedione appear a light pink color and may be difficult to visualize with the unaided eye.

- Remove the evidence from the chamber and examine with an alternate light source ($\approx 505 - 530\text{nm}$ with an orange barrier filter).
- Photograph prints, if any.
- If no results are present or the reaction is weak, the paper(s) can be placed into an envelope or plastic bag and place into a dark secured storage location at room temperature.
- Monitor the results for a period of approximately twenty-four (24) to forty-eight (48) hours.
- Ensure photographs are downloaded to the appropriate image archival system.

7.10.4 Ninhydrin

7.10.4.1 Scope

The following procedures describe the development of latent prints using ninhydrin on porous surfaces/semi-porous surfaces which are not water soaked and do not contain inherent animal proteins; for example but not limited to, grease laden food wrappers.

7.10.4.2 Background

Ninhydrin, or 1,2,3-Triketohydrindene monohydrate, is a sensitive indicator of amino acids, proteins, peptides and polypeptides.

The reaction produces a violet to blue-violet (Ruhemann's Purple) coloring of the amino acids, proteins, peptides and polypeptides and is effective even with older deposits and/or minute deposits of amino acids.

7.10.4.3 Safety

Wear personal protective equipment (e.g., lab coat, gloves, mask, hair net, eye protection), when deemed necessary to carry out standard operating procedures.

Read Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedures.

Ninhydrin applications must be performed in a fume hood.

7.10.4.4 Materials

- Ninhydrin solution (Pre-formulated or stock)
- Fume hood
- Humidity chamber or a steam iron
- Glass or metal trays
- Camera equipment

7.10.4.5 Standards and Controls

A positive and negative control shall be performed with each procedure. A quality check will be performed on each lot upon opening, and the results shall be recorded in the Chemical Inventory database. For a positive control, place a known latent print onto a suitable analogous surface. The negative control shall lack the latent print.

Expose the positive and negative control to the same procedure of the evidence.

Proceed with evidence processing after the confirmation of a positive test print and a negative control.

Positive and negative control results as well as reagent lots shall be recorded in notes and/or worksheets.

7.10.4.6 Procedures

- Select the appropriate application method (spray, dip) depending on the size of the evidence being processed.
- Choose the appropriate Ninhydrin formulation based on the composition of the evidence.
- Petroleum Ether based Ninhydrin
- Use for general porous surfaces.

7.10.4.6.1 HFE-7100 based Ninhydrin

Stock Solution

- Dissolve 5g ninhydrin crystals in 45 mL of reagent grade ethanol
- Add 2 mL of reagent grade ethyl acetate and 5 mL of Glacial acetic acid to solution from 1.
- Mix until the ninhydrin has dissolved into the solution.

Working Solution

- Transfer the ninhydrin stock solution to a beaker containing 1 L of HFE-7100 and stir. The solution will appear cloudy at first; stir until the solution becomes clear.
- When the solution clears, there will be a film on the top of the solution that consists of water, excess ethanol, and un-dissolved ninhydrin.
- Filter the solution through a separating funnel.
- Label appropriately.
- Use for documents where the preservation of ink is necessary.

7.10.4.7 Ninhydrin Development

- Allow the evidence to completely dry before applying steam using the humidity chamber or a steam iron.

Misonix Humidity Chamber Operation (Note: The chamber conditions on the control panel appear in the red display while the set points appear in the green display):

- Ensure that the water reservoir is full.
- Turn the "Humidity Switch" to ON.
- Set the "Temperature Fail Safe" as follows:

- Minimum: 10°C
- Maximum: 80°C
- Enter the Temperature and Humidity set points:
 - Temperature: 50°C
 - Humidity: 70%

Air Science Humidity Chamber Operation (Note: The chamber conditions on the control panel appear in the red display while the set points appear in the green display):

- Place evidence and controls in the chamber so the entire surface area is exposed and items do not touch each other.
- Ensure that the water reservoir is full.
- Turn the unit to ON and designated the settings as designated on the unit.
- Once the temperature and humidity levels have reached the desired settings, place the evidence and controls in the chamber.
- The humidity level will drop very quickly once the door is opened; therefore, place evidence in the chamber in a quick and efficient manner and close the door as quickly as possible.
- Evaluate the evidence and controls at approximately 20 minutes of incubation in the Misonix chamber and according to specifications on the Air Science chamber.
- Continue development until ridge detail is observed on the controls, then remove.
- A steam iron may be used only when the humidity chamber is off-line.
 - Fill the iron with water and set the iron to the highest steam setting.
 - Once the steam setting has been reached,

hold the iron two (2) to three (3) inches away from the paper ensuring not to make physical contact between the evidence and the hot iron.

- Move the iron back and forth over the paper until the prints develop.
- Photograph latent prints, if any.
 - The Ninhydrin coloration (Ruhemann's purple) is not permanent. Photographic preservation is essential and should be accomplished as soon as possible.

