Department of Forensic Science

IMPRESSIONS - FOOTWEAR AND TIRE TREAD PROCEDURES MANUAL

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1 INTRODUCTION

1.1 Evidence Examination

Impression examinations comprise a wide variety of evidence and examination types. Anytime two objects come into contact, there is the potential for impression evidence. This manual consists of the procedures used to analyze footwear and tire tread impressions evidence submitted to the Latent Print (LX)/Impressions (IMP) Section of the Virginia Department of Forensic Science (the Department, DFS). These procedures apply to the preservation, recovery, and examination of footwear and tire tread impressions on a variety of surfaces. This manual provides the basis for effective quality management of analyses. The Department's Quality Manual (QM) and Safety Manual provide additional guidelines.

1.1.1 Evidence packaging and item(s) shall be documented and marked as outlined in the QM.

1.1.2 In general, the analysis of items (including the analysis and comparison of questioned impressions) in a case is limited to the number of items which will yield the most probative information.

1.1.3 Determination of probative evidence will be decided based on a number of factors including the type of case, the evidence collected, the number of victim(s) and perpetrator(s), etc.

1.1.4 Large evidence submissions will be reviewed by the examiner/supervisor via telephone or email communication or in-person meetings to identify the most probative evidence for the respective case and analysis/comparisons will be limited to those items.

1.1.5 Three-dimensional and two-dimensional impressions are customarily submitted for examination/comparison. Preservation of the impression will differ depending upon the type of impression, the substrate, and the receiving surface.

1.1.6 Short term storage is used when evidence is in the process of examination. The length of time evidence may remain in short term storage is sixty (60) days.

1.1.7 The Department's laboratory facilities provide sufficient environmental conditions to conduct all tests listed in the Procedures Manual with no further consideration required.

1.1.8 Quality Assurance (QA) requirements for equipment and reagents are addressed in the QA section of this manual.

1.2 Examination Documentation

Examination documentation shall include each examination activity conducted, the sequence of those activities, and the result of each. Activities can include the development techniques, quality control checks, the preservation technique (lifting and/or digitally capturing), database searches/online or other resource searches conducted to include the result, source of known test impressions (if applicable), comparisons conducted, and the conclusions reached. Documentation shall be sufficient such that in the absence of the examiner, another competent examiner could evaluate what was completed and interpret the data.

1.2.1 Electronic note taking shall be recorded using the Mideo Caseworks software (hereafter referred to as Mideo).

1.2.2 If the instrument computer network which houses Mideo is unavailable, it is acceptable for examination documentation to be recorded by hand (utilizing appropriate worksheets) and entered into the system as soon as possible.

1.2.3 Calibration and clarification of images shall be completed using the tools available in Photoshop.

1.3 Cross Comparison / Inter-Related Cases

1.3.1 It is acceptable for comparison documentation to be retained in one case file and include information in other case files indicating which case file contains the complete comparison documentation. It is not required to duplicate the comparison documentation. This approach is only acceptable for cases which were submitted in the same calendar year.

1.3.2 Comparison documentation shall reside in the case file associated with the questioned impression(s). If comparing a questioned impression to a questioned impression the comparison documentation shall be retained in one case file, not both.

1.3.3 The examination documentation associated with the items, questioned impression or knowns, shall reside in the case file under which they were submitted. For example: The documentation associated with known footwear, tire or known standard shall reside in the case file associated with that submission.

1.3.4 The Certificate of Analysis (CoA) shall contain details related to where the supporting examination documentation is retained.

1.4 Terminology

1.4.1 ACE-V

1.4.1.1 Methodology used in impression examination.

1.4.1.2 Acronym for Analysis - Comparison - Evaluation – Verification.

1.4.2 Analysis

1.4.2.1 Interpretation of observed data in an impression in order to categorize its suitability for comparison.

1.4.3 Characteristics of Use

1.4.3.1 Features that are acquired through the wearing/usage of shoes and tires, to include general wear, specific wear, Schallamach, and randomly acquired characteristics (RACs).

1.4.4 Class Characteristics

1.4.4.1 A feature shared by two or more items of footwear or tires. The footwear outsole or tire tread design and the physical size features of a footwear outsole or tire tread are two common manufactured class characteristics. General wear of the outsole or tire tread is also a class characteristic.

1.4.5 Correspondence (corresponds)

1.4.5.1 An interpretation that observed similarities between compared items (e.g., questioned impressions and known footwear or tires) are in agreement.

1.4.6 Comparison

1.4.6.1 Search for and detection of similarities and differences in the observed data between two potentially corresponding impressions.

1.4.7 Discriminability or distinctiveness

1.4.7.1 The property of an observed characteristic or an item of footwear or tire that distinguishes it from different sources.

1.4.8 Dissimilarity (dissimilar)

1.4.8.1 An observation that characteristics have the appearance of being potentially different but do not meet the criteria for an exclusionary difference. This observation could be caused by numerous factors including but not limited to the impression making process, factors prior to recovery, and/or the recovery process.

1.4.9 Distinguishing characteristics

1.4.9.1 Feature(s) on a footwear or tire, including manufacturing variables/defects and characteristics of use, that may be used to differentiate the items from others of the same class.

1.4.10 Evaluation

1.4.10.1 Weighting of aggregate strength of the observed similarities and differences between the observed data in the two impressions in order to formulate a source conclusion.

1.4.11 Examination quality photograph

1.4.11.1 A photograph that contains sufficient quality of information, including an L-shaped scale placed in the proper position, for the purpose of conducting a forensic footwear or tire examination.

1.4.12 Exclusion

1.4.12.1 Conclusion reached when an examiner determines that there is sufficient observed data in disagreement to conclude that the impression did not originate from the same source

1.4.13 Identification

1.4.13.1 Conclusion reached when an examiner determines there is sufficient observed data in agreement to conclude that the impressions originated from the same source.

1.4.13.2 Reached when the impressions have corresponding detail and the examiner would not expect to see the same arrangement of details repeated in an impression that came from a different source.

1.4.14 Impression

1.4.14.1 Unintentional recording of an impression from an unknown source.

1.4.14.2 Used generally to refer to any questioned impression or impression of unknown source.

1.4.15 Inconclusive

1.4.15.1 Conclusion reached when an examiner is unable to identify or exclude the source of an impression because the corresponding areas and/or detail are absent or unreliable.

1.4.15.2 Reached when the observations do not provide a sufficient degree of support for exclusion or identification.

1.4.16 Individual Characteristic

1.4.16.1 A measurable feature that differentiates a single member of a set from every other member of that set. Individual characteristics are exceptional characteristics that may establish uniqueness of an object. These unique markings are accidental, or unintentional, characteristics resulting from wear and random markings on the item during manufacturing and use.

1.4.17 Known Standard (test impression)

1.4.17.1 Intentional recording of an outsole of tire tread from a known source.

1.4.18 Lift

1.4.18.1 Used generally to refer to any method of impression recovery utilizing tape or adhesive material.

1.4.19 Observed data

1.4.19.1 Any demonstrable information observed within an impression that an examiner relies upon to reach a decision, conclusion or opinion.

1.4.20 Quality

1.4.20.1 A subjective measure of the character and fidelity (accuracy and clarity) of a questioned impression or known item of footwear or tire (including associated exemplars), both of which determine its value for comparison.

1.4.21 Randomly Acquired Characteristics (RACs)

1.4.21.1 A feature on a footwear outsole or tire tread resulting from random events including, but not limited to the following: cuts, scratches, tears, holes, stone holds, abrasions and the acquisition of debris. The position, orientation, size and shape of these characteristics contribute to the uniqueness of a footwear outsole or tire tread. Randomly acquired characteristics are essential for an identification of a particular item of footwear or tire as the source of an impression.

1.4.22 Schallamach

1.4.22.1 Microscopic patterns that develop as ridges on rubber material as a result of repeated abrasive forces. These patterns are very similar in their size and appearance to skin friction ridges and are highly individual. They continue to change rapidly as affected by continued abrasion. Schallamach patterns are randomly acquired characteristics. The term gets its name from a researcher of the same name.

1.4.23 Similarity (similar)

1.4.23.1 An observation that an impression and an item of footwear or tire share a likeness of details.

1.4.24 Specific wear

1.4.24.1 Discrete wear on an item of footwear or tire that is more distinctive than general wear by virtue of its position, degree, and orientation (e.g., wear in atypical contact areas, Schallamach patterns).

1.4.25 Suitability determinations (for comparison)

1.4.25.1 A suitability determination is a judgement made prior to comparison (i.e., prior to examining the known footwear or tire) of whether an item contains sufficient quality and value for a comparison.

1.4.25.1.1 Not suitable for comparison-determination that a more detailed examination is not warranted. The examiner determined there were minimal or no confirmable discernable features present. This determination applies when there is insufficient detail to conduct any comparison.

1.4.25.1.2 Suitable for comparison-determination that a conclusion can potentially be reached. The examiner determined that the item contains sufficient observed data (e.g., sufficient quality and quantity of features, size, or condition of any evidence items) to be used for comparison.

1.4.26 Three-dimensional impression(s)

1.4.26.1 Three-dimensional impressions occur when a footwear or tire comes into contact with a soft receiving surface. The impression is then impressed into the substrate (dirt, mud, snow, etc.). The resulting impression has a visible length, width, and depth.

1.4.27 Two-dimensional impression(s)

1.4.27.1 Two-dimensional impressions can occur when there is a transfer of materials (trace or residue) between the footwear or tire and the substrate. The resulting impression has a visible length and width, but not significant depth.

1.4.27.1.1 Negative impression- results from the removal of a substance from a substrate by a footwear outsole or tire tread.

1.4.27.1.2 Positive impression (transfer impression)- made on a two-dimensional surface as a result of a footwear outsole or tire tread coming into contact with and acquiring a substance that the outsole or tire tread subsequently deposits or transfers to a substrate in the form of an impression.

1.4.28 Verification

1.4.28.1 Confirmation, through re-examination by another examiner, that a conclusion or opinion conforms and is reproducible.

1.4.28.2 Independent application of ACE by a second qualified examiner.

1.4.29 Wear

1.4.29.1 The extent to which a footwear outsole or tire tread has been eroded.

2 INVENTORY AND CASE APPROACH

2.1 Introduction

Every case is unique and must be evaluated by the individual examiner. It is the examiner's responsibility to choose the best analytical approach for each case, particularly for evidence not routinely encountered or for large evidence submissions. It is expected that Supervisors or the Physical Evidence Program Manager (PM) will be consulted for deviations from existing procedures in accordance with the Department's QM.