7.10.4.8 Ninhydrin chamber

- The ninhydrin latent print development chamber is a humidity incubator type chamber.
- Chamber surfaces should be cleaned periodically using products containing citric acid (Ex: WypAll waterless wipes, Magic Eraser, glass cleaner, etc.) or acetone. Maintenance to be recorded in the equipment log.
- Acetone should not be used on plastic parts.
- Chamber shelves shall be disinfected periodically using 10% bleach followed by 70% ethanol. And recorded in laboratory equipment logs.
- If the chamber appears to be malfunctioning, notify the LFU Manager, Technical Leader and Quality Assurance specialist so that a service call may be placed to the manufacturer or outside contractor for repairs.

7.10.5 Silver Nitrate Spray

7.10.5.1 Scope

Silver nitrate is a reagent that is used on porous items to develop latents. The development process can be negatively affected by the presence of metal.

7.10.5.2 Background

Silver nitrate reacts with the chlorides present in fingerprints to produce silver chloride, a material which turns grayish-brown when exposed to light. It can be used on paper, cardboard and light colored raw-wood. Silver nitrate is not suitable for items that have been wet.

Note: Silver nitrate may interfere with blood and body fluid examinations, specifically recovery of DNA.

7.10.5.3 Safety

Wear chemical resistant gloves and use forceps (as directed above) to handle treated items. If a risk of splashing chemicals is present, wear safety goggles. When possible, perform work in the hood. The chemicals used for this process are corrosive and toxic and will cause black stains to appear on skin and clothing.

Silver nitrate solution can be stored at room temperature in an airtight dark bottle. Dispose of excess solution in a dedicated container for silver nitrate in the hood.

7.10.5.4 Materials

Pre-formulated silver nitrate spray.

7.10.5.5 Standards and Controls

A positive and negative control shall be performed upon opening each lot. The information shall be recorded in the Evidence Inventory database. For a positive control, place a known latent print onto a suitable analogous surface. The negative control shall lack the latent print.

Expose the positive and negative control to the same procedure of the evidence.

Proceed with evidence processing after the confirmation of a positive test print and a negative control.

Positive and negative control results as well as reagent lots shall be recorded in notes and/or worksheets.

7.10.5.6 Procedures

1. Apply by spraying.
2. Allow the item to dry.
3. Latent impressions will develop when exposed to room light. To accelerate development, expose the evidence to short-wave ultraviolet light or direct sunlight.

Visualization

1. Latent impressions developed with silver nitrate will be dark grayish-brown in color.
2. Photograph immediately following development.
3. Latent impressions developed with this method will not fade. On the contrary, they will continue to develop when exposed to light.

7.10.6 Oil Red O

7.10.6.1 Scope

Oil Red O is a reagent used to develop impressions on porous substrates. Oil Red O is sensitive to lipid components and can be used on porous items that are wet.

7.10.6.2 Background

Oil Red O is a development technique primarily used on porous items that have become wet. It is a lipid stain that can also be used on thermal paper, and may be used as a precursor to Silver Nitrate treatment.

7.10.6.3 Safety

Wear chemical resistant gloves to handle treated items. If a risk of splashing chemicals is present, wear safety goggles. When possible, perform work in the hood. The chemicals used for this process are corrosive and may cause red stains to appear on skin and clothing.

Oil Red O solution can be stored at room temperature in an airtight dark bottle. Dispose of excess solution in a dedicated container for Oil Red O in the hood.

7.10.6.4 Materials

Pre-formulated Oil Red O solution and destain rinse (phosphate buffer.)

7.10.6.5 Standards and Controls

A positive and negative control shall be performed upon opening each lot. The information shall be recorded in the Evidence Inventory database. For a positive control, place a known latent print onto a suitable analogous surface. The negative control shall lack the latent print.

Expose the positive and negative control to the same procedure of the evidence.

Proceed with evidence processing after the confirmation of a positive test print and a negative control.

Positive and negative control results as well as reagent lots shall be recorded in notes and/or worksheets.

7.10.6.6 Procedures

1. Apply by spraying or dipping.
2. Development should begin in 5 minutes.
3. Allow the item to dry.
4. Rinse item using the destain rinse.

5. Photograph any visualized impressions.

Visualization

1. Latent impressions developed with Oil Red O will be reddish in color.
2. Photograph immediately following development.

7.10.7 Zinc Chloride

7.10.7.1 Scope

Zinc chloride is a reagent used to develop impressions on porous substrates. Zinc chloride is sensitive to Ninhydrin and 1,2 Indanedione components and can be used in formulation with 1,2 Indanedione to increase fluorescence.

7.10.7.2 Background

Zinc chloride is traditionally used post-ninhydrin treatment to increase contrast and offer a fluorescent visualization. It has also been shown to increase the fluorescence of 1,2 Indanedione treatment in developing latent impressions on porous items.

7.10.7.3 Safety

Wear chemical resistant gloves to handle treated items. If a risk of splashing chemicals is present, wear safety goggles. When possible, perform work in the hood. The chemicals used for this process are flammable and contact with skin and clothing should be avoided.