2.2 Order and Scope of Examinations

2.2.1 Evaluation of the unknown impression is conducted prior to examining the known or known standard.

2.2.1.1 The unknown impression could be a footwear, tire or pattern impression, but is only compared to a footwear outsole or tire tread.

2.2.2 In general, forensic biology examinations should be completed before impression examinations.

2.2.3 In general, the most appropriate sequence of examinations for trace evidence and digital media will be determined via consultation.

2.2.4 If any questions arise as to the proper sequence of examinations between disciplines, consult with a representative from the appropriate section(s).

2.2.5 General procedures for evidence examination are usually divided into two categories, those for porous and those for non-porous surfaces. Each category contains an enormous variety of materials with individual properties that may enhance or diminish the effectiveness of a particular technique.

2.2.6 It is acceptable to discontinue processing once an identification is effected and verified if agreed to by the submitting agency. If this approach is taken, the extent of processing and possibilities for future examination shall be clearly communicated in the Certificate of Analysis (CoA).

2.2.7 It is acceptable to discontinue comparisons once an identification is effected. If this approach is taken, it shall be clearly communicated in the CoA that comparisons were discontinued due to the identification and that additional comparisons can be performed if needed.

2.3 Inventory

2.3.1 Upon opening the case, an inventory is performed in order to document the item(s) of evidence received and develop the processing plan for item(s).

2.3.2 Non-manufactured writing or markings on documents shall be recorded via photocopying, digitally scanning or digitally photographing prior to the application of any chemicals. The CoA shall inform the customer that the writing or markings were preserved as part of the examination documentation.

Example: Prior to processing, the writings/markings present on Item 04 were captured and preserved as part of examination documentation.

2.3.2.1 Due to the destructive nature of the chemicals, some inks may be damaged. The writings are captured to preserve them in case of possible damage.

2.3.3 If the condition of the item(s) is such that it necessitates a change to the usual processing sequence for the item(s), it shall be discussed with the Section Supervisor prior to processing, be documented on the CoA and within the examination documentation.

2.4 Case Approach

2.4.1 The evidence submitted will dictate the exam sequence. Evidence commonly seen in the section includes submitted digital media containing images, casts, lifts, knowns for comparison and items to be processed.

2.4.2 Development techniques will be chosen based on the appropriate sequential processing for that item and its properties.

2.4.2.1 Approved development techniques and the associated item(s) properties:

Porous:	Non-Porous:	Adhesive:	Blood:	Dirt or Dust:
DFO, NIN, PD, ORO	CA, Dye Stains, Powder, SPR	GV, SSP, TapeGlo™, WetWop™	Amido Black, Coomassie Blue, LCV, NIN	Ammonium or Potassium Thiocyanate

2.4.3 The following processing sequences are recommended for the items below:

2.4.3.1 Footwear and tire impressions should be documented prior to and after processing or lifting.

2.4.3.1.1 Any impressions that have the potential to be used for comparison purposes shall be photographed using proper techniques prior to enhancement, and after enhancement, to capture examination quality photographs.

2.4.3.2 Lifts: Visual

2.4.3.3 Submitted digital media images: Visual

2.4.3.4 Known footwear/tires or standards for comparison: Visual

2.4.3.5 Porous items: Visual, NIN

2.4.3.6 Porous items (thermal): Visual, NIN (thermal)

2.4.3.7 Porous items (wet or previously wet): Visual, ORO and/or PD

2.4.3.8 Non-porous item: Visual, CA, dye stain

2.4.3.9 Non-porous items (wet or previously wet): Visual, SPR

2.4.3.9.1 CA may occur as part of this sequence

2.4.3.10 Adhesive items:

2.4.3.10.1 Non-adhesive side processing shall occur before adhesive side processing. The adhesive side should be as protected as possible throughout.

2.4.3.10.2 The non-adhesive side processing should follow a processing sequence suitable for the properties of the non-adhesive side.

2.4.3.10.3 Adhesive side: Visual, Adhesive processing

2.4.3.11 Blood-stained items:

2.4.3.11.1 Blood-stained, porous items: Visual, DFO, NIN

2.4.3.11.2 Amido Black, Coomassie Blue and LCV may occur as part of this sequence

2.4.3.11.2.1 Blood-stained, non-porous items: Visual, LCV and/or Amido Black

2.4.3.11.3 CA may occur as a part of this sequence

2.4.3.12 Dirt (wet residue, muddy) or dust residue:

2.4.3.12.1 Porous or non-porous items: Visual, Ammonium or Potassium Thiocyanate

2.4.3.13 Combination items:

2.4.3.13.1 Items that exhibit combinations of different properties should be processed in a manner that allows for the most complete development of impressions.

2.4.3.14 Unique surfaces:

2.4.3.14.1 Bloody Carpet/Fabric: Visual, LCV, NIN, Amido Black

2.4.3.14.2 Dust on Fabric: Visual, Lift, Ammonium or Potassium Thiocyanate

2.4.3.14.3 Skin: Visual

2.4.3.14.4 Rubber/nitrile gloves: Visual, CA, dye stain, Wet Powder Suspension

2.4.3.14.5 Glossy paper/cardboard (semi-porous): Visual, CA, IND, NIN, dye stain

2.4.3.15 Powder may be used in addition to, or in lieu of, and prior to dye stain as appropriate.

2.4.3.16 Wet or blood-stained items shall be dried before proceeding with processing.

2.4.3.17 Alternate processing sequences shall be discussed with the Section Supervisor prior to use in casework and documented.

3 DIGITAL IMAGING

3.1 Introduction

Footwear and tire impression evidence may have inherent limitations due to substrate features, quality of the original impression, and method of collection that affect the quality of the digital capture.

3.2 Minimum Standards and Controls

3.2.1 A rigid, L-shaped scale shall be placed alongside the length of the impression on the same plane as the bottom of the impression. For long tire impressions, in addition to a rigid scale, a long tape measure may be placed along the full length of the impression being captured.

3.2.1.1 The following information shall be included, either in the image or electronically associated with the file, for all DFS captured images of impressions and impressions evidence used for examination.

- Scale (L-shaped)
- FS lab #
- Examiner initials
- Item / sub-item designation

3.2.2 If the entire lift, cast, or object is captured, it is not necessary to mark the area of interest on the evidence. If sections of the lift, cast, or object are captured, then the area of interest shall be marked with a bracket or outline and the impression number as part of sequential processing. The impression number is the Item number followed by the letters FW, TT, or PI (depending on the type of impression) and the impression number.

3.2.2.1 It is acceptable to shorten the Item number as part of the impression number for ease of marking and clarity of documentation. The impression shall be traceable to the evidence item it originates from.

Examples:

- Footwear impression XXX004XFW1 may be shortened to 4XFW1
- Tire impression 1-X-1TT3 may be shortened to 1XTT3
- Patterned impression 0004PI2 may be shortened to 4PI2

3.2.2.2 The reason for not marking the impression number on the evidence prior to capture shall be documented.

3.2.2.3 The impression number written on the item of evidence is used to identify an area of interest for capture and further analysis. It is not an indication of value.

3.2.2.4 Each impression shall be captured individually as a separate file, if possible.

3.2.2.5 Images will be checked for sharpness, contrast, and accurate reproduction of detail.

3.2.2.5.1 The highest quality image captured from a particular processing technique will be utilized for further analysis and examination.

3.2.2.5.2 It is not required to preserve the same impression that was developed with previous techniques if no subsequent improvement is evident.

3.3 Photography

3.3.1 Images of impressions shall be captured at a minimum of 300ppi in the tag image file (TIF) format.

3.3.1.1 It is acceptable to capture a small region of interest within an impression or known footwear/tire at 1000ppi in order to optimize resolution in these areas (e.g., Schallamach pattern).

3.3.2 Utilize the TIFF Large setting on the digital camera.

3.3.3 The camera focal plane shall be parallel to the impression, outsole, or tread (i.e., on a copy stand, tripod, or other fixed instrument).

3.3.4 Fill the camera frame with the impression, outsole, or tread, and L-shaped scale.

3.3.4.1 The scale shall be placed on the same plane as the impression, outsole, or tread.

3.3.4.2 When multiple impressions are present in the same area on an item, the scale should be placed next to the impression being captured for examination.

3.3.5 Photograph using the appropriate lighting techniques to enhance contrast based on the type of evidence (e.g., oblique, ambient, ALS, etc.)

3.4 Scanning

3.4.1 Place the scale on the same plane and as close as possible to the impression without obscuring detail.

3.4.2 Scan the selected area of interest at 24-bit color or 8-bit grayscale.

3.4.3 Scans should be captured at a minimum of 300ppi resolution in the tag image file (TIF) format. For capturing detail, a smaller region of interest within the impression or known footwear/tire should be captured at a higher resolution (e.g., Schallamach pattern).

3.5 Full Spectrum Imaging System (FSIS)

3.5.1 Place the scale on the same plane and as close as possible to the impression without obscuring detail.

3.5.2 Capture the marked impression with a scale visible in the image using the FSIS.

3.6 Clarification

3.6.1 The clarification of images of impressions shall be accomplished using the tools available in Adobe Photoshop.

3.6.2 When utilizing Adobe Photoshop to clarify an image, the below log options shall be set as follows:

- Choose Edit>Preferences>General
- Check the “History Log” option (a checkmark must appear in the check box to enable the History Log)
- Select “Both” for “Save Log Items To” option
- Select “Detailed” option for the “Edit Log Items”
- Click OK to save settings

3.6.3 The original and all clarified versions of the images shall be retained with the examination documentation and saved to a CD/DVD to allow for the retention of the history log file of the clarification techniques used.

3.6.3.1 The file name of the original image shall be the FS Lab# followed by the impression number. Different images of the same impression may be designated with letters or development technique.

3.6.3.2 The file name of the clarified image(s) shall be the FS Lab# follow by the impression number, followed by an appropriate notation to indicate that the image has been clarified and/or calibrated (e.g. “clarified”, “C”, etc.) If there are multiple clarifications for one image, indicate each by a numerical notation added (e.g. “clarified1”, “clarified2” or “C1”, “C2”, etc.).

3.7 Created Digital Media

3.7.1 Digital media (DM), CD or DVD, containing the original images of impressions and impressions evidence captured shall be created, treated as evidence and returned to the submitting agency with the evidence.

3.7.1.1 Impressions and impressions evidence may include images of impressions captured from submitted items, lifts, casts as well as known footwear and known standards.