Zinc chloride solution can be stored at room temperature in an airtight dark bottle. Excess solution should be allowed to evaporate under a fume hood and residual waste may be rinsed.

7.10.7.4 Materials

Pre-formulated Zinc Chloride solution.

If preparing Zinc Chloride within the laboratory:

Zinc Chloride Stock Solution

8 grams Zinc chloride crystals
180 ml Ethanol
Add 20 ml Glacial Acetic acid

Combine and stir with a magnetic stirrer
until ALL the ingredients are dissolved.

Zinc Chloride Working Solution

6 ml Zinc chloride stock solution
100 ml Petroleum ether

7.10.7.5 Standards and Controls

A positive and negative control shall be performed upon opening each lot. The information shall be recorded in the Evidence Inventory database. For a positive control, place a known latent print onto a suitable analogous surface. The negative control shall lack the latent print.

Expose the positive and negative control to the same procedure of the evidence.

Proceed with evidence processing after the confirmation of a positive test print and a negative control.

Positive and negative control results as well as reagent lots shall be recorded in notes and/or worksheets.

7.10.7.6 Procedures

1. Apply by spraying.
2. Allow the item to dry. (Repeat steps 1 and 2)
3. Bake in DFO Oven at 80-100°C at approx. 65% humidity for 40 minutes. Caution: Not for use with thermal paper at these temperatures.

4. Zinc Chloride may also be developed using the humidity chambers in accordance with the settings and procedures for ninhydrin in section 7.10.4.7.
5. View at 490nm - 570nm with an appropriate barrier filter
6. Photograph any visualized impressions.

Visualization

1. Latent impressions developed with Zinc Chloride will be fluorescent.
2. Photograph immediately following development.

7.11 Blood Reagents

7.11.1 Amido Black

7.11.1.1 Scope

The following procedures are for the enhancement of bloodstain evidence using Amido Black (Naphthol Blue Black, Naphthalene Black 10B).

7.11.1.2 Background

Amido Black is a general protein stain particularly to proteins present in blood. Amido Black binds to hemoglobin (protein in blood), changing bloodstains a blue-black color. Amido Black is a permanent procedure which can be used on nonporous surfaces.

Research has indicated that the application of Amido Black is not detrimental to subsequent DNA analysis, based on the formulation chosen.

7.11.1.3 Safety

Wear personal protective equipment, PPE, based on laboratory and fieldwork requirements when carrying out standard operating procedures.

Read Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedures.

7.11.1.4 Materials

- Pre-formulated Amido Black (5-SSA application may be required)
- PPE
- Amido Black reagent
- Trays or wash bottles
- Camera equipment

7.11.1.5 Standards and Controls

A quality check will be done upon opening each lot. The results will be entered in the Chemical Inventory database. These checks will include positive and negative controls before application of the Amido Black reagent to evidence.

A positive control should consist of a known blood standard.

A negative control should consist of an unstained substrate.

Positive and negative control results as well as reagent lots shall be recorded in notes and/or worksheets.

7.11.1.6 Procedures

Prior to applying Amido Black treatment, collect a sample of the suspected blood, if visible, for DNA testing.

Caution should be exercised not to disturb the pattern.

Test a control area with some rinse solution to prevent the potential destruction of the pattern-containing surface.

Choose the appropriate formulation based on the surface test.

7.11.1.6.1 Methanol based solution.

The methanol content adversely affects certain surfaces such as finished wood, certain plastics, and some painted surfaces. If any surface alteration or destruction occurs, use the aqueous based formula.

Formulation

Amido Black
Glacial Acetic Acid
Methanol

Procedure

1. Staining solution:
 - Add 10 ml of glacial acetic acid to 90 ml methanol.
 - Dissolve 0.2 g of amido black in the methanol/acetic acid solution.
2. De-stain solution:
 - Add 10 ml of glacial acetic acid to 90 ml methanol.

Storage Conditions

Clear or amber bottles
Flammable cabinet

Expiration Information

Up to 3 years from date of preparation

7.11.1.6.2 Aqueous based solution.

Use for general items where methanol will cause a deleterious effect on the composition of the item.

Subsequent DNA collection can be performed when using the aqueous based solution

Formulation

5-Sulfosalicylic acid
Amido Black
Citric Acid, Anhydrous
Kodak 'Photo-Flo 200' Solution
Deionized Water

Procedure

1. Fixing solution:

- Add 20 g of 5-Sulfosalicylic acid to a dry beaker.
- Add 1000 ml of deionized water to the beaker.
- Stir using a stirring plate until the 5-Sulfosalicylic acid has dissolved.

2. Staining solution:

- Add 19 g of citric acid to 1000 ml of deionized water. This creates the stock.
- Dissolve 2 g of Amido Black into the stock solution and stir for approximately 30 minutes.
- Add 6 ml of Kodak 'Photo-Flo 200' to the mixture and stir.