3.7.1.2 The first DM created shall be designated as sub-item DM1 and subsequent DMs created, for the same case, will be labeled sequentially (DM1, DM2, DM3, etc.).

3.7.2 These sub-items shall be added to the Request for Laboratory Examination (RFLE) and created in the Laboratory Information Management System (LIMS) on the date created.

3.7.3 The examiner shall verify and document in the notes that the appropriate images are on the media prior to returning to the submitting agency.

3.7.4 When impressions are developed on more than one item, the DM shall be returned with the first item on which the impressions were developed, if possible. The notes and CoA shall document in which container the DM is returned.

3.7.5 The packaging for the digital media shall be sealed and labeled with the FS lab #, examiner’s initials and the item numbers from which the images were developed or captured.

4 VISUAL EXAMINATION CASES

4.1 Introduction

4.1.1 Visual examination of evidence is the first step in any processing procedure and is the mechanism by which development techniques are selected from observation of the residue, item condition, and composition of the item.

4.1.2 All submitted lifts, casts, known footwear/tires shall have a unique Item or sub-item number. Images from submitted digital media shall be assigned a unique designation or sub-item number if they are examined.

4.2 Visual Examination

4.2.1 A thorough examination of the evidence is conducted using white light.

4.2.2 Additional light sources, such as oblique light, ALS, etc., may be utilized based on the evidence type and suspected residue composition.

4.2.3 Visible impressions shall be photographed prior to the application of any processing techniques.

4.3 Lifts

4.3.1 All submitted lifts shall be photographed in their entirety (with an appropriate scale in the image) using appropriate lighting, which may include but is not limited to, oblique lighting, alternate light sources, or ambient light.

4.3.1.1 The acetate cover on gel lifters should be removed prior to photographing.

4.3.1.2 The images shall be clarified to determine if impressions are present.

4.3.2 Procedure

4.3.2.1 Review the item(s) for any present impressions.

4.3.2.2 If multiple impressions are present, capture each impression on the lift separately, if possible, for analysis and further examination.

4.3.2.3 The presence of additional impressions not suitable for capture shall be documented in the examination documentation.

4.3.2.4 Another qualified impressions examiner shall review any lifts on which an examiner concludes there are not impressions suitable for analysis on the entire lift.

4.3.2.4.1 The review shall be documented in the examination documentation.

4.3.2.4.2 It is not required to review impressions not suitable for capture in a lift that contains an impression captured for analysis.

4.3.2.4.2.1 A review of the lift is not needed when a captured impression is later deemed not of value for comparison during Analysis.

4.3.2.5 The below are acceptable options for situations when it is presumed that the same impression is lifted multiple times or if the impression lifted corresponds with a submitted image.

4.3.2.5.1 If the lift(s) are labeled indicating they are consecutive lifts of the same impression or area, capture at least one impression and document the reason for not examining the remaining duplicates.

4.3.2.5.2 If the lift(s) are labeled or the RFLE indicates that the same impression is captured in a submitted image, it is acceptable to preserve the captured impression (submitted image) and document the reason for not examining the lifted impression if the submitted image of the impression is utilized for the examination.

4.3.2.5.3 If the lifts are not labeled indicating they are consecutive or there is no indication that the impression is captured in a submitted image, contact the contributor for clarification. Indications that an impression is lifted or captured multiple times may include background debris, visible grout lines in the lift/image, etc.

4.4 Casts

4.4.1 All casts shall be photographed in the condition which they are received.

4.4.2 Clean casts with a soft brush and water, if necessary, to remove extraneous material taking care not to damage the impression. Allow to dry. If other techniques are utilized, it shall be documented.

4.4.3 Re-photograph the cleaned cast (with an appropriate scale placed even with the impression) using appropriate lighting, which may include but is not limited to, oblique lighting, alternate light sources, or ambient light.

4.4.4 The below are acceptable options for situations when it is presumed that the same cast impression is captured in a submitted image.

4.4.4.1 If the cast is labeled or the RFLE indicates that the same impression is captured in a submitted image, it is acceptable to capture the impression and document the reason for not examining the cast impression if the submitted image of the impression is utilized for the examination.

4.4.4.2 If the cast is not labeled or there are no indications that the impression is captured in a submitted image, contact the contributor for clarification.

4.5 Submitted Digital Media

4.5.1 Document the number and type of files (TIFF, JPG, NEF, etc.) on the media. All images on the media shall be retained in the case file, either electronically on the examination documentation disc or on a contact sheet(s), with the image file name and any associated image or sub-item designation, as applicable.

4.5.1.1 Images that will be used for examination shall be converted and saved in TIFF prior to any calibration and clarifications.

4.5.1.2 If the same impression/area is captured in multiple images, it is acceptable to document the file name(s) and designate an image or sub-item number(s) for only the image(s) that will be examined. Images not examined do not require a sub-item number.

4.5.1.2.1 It is not necessary to create images as sub-items in LIMS as the purpose of the sub-item number is for ease of reporting.

4.5.1.2.2 Review the image(s) for the presence of impressions.

4.5.1.2.3 Another qualified impressions examiner shall review all images when an examiner concludes there are no impressions suitable for further analysis in the entire image.

4.5.1.2.3.1 The review shall be documented in the examination documentation.

4.5.1.2.3.2 It is not required to review fragments of impressions in an image that contains an impression determined to be suitable for analysis.

4.5.1.2.3.3 It is not required to review images that contain no impressions (overall images) or duplicate images. The reason for the lack of review shall be documented in the examination documentation by the examiner.

4.5.1.3 Images used for examination shall be calibrated so that a natural size image may be printed as necessary.

4.5.1.3.1 If there is not a scale in the image and no point of reference that can provide an approximate size (e.g. common size tile flooring, dollar bill, etc.) then a print-out, 8x10 or larger with the impression filling the frame, should be made to allow the examiner to more easily evaluate the characteristics present in the impression.

4.5.1.3.2 It is acceptable not to examine images that do not contain a scale or exhibit improper photography (improper camera angle, improper scale placement, etc.). The reason(s) for not examining images shall be reported in the Certificate of Analysis.

4.6 Known Footwear

4.6.1 Document the make, model (if known), type, and size of submitted known footwear, if used for examination, to include in the item description.

Example: One pair of Nike, Air Force 1, athletic shoes, US size 9

4.6.1.1 Type may include athletic shoe, sneaker, boot, sandal, dress shoe, slide, etc.

4.6.1.2 Size should be stated in US size, if available, on the shoe or shoe tag.

4.6.1.3 Update the RFLE as necessary.

4.6.2 Document the shoe tag information present on both shoes. This may be accomplished by photographing the shoe tags or including all the information contained on the tags from both shoes in your notes.

4.6.3 Photograph the original condition of outsoles and outsole design. Photographs shall contain an L-shaped scale placed even with the outsole for proper calibration of the image.

4.6.3.1 When possible, known standards should be created with the footwear in the condition they are received. It may be necessary to remove excess debris from the outsoles when conducting comparisons to questioned impressions. If this occurs, subsequent photographs and known standards should be created. Refer to Section 8 of this manual for creating Known Standards.

4.6.3.2 It is not necessary to create known standards of the footwear if the design is different than the questioned impressions. A photograph of the outsole is sufficient.

4.6.4 If multiple shoes of the same make/model are submitted, photograph the uppers as well as the outsoles.

4.7 Known Tires

4.7.1 Document the make, model, size, and DOT number of submitted known tires, if used for examination. Only the make and model are necessary for item descriptions unless additional information is included on the RFLE.

Example: One Goodyear Assurance Max Life 2 tire

4.7.2 Photograph the original condition of the tire tread design. It is acceptable to photograph a segment of the tread design and not the entire circumference. Photographs should contain an L-shaped scale for calibration of the image.

4.7.2.1 When possible, known standards should be created with the tires in the condition they are received. It may be necessary to remove excess debris from the tire tread when conducting comparisons to questioned impressions. If this occurs, subsequent photographs and known standards should be created. Refer to Section 8 of this manual for creating Known Standards.

4.7.2.2 It is not necessary to create known standards of the tire if the design is different than the questioned impressions. A photograph of the tire tread is sufficient.

4.8 Submitted Known Standards

4.8.1 Document the type and condition of the submitted known standards, if they will be used for examination. This may include any labeling present on the known standard.

4.8.2 Digitally capture submitted known standards (photograph or scan) that will be used for examination.

4.8.2.1 It may be necessary to clarify the images for better clarity of detail in the submitted standards.

4.8.3 If a known standard is submitted as 3-dimensional, i.e. biofoam, microtrax, etc., a cast shall be made for any comparisons conducted.

4.8.3.1 It is not necessary to create a cast of the submitted known standard if the design is different than the questioned impressions. A photograph of the known standard is sufficient.

5 CHEMICAL PROCESSING METHODS

5.1 Use of Chemical Processing Methods

5.1.1 Any of the listed preparations or commercially purchased reagents may be used at the examiner's discretion.

5.1.2 A performance check of methods used shall be completed for each case.

5.1.2.1 The result of the check and the batch number will be included in the examination documentation.

5.1.2.2 The procedure for creating test strips is outlined in the QA section of this manual.

5.1.3 When mixing a stock solution into a working solution, the use of a magnetic stirrer is not recommended. Magnetic stirrers could cause the reagent to fall out of solution in the working solution.

5.1.4 A final volume of reagent not listed in a particular preparation instruction may be made as long as the preparation and final volumes are reviewed by another examiner and documented in the reagent log.

5.2 Amido Black

Amido Black is used to enhance impressions that have been deposited in blood or other protein-based substances on either porous or non-porous items. Caution must be used when applying the methanol-based formula to painted surfaces. The formula may destroy the impressions as well as the surface beneath.

5.2.1 Preparation:

5.2.1.1 Amido Black Methanol Working Solution

Chemicals Required

- 2 g Amido Black
- 100 mL Glacial Acetic Acid
- 900 mL Methanol

Directions

1. Combine the ingredients and stir using a magnetic stirrer for approximately thirty minutes or until Amido Black is dissolved.

5.2.1.2 Amido Black Methanol Rinse Solution

Chemicals Required

- 100 mL Glacial Acetic Acid
- 900 mL Methanol

Directions

1. Combine the ingredients.

5.2.1.3 Amido Black Aqueous Working Solution

Chemicals Required

- 500 mL Reverse Osmosis (R/O) or Deionized (DI) water

- 20 g 5-Sulfosalicylic Acid
- g Amido Black
- g Sodium Carbonate
- 50 mL Formic Acid
- 50 mL Glacial Acetic Acid
- 12.5 mL Surfactant
- R/O or DI water

Directions

1. Combine the ingredients in the order listed using a magnetic stirrer to mix well.
2. Dilute the solution to 1 L using R/O or DI water.