3. De-staining solution:

- Add 19 g of citric acid to 1000 ml of deionized water.

Storage Conditions

Amber bottles
Flammable cabinet (Staining and De-staining solutions)
Cool, dry cabinets (5-Sulfosalicylic acid solution)

Expiration Information

Up to 1 year from date of preparation

Immerse the item to be stained in enough stain solution to cover it fully, or apply enough of the stain solution to the item by pouring or spraying. Keep the item in the stain solution for approximately 1-2 minutes.

Remove the item from the stain solution.

Rinse gently with an appropriate destain solution, or distilled water for pre-formulation, until excess stain has been removed, changing destain solution as necessary.

Fully record and document all visualized or enhanced patterns.

Photograph patterns, if any.

Impressions that were not visible or recorded prior to the application of the reagent should be sampled for DNA testing at this time.

Perform such a collection only if the aqueous based solution was employed.

Archive photos into the Mideo Imaging Database.

7.11.1.7 Interpretation

The blood impressions may be intensified and additional detail not previously visible may be revealed. Amido Black is extremely stable. However, developed impressions considered to be useful should be photographically preserved. Dried impressions which lose contrast may be immersed a second time in the last solution and photographed.

7.11.2 Leucocrystal Violet (LCV)

7.11.2.1 Scope

The following procedures describe how Leucocrystal Violet (LCV) can be used to enhance and develop visible/latent impressions produced in blood on porous and nonporous surfaces.

7.11.2.2 Background

LCV, a catalytic test for blood, is the reduced or colorless form of crystal violet (also called gentian violet). When LCV and hydrogen peroxide come into contact with hemoglobin or its derivatives, a violet colored dye (crystal violet) is formed. This

occurs through the catalytic oxidation of the dye. Furthermore, the LCV formulation fixes the blood impressions through the use of 5-Sulfosalicylic Acid.

LCV is a presumptive test and a positive result using this reagent is an indication of the possible presence of blood. However, it may react with other substances not specific to blood and can also have an affinity for other proteins.

Research has indicated that the application of Leucocrystal Violet is not detrimental to subsequent DNA analysis.

7.11.2.3 Safety

Wear personal protective equipment based on laboratory and field-work requirements.

Read Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedures.

7.11.2.4 Materials

- Leucocrystal Violet solution
- Tray or spray bottle
- Camera equipment

7.11.2.5 Standards and Controls

A quality check will be done upon opening each lot. The results will be entered in the Chemical Inventory database. These checks will include positive and negative controls before application of the LCV reagent to evidence.

A positive control should consist of a known blood standard.

A negative control should consist of an unstained substrate.

Positive and negative control results as well as reagent lots shall be recorded in notes and/or worksheets.

7.11.2.6 Procedures

Prior to applying LCV treatment, collect a sample of the suspected blood, if visible, for DNA testing.

Caution should be exercised not to disturb the pattern.

Immerse the item to be stained in enough solution to cover it fully, or apply enough of the solution to the item by pouring or spraying. Allow to react for at least 30 seconds.

Remove the item from the solution.

Impressions that were not visible or recorded prior to the application of the reagent should be sampled for DNA testing at this time.

Rinse gently with water (this step is not always necessary and is optional.)

Fully record and document all visualized or enhanced patterns.

Photograph patterns, if any.

Archive photos into an appropriate database.

7.11.2.7 Formulation

5-Sulfosalicylic Acid
Sodium Acetate
Leucocrystal Violet (LCV)

- LCV crystals should have a white characteristic color.
- Discard yellow colored LCV crystals

3% Hydrogen Peroxide

Procedure

1. Dissolve 10 g of 5-sulfosalicylic acid into 500 ml of 3% hydrogen peroxide.
2. Add 3.7 g of sodium acetate.
3. Add 1.0 g of LCV.
4. Stir until LCV crystals have dissolved.

Storage Conditions

Amber glass bottles

Expiration Information

Up to 3 months at room temperature.

Up to 9 months when refrigerated.

7.11.2.8 Limitations

Over time the Leucocrystal Violet will oxidize to crystal violet turning the substrate violet in color. The process is hastened if the surface to be developed is in a bright sunlit environment. The patterns should be photographed as soon as possible. Prior treatment with cyanoacrylate may be detrimental to the development of LCV.

7.11.3 Luminol and Bluestar® Procedures

7.11.3.1 Scope

The following procedures are used to determine the possible presence of blood, not readily visible to the unaided eye.

7.11.3.2 Background

Generally, these tests should only be used as a last resort when other attempts to locate and recover blood have been unsuccessful and blood is expected to be present at a particular location and may have been cleaned up or was deposited at a much earlier date and is no longer visible. These tests (Luminol, Bluestar®) are presumptive tests that involve spraying a chemical mixture on a suspected bloodstained area, in situ, and photographing the result.