5.2.2 Instrumentation:

5.2.2.1 None noted.

5.2.3 Minimum Standards and Controls:

5.2.3.1 Amido Black and rinse have an indefinite shelf life.

5.2.3.2 Deposit an impression with a small amount of animal or synthetic blood on a surface similar to the item(s) to be processed. Follow the procedure listed below to process the test impression once the blood is dry. If the test impression turns blue-black, the working solution can be used to process evidence.

5.2.4 Procedure or Analysis:

5.2.4.1 Ensure the blood is dry before proceeding with application.

5.2.4.2 Amido Black Methanol application:

5.2.4.2.1 Apply the solution to the item(s) by immersion, spraying or squirting.

5.2.4.2.2 Allow the solution between 30 seconds and one minute to set.

5.2.4.2.3 Apply the rinse solution.

5.2.4.2.4 These steps can be repeated to improve contrast.

5.2.4.2.5 Rinse the item(s) with R/O or DI water.

5.2.5 Amido Black Aqueous application:

5.2.5.1.1 Apply the solution to the item(s) by dipping or squirting.

5.2.5.1.2 Allow the solution three to five minutes to set.

5.2.5.1.3 Rinse the item(s) with R/O or DI water.

5.2.5.1.4 These steps can be repeated to improve contrast.

5.2.6 Review the item(s) for any developed impressions.

5.2.7 Capture impressions for analysis and further examination.

5.3 Ammonium or Potassium Thiocyanate

The thiocyanate ion, in an acid environment, will react with iron ions. Since iron is frequently found in soil and fertilizers, this method is a good choice for dirt or dust impressions. This procedure works well for wet residues and muddy impressions on all surfaces.

5.3.1 Preparation (Ammonium Thiocyanate):

5.3.1.1 Chemicals required:

- 2g Ammonium thiocyanate
- 90 mL acetone
- 10 mL dilute nitric acid (1.2 mL nitric acid/8.8 mL distilled water)

Directions:

1. Dissolve 2g ammonium thiocyanate in 90 mL of acetone.

2. Slowly add 10 mL of dilute nitric acid to the ammonium thiocyanate/acetone mixture.

   Note: Always add the nitric acid to the ammonium thiocyanate/acetone mixture. DO NOT add the ammonium thiocyanate/acetone mixture to the acid or it may explode.

3. Transfer to a fine mist, glass spray bottle for application.

   Note: No precipitation will result as with potassium thiocyanate; no separation is required after preparation of the reagent.

5.3.2 Preparation (Potassium Thiocyanate):

5.3.2.1 Chemicals Required:

- 15 g Potassium thiocyanate
- 120 mL acetone
- 15 mL distilled water
- 10 mL dilute sulfuric acid (1 mL concentrated sulfuric acid/9 mL distilled water)

Directions:

1. Mix 15 mL distilled water with 120 mL acetone.

2. Add 15 g of potassium thiocyanate.

3. Slowly add 10 mL of dilute sulfuric acid to the potassium thiocyanate/water mixture.

4. Allow the mixture to separate, transfer the top (clear) layer to a fine mist, glass spray bottle for application

   Note: It may be necessary to filter any precipitate from the top layer prior to transferring into the spray bottle.

5.3.3 Instrumentation:

- Balance, magnetic stirrer/stirring bar
- Beakers
- Graduated cylinder
- Spray bottles

5.3.4 Minimum Standards and Controls

5.3.4.1 The reagent shall be stored in a dark bottle and have a shelf life not exceeding six months.

5.3.4.2 Deposit a test impression with a small amount of a ferric salt solution on a surface similar to the item(s) to be processed. Follow the procedure listed below to process the test impression once the ferric chloride solution is dry. A positive reaction will result in a red-brown color.

5.3.5 Procedure or Analysis:

5.3.5.1 Apply a light spray (fine mist) application to the item(s).

5.3.5.1.1 Avoid over-spraying of the item, as this may cause the soil residue to wash off.

5.3.5.1.2 Gel lifting of the impression first and treatment of the gel lift with the reagent may be indicated, depending on the substrate and type/amount of residue.

5.3.5.2 Review the item(s) for any developed impressions.

5.3.5.3 Capture impressions for analysis and further examination

5.4 Ardrox

Ardrox is a dye stain that can be used undiluted or as part of a solution that enhances impressions previously developed with cyanoacrylate ester. Ardrox is applied to the object and visually examined utilizing an alternate light source (ALS).

5.4.1 Preparation:

5.4.1.1 Ardrox Working Solution

Chemicals Required

- 2 mL Ardrox
- 10 mL Acetone
- 25 mL Methanol
- 10 mL Isopropyl Alcohol
- 8 mL Acetonitrile
- 945 mL Petroleum Ether

Directions

1. Combine the ingredients in the order listed.

5.4.2 Instrumentation:

5.4.2.1 An ALS is required for visualization of developed impressions.

5.4.3 Minimum Standards and Controls:

5.4.3.1 Ardrox working solution shall not exceed six months.

5.4.3.2 Follow the procedure listed below to process a test impression previously deposited and developed with cyanoacrylate ester. If the test impression fluoresces, the working solution can be used to process evidence.