Luminol, or 3-aminophthalhydrazide, is a basic reagent that produces a blue chemiluminescence that may vary in intensity depending on the heme concentration. Bluestar® is similar to Luminol but is a proprietary formulation and is a derivative of 3-aminophthalhydrazide. Both reagents must be used in subdued light environments.

Both Luminol and Bluestar® have a limited working time, generally less than one hour once the chemicals are mixed. A fresh batch should only be prepared immediately prior to use.

Research has shown that these reagents have the greatest specificity and sensitivity for environments with dilute blood concentrations. In addition, DNA typing integrity has been maintained in excess of 48 hours of post exposure.

7.11.3.3 Safety

Wear personal protective equipment, PPE, based on laboratory and fieldwork requirements when carrying out standard operating procedures.

Read Material Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedures.

The procedure should be performed wearing proper respiratory protection to prevent mist inhalation

7.11.3.4 Materials

- PPE
- Luminol or Bluestar® reagent
- Positive control
- Spray bottles
- Camera equipment

7.11.3.5 Standards and Controls

Test positive and negative controls before application of Luminol/Bluestar® reagent to evidence.

A positive control should consist of a known blood standard.

A negative control should consist of an unstained substrate.

Positive and negative control results as well as reagent lots shall be recorded in notes and in the Chemical Inventory database.

7.11.3.6 Procedures

Testing should be carried out in a subdued light environment.

Prepare reagent batch immediately prior to use.

Identify the area(s) that need to be processed and incorporate a scale if possible. Only small sections should be worked at a time.

Spray the area with the reagent and observe any reaction. A fine mist should be used and caution should be exercised not to overspray.

Spray lightly and horizontally ahead of you. Spray in a side to side sweeping motion.

Formulation

BlueStar® tablets
Deionized Water
Spray bottle

Procedure

1. Prepare immediately prior to use.
2. Add 125 ml of deionized water to a spray bottle.
3. Add a pair of BlueStar® tablets (one white tablet and one beige tablet) to the water.
4. For larger volumes, double the volume of deionized water (250 ml) and use 4 tablets of BlueStar® (2 white tablets and 2 beige tablets)
5. Allow 10-20 minutes for tablets to enter solution while gently stirring.
 - a. DO NOT SHAKE.

Storage Conditions

Away from light.

Expiration Information

Up to 3 hours for working solution.

7.11.3.7 Photographing Chemiluminescence

Set the camera on a tripod.

The camera equipment should be positioned to document the area being treated prior to testing. This will help reduce the need to re-spray.

Photographic documentation of the chemiluminescent reaction should also be conducted in a subdued light environment.

It may be necessary to re-spray in order to photographically document the reaction.

Set a long exposure time, typically greater than twenty (20) seconds

A camera equipped with a remote shutter release or delayed timer should be used.

Open the shutter of the camera. A rear curtain flash setting is recommended with the flash pointed towards the ceiling or a wall away from the chemiluminescent reaction being photographed. This permits the flash to fire at the end of the exposure providing just enough light to illuminate the subject without overwhelming the chemiluminescent reaction.

Once a quality image has been obtained, the evidence in the area may be collected using the appropriate collection method.

Archive photos into an appropriate database.

7.11.3.8. Limitations

An immediate blue chemiluminescence is a positive result. However the reaction must be interpreted with caution. Certain metals (e.g. brass and copper) and cleaning agents (e.g. bleach) may produce "false" positives. Bleach will produce an intense chemiluminescence that lasts for a short

duration.

Re-spraying or over spraying of the target surface introduces a dilution factor creating a potential situation where collecting enough material for DNA analysis is not feasible.

7.11.4 5-Sulfosalicylic Acid (SSA)

7.11.4.1 Scope

5-Sulfosalicylic Acid is a blood fixative used for impressions that may be in blood.

7.11.4.2 Background

5-Sulfosalicylic Acid is a fixative used on impressions that have been made in blood. The use of this reagent is to stabilize the impression onto the surface area for additional chemical processing methods.

7.11.4.3 Safety

Wear personal protective equipment, PPE, based on laboratory and fieldwork requirements when carrying out standard operating procedures.

Read Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedures.

The procedure should be performed wearing proper respiratory protection to prevent mist inhalation

7.11.5 Acid Yellow 7

7.11.5.1 Scope

Acid Yellow 7 is a fluorescent stain sensitive to blood proteins. It is especially effective on dark colored backgrounds and textured surfaces.

7.11.5.2 Background

Acid Yellow 7 is a dye stain that produces a yellow fluorescence upon reaction with the proteins in blood. Due to its fluorescence, it is particularly useful on dark backgrounds. Acid Yellow 7 is effective on non-porous surfaces and may require a longer fixative period if a heavy depositions of blood is present.

7.11.5.3 Safety

Wear a laboratory coat and non-porous gloves. Safety glasses or goggles will be worn if the potential of splashing chemicals exists. Items must be processed in a fume hood or well-ventilated area with the appropriate mask. Caution should be exercised when using this chemical due to the flammable nature of the solvents and carriers used in its formulation.