5.4.4 Procedure or Analysis:

5.4.4.1 Undiluted Ardrox application

5.4.4.1.1 Completely cover the item(s) by immersion or squirt bottle.

5.4.4.1.2 Allow the liquid to remain on the item(s) for about ten minutes.

5.4.4.1.3 Rinse the item(s) under R/O or DI water until no yellow color remains.

5.4.4.2 Ardrox Working Solution application.

5.4.4.2.1 Apply the solution to the item(s) by immersion or squirt bottle.

5.4.4.2.2 Allow the solution to remain on the item(s) for several minutes.

5.4.4.3 Review the item(s) using an ALS with appropriate goggles without rinsing to evaluate if/how much background staining may have occurred.

5.4.4.4 If no background staining is noted, proceed to the next step.

5.4.4.5 If background staining is observed and prevents visualization, subject the item(s) to a light R/O or DI water rinse.

5.4.4.6 Allow the item(s) to dry completely.

5.4.4.7 Review the item(s) for any developed impressions using an ALS with appropriate goggles.

5.4.4.8 Ardrox fluoresces best with blue-green light and can be viewed using yellow barrier filters.

5.4.4.9 Capture impressions for analysis and further examination.

5.5 Basic Yellow 40 (BY40)

BY40 is a dye stain that enhances impressions previously developed with cyanoacrylate ester. BY40 is applied to the object and visually examined utilizing an ALS.

5.5.1 Preparation:

5.5.1.1 BY40 Working Solution

Chemicals Required

- 3 g Basic Yellow powder concentrate
- 1 L Methanol

Directions

1. Combine the ingredients and stir the solution until all of the powder is dissolved.

5.5.2 Instrumentation:

5.5.2.1 An ALS is required for visualization of developed impressions.

5.5.3 Minimum Standards and Controls:

5.5.3.1 BY40 working solution shall not exceed six months.

5.5.3.2 Follow the procedure listed below to process a test impression previously deposited and developed with cyanoacrylate ester. If the test impression fluoresces, the working solution can be used to process evidence.

5.5.4 Procedure or Analysis:

5.5.4.1 Apply the solution to the item(s) by immersion, brush, spray canister or squirt bottle.

5.5.4.2 Allow the solution at least one minute to set.

5.5.4.3 Rinse the item(s) thoroughly under running R/O or DI water. It is acceptable to rinse the item(s) with a solution of 200 parts R/O or DI water to one part Surfactant.

5.5.4.4 Allow the item(s) to dry completely.

5.5.4.5 Review the item(s) for any developed impressions using an ALS with appropriate goggles.

5.5.4.6 BY40 fluoresces best with blue light and can be viewed using yellow barrier filters.

5.5.4.7 Capture impressions for analysis and further examination.

5.6 Coomassie Brilliant Blue R250

Coomassie Brilliant Blue R250 is used to enhance impressions that have been deposited in blood on either porous or non-porous items.

5.6.1 Preparation:

5.6.1.1 Coomassie Working Solution

Chemicals Required

- 0.96 g Coomassie Brilliant Blue R250
- 84 mL Glacial Acetic Acid
- 410 mL Methanol
- 410 mL R/O or DI water

Directions

1. Dissolve Coomassie Brilliant Blue R250 in Methanol.
2. Add R/O or DI water and Glacial Acetic Acid to the Methanol solution and stir.

5.6.1.2 Coomassie Destaining Solution

Chemicals Required

- 200 mL Methanol
- 200 mL R/O or DI water
- 40 mL Glacial Acetic Acid

Directions

1. Add Methanol to R/O or DI water and stir.
2. Add Glacial Acetic Acid to the Methanol solution and stir.

5.6.2 Instrumentation:

5.6.2.1 None noted.

5.6.3 Minimum Standards and Controls:

5.6.3.1 Coomassie Brilliant Blue R250 and rinse have an indefinite shelf life.

5.6.3.2 Deposit a test impression with a small amount of animal or synthetic blood on a surface similar to the item(s) to be processed. Follow the procedure listed below to process the test impression once the blood is dry. If the test impression turns blue-black, the working solution can be used to process evidence.

5.6.4 Procedure or Analysis:

5.6.4.1 Ensure the blood is dry before proceeding with application.

5.6.4.2 Agitate the working solution before application to the item(s).

5.6.4.2.1 Immersion application:

5.6.4.2.1.1 Immerse the item(s) in the working solution and agitate for two minutes

5.6.4.2.1.2 Immerse the item(s) in the destaining solution for one minute.

5.6.4.2.1.3 Agitate the solution until background discoloration fades.

5.6.4.2.1.4 Staining and destaining may be repeated until optimal contrast is achieved.

5.6.4.2.2 Squirt Bottle application:

5.6.4.2.2.1 Apply to large surfaces by squirt bottle or pouring for about five minutes or until maximum contrast is achieved.

5.6.4.2.2.2 Apply the destaining solution by squirt bottle or pouring.

5.6.4.3 Review the item(s) for any developed impressions.

5.6.4.4 Capture impressions for analysis and further examination.

5.7 Cyanoacrylate Ester Fuming (CA)

Cyanoacrylate esters are the active ingredients in super bond adhesives and, in an atmosphere of relatively high humidity, the molecules are attracted to residue and polymerize upon the deposit.

5.7.1 Preparations:

5.7.1.1 No specific preparations are needed as the cyanoacrylate materials