The stock solution can be stored at room temperature in a clear or dark airtight container. Excess solution should be treated with sodium hypochlorite and disposed down the drain.

7.11.5.4 Materials

- Pre-formulated Acid Yellow 7.
- Rinse – Rinse with deionized water.
- Black gel lifters

7.11.5.5 Standard and Controls

A quality check will be performed on each lot upon opening and recorded in the Chemical Inventory database. This check will consist of both a positive and negative control.

The quality control will be performed on an impression consisting of a known blood standard that has also been fixed using 5-SSA.

7.11.5.6 Procedures

Method of Analysis

1. The area in question should be treated with 5-sulphosalicylic acid (5-SSA) prior to the staining process.
2. The 5-sulphosalicylic acid should be sprayed onto the impression, and covered with filter paper, or similar equivalent ensuring that no air pockets are present. The area must remain moist with the solution for a minimum of 5 minutes.
3. After removing the filter paper, or similar equivalent, the item must be allowed to air dry before the application of the Acid Yellow 7 reagent.
4. Application can be performed by spraying, immersing, toweling, cascading, or pooling.
5. The solution should be in contact with the impression in blood for at least 5 to 10 minutes.
6. Wash off excess Acid Yellow 7 with the rinse solution. The rinse solution may need to be applied several times in order to reduce the background staining to achieve the greatest contrast.
7. Allow the item to dry.

Note: Low contrast impressions may be improved by retreatment with Acid Yellow 7. Follow the procedure omitting the fixing stage.

8. Acid Yellow 7 can also be lifted with a black gel lift. The lift is placed onto the developed impression and allowed to rest in situ for several minutes. The resulting lifted impression may be visualized in a similar manner as the original impression.

Visualization

1. Visualize with an ALS under 400nm-490nm and contrasting goggles/filter.

7.11.6 Acid Fuchsin (Hungarian Red)

7.11.6.1 Scope

Acid Fuchsin/Hungarian Red is a reagent sensitive to the proteins found in blood. This technique has fluorescent properties and can also be lifted to aid in visualization. This method has benefits on dark colored surfaces.

7.11.6.2 Background

Acid Fuchsin/Hungarian Red is a water-soluble dye that reacts with the proteins in blood to form a deep magenta colored product which may be lifted. This may prove to be useful on backgrounds that are dark or multi-colored. Impressions on both non-porous and porous surfaces may be successfully stained and then transferred with a white gelatin lift.

7.11.6.3 Safety

Wear a laboratory coat and non-porous gloves. Perform processing in a well-ventilated area or a fume hood. Safety glasses or goggles will be worn if the potential of splashing chemicals exists.

The stock solution can be stored at room temperature in a clear glass bottle. Excess solution should be treated with sodium hypochlorite and disposed down the drain.

7.11.6.4 Materials

Pre-formulated Hungarian Red

White Gel lifters

7.11.6.5 Standards and Controls

A quality check will be done upon opening each lot. The results will be entered in the Chemical Inventory database. These checks will include positive and negative controls before application of the Hungarian Red reagent to evidence.

A positive control should consist of a known blood standard.

A negative control should consist of an unstained substrate.

Positive and negative control results as well as reagent lots shall be recorded in notes and/or worksheets.

7.11.6.6 Procedures

1. A small area of the object or surface being stained should first be tested with the staining solution. If the background also stains, it may obscure the impression you are trying to enhance.
2. If no significant background staining occurs, proceed to stain the impression.
3. Application can be performed by spraying, immersing, toweling, cascading, or pooling.

Visualization

1. If lifting with a gel lift, use a white lifter and allow lift to remain on the print for 15 to 20 minutes.
2. Visualize with an ALS under 515nm-560nm and red goggles/filter.
3. If applicable, the lifter should be photographed within 30 minutes, since the lifted impression will diffuse into the gelatin. Photographs taken of the lift must be laterally reversed for examination purposes.

7.11.7 Phloxine B

7.11.7.1 Scope

Phloxine B, a derivative of fluorescein, is a reagent sensitive to the proteins found in blood. This technique develops red, and has reflective properties under various angles of light. This method has benefits on dark colored surfaces.

7.11.7.2 Background

Phloxine B is a water-soluble dye that reacts with the proteins in blood to form a deep magenta colored product which also has reflective properties under various angles of light. This may prove to be useful on backgrounds that are dark or multi-colored.

7.11.7.3 Safety

Wear a laboratory coat and non-porous gloves. Perform processing in a well-ventilated area or a fume hood. Safety glasses or goggles will be worn if the potential of splashing chemicals exists.

The stock solution can be stored at room temperature. Excess solution should be treated with sodium hypochlorite and disposed down the drain.

7.11.7.4 Materials

Pre-formulated Phloxine B

7.11.7.5 Standards and Controls

A quality check will be done upon opening each lot. The results will be entered in the Chemical Inventory database. These checks will include positive and negative controls before application of the Phloxine B reagent to evidence.

A positive control should consist of a known blood standard.

A negative control should consist of an unstained substrate.

Positive and negative control results as well as reagent lots shall be recorded in notes and/or worksheets.

7.11.7.6 Procedures

1. A small area of the object or surface being stained should first be tested with the staining solution. If the background also stains, it may obscure the impression you are trying to enhance.

2. If no significant background staining occurs, proceed to stain the impression.
3. Visualization of Phloxine B is a pink/red stain. In addition, the use of oblique white light can cause the development to appear reflective.
4. Application can be performed by spraying, immersing, toweling, cascading, or pooling.

7.12 Adhesive Surfaces

7.12.1 Wet-Wop™

7.12.1.1 Scope

The following procedures describe the development of latent print impressions on the adhesive side of tape.

7.12.1.2 Background

The application of a powder suspension is a stable and effective technique used for the development of friction ridge impressions on adhesive substrates.

The powder suspensions can be purchased in pre-mixed ready to use formulation, such as Wet-Wop™ or they can be prepared in house using the appropriate reagent procedures.

The surfactant portion of the suspension causes micelles to form around the powder particles. Components from the latent ridges destabilize the micelles, causing the powder to preferentially adhere to the latent ridge detail.

Powder suspensions are applied to the surface of interest using a soft brush, ensuring that the brush is well loaded with the suspension mixture to avoid damage that could be caused to the fingerprint by a dry brush and to avoid streaks in background development.

7.12.1.3 Safety

Wear personal protective equipment (e.g., lab coat, gloves, mask, hair net, eye protection), when carrying out standard operating procedures.

Read Safety Data Sheets to determine the safety hazards for chemicals and reagents used in the standard operating procedures.

7.12.1.4 Materials

- Pre-formulated Wet-Wop
- PPE
 - Lab coat
 - Mask
 - Eye-protection
 - Hair net
 - Gloves
- Adhesive powder solution Wet-Wop™
- Camel hair brush
- Water
- Camera equipment

7.12.1.5 Standards and Controls

A positive and negative control shall be performed on each lot upon opening. For a positive control, place a known latent print onto a suitable analogous surface. The negative control shall lack the latent print.

Positive and negative control results as well as reagent lots shall be recorded in notes and Chemical Inventory database

7.12.1.6 Procedures

1. Tape may be subjected to cyanoacrylate fuming prior to adhesive side development in order to develop and preserve any prints on the non-adhesive side of the tape.

2. Gently place the adhesive side of the tape on a non-destructive backing (acetate paper, plastic bag) in order to preserve the adhesive side during cyanoacrylate treatment.
3. Touch DNA and stain collection should be conducted prior to adhesive side powder application.
4. Select the appropriate powder suspension that will provide the most contrast with the surface to be processed.
5. Expose the adhesive side of the tape by gently extending the tape to its full length, if possible.
6. Thoroughly shake the commercial Wet-Wop™
7. Using a camel hair brush, apply the suspension to adhesive side of the tape.
8. Let stand for 30-60 seconds.
9. Rinse under a gentle stream of cold tap water.
10. Allow tape to air-dry.
11. Photograph latent prints, if any.
12. Archive photos into an appropriate database.

7.12.2 Crystal Violet (Gentian Violet)

7.12.2.1 Scope

Crystal Violet (Gentian Violet) is a technique used for the development of latent impressions on the adhesive side of tape. It is especially effective in developing impressions on clear tape and duct tape.

7.12.2.2 Background

Crystal violet (Gentian Violet) is a sensitive stain which reacts with epithelial cells and other sebaceous portions of latent print residue transferred upon surface contact. Crystal violet is

typically effective on surfaces which readily hold the deposited sebum, such as the adhesive side of tape. It will also develop latent prints on other surfaces, particularly those contaminated with oils and grease.

7.12.2.3 Safety

Wear a laboratory coat and non-porous gloves. Crystal Violet can be very toxic by swallowing or skin absorption and should never be used in large quantities. Perform processing in a well-ventilated area or a fume hood. Safety glasses or goggles shall be worn if the potential of splashing chemicals exists.

7.12.2.4 Materials

- Pre-formulated Crystal Violet
- PPE
 - Lab coat
 - Mask
 - Eye-protection
 - Hair net
 - Gloves

7.12.2.5 Standards and Controls

Crystal Violet will be tested via quality control check upon opening each lot of reagent. The results will be documented within the Chemical Inventory database. The quality check shall be performed by placing a known impression on an appropriate piece of tape.

A positive and negative control shall be performed with each procedure. For a positive control, place a known latent print onto a suitable analogous surface. The negative control shall lack the latent print.

Positive and negative control results as well as reagent lots shall be recorded in notes and/or worksheets.

7.12.2.6 Procedures

Application

- If applicable, separate the adhesive surfaces by applying drops of Un-Du and the pull material apart. Some tapes may have an adverse reaction to UnDu. Analysts should test the item to ensure effectiveness. Canned air may also be used to separate layers of tape.
- Apply by spraying, immersion or painting. Development will occur within 2 minutes.

Visualization

- Latent impressions will appear purple.

Storage/Disposal

- The crystal violet working solution can be stored at room temperature in a sealed container. Excess solution can be disposed of down the drain with excess water.

8. Sampling

Not applicable

9. Calculations

Not applicable

10. Uncertainty of Measurement

Not applicable

11. Limitations

Latent prints are a chance impression and may or may not be developed on the surface on an evidentiary item regardless of the sequential methods utilized. The available reagents to analysts shall be implemented in a proper sequence in order to develop latent print detail for visualization and suitability determination.

12. Documentation

- LFU Processing Worksheets
 - LFU Report of Results
 - FSL Administrative Review Worksheet
 - Mideo LatentWorks Database

13. References

Forensic Science Laboratory Quality Assurance Manual (Current Version)

FSL Departmental Operations Manuals (Current Versions)

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Appendix A: Application Techniques

Spraying

1. Use a fine mist sprayer and spray the area to be developed / fixed.

2. Rinse the item with deionized water / rinse solution. Allow the item to dry.

Immersion

1. Place the item into a tray of the solution and leave until development / fixing is complete.
2. Remove item and rinse with deionized water / rinse solution. Allow the item to dry.

Toweling

1. Place a piece of filter paper over the area to be developed / fixed and apply the solution with a squirt bottle. Leave until development / fixing is complete.
2. Remove air pockets (using a roller if needed) from beneath the filter paper to assure that all areas of the impression are treated.
3. Remove the filter paper and rinse the processed area with deionized water / rinse solution. Allow the item to dry.

Cascading

1. Hold the item bearing the impression at an angle and pour the solution over the area to be developed / fixed. Leave until development / fixing is complete.
2. Rinse the item with deionized water / rinse solution. Allow the item to dry.

Pooling

1. Apply the solution using a disposable pipette/squirt bottle and leave until the development / fixing is complete.
2. Gently remove the excess reagent using filter paper.
3. Rinse the item with deionized water / rinse solution. Allow the item to dry.

Painting

1. Using a soft bristle brush, carefully paint the specimen with the solution.
2. Rinse the item under deionized water / rinse solution. Allow the item to dry.

Appendix B: Case File and Reporting Procedure

Case File Information

1. The LFU EP analyst will be responsible for building the LFU-EP case file as they are completing the request and before they submit the case file for technical review. For LFU, the case file is fully electronic and any future mention of “case file” refers to the electronic case file created by the analyst. The following documentation can be found in the case file:
 - LFU Evidence Processing Worksheet
 - LFU Evidence Processing Report of Examination
 - Technical and Administrative Review forms
2. The analyst will upload the completed case file to LIMS Imaging, in the Requests folder under the applicable evidence processing request.

Reporting

1. Upon completion, the Latent Fingerprint Unit evidence processing staff shall disseminate Evidence Collection Logs and Reports of Examination:
2. Evidence Collection logs
 1. Evidence Collection Logs will use the naming structure: [CCN] LFU EP Log (e.g. 19123456 LFU EP Log)
 2. Shall be uploaded to the USAO Portal Network Drive at: U:\FSL-Data\$
 3. The Evidence Collection log shall be sent to:
 - i. MPD, logs will be sent to cid-evidence.reports@dc.gov, and, if known, the lead detective and top-ranking official for the appropriate district or unit.
3. Reports of Examination
 1. Reports of Examination will use the naming structure: [CCN] LFU EP Report (e.g. 19123456 LFU EP Report)
 2. Shall be uploaded to the USAO Portal Network Drive at: U:\FSL-Data\$
 3. The Case File shall be digitally scanned and uploaded into LIMS
 4. The Report of Examination shall be sent to:
 - i. MPD, reports will be sent to cid-evidence.reports@dc.gov

- ii. Reports of Examination and Evidence Collection Logs that are designated MPD IAD (IAD is requesting agency) should only be sent to designated IAD officials, including dfs.iadreport@dc.gov and iad.adminbox@dc.gov.
4. If the case was requested by another agency besides USAO or MPD, the log and report are emailed to the Unit Manager or designee for distribution to the customer and the following naming convention will be used:
 1. Office of the Attorney General reports will have "OAG" at the end of the file name (i.e. 17123456 LFU EP Report/Log OAG).
 2. U.S. Park Police reports will have "USPP" at the beginning of the file name (i.e. USPP17123456 LFU EP Report/Log)
 3. U.S. Capitol Police reports will have "USCP" at the beginning of the file name (i.e. USCP170123 LFU EP Report/Log)
 4. Metro Transit Police reports will have "MTP" at the beginning of the file name (i.e. MTP1712345 LFU EP Report/Log)
5. The analyst will mark the report as "distributed" in LIMS following the Technical and Administrative Review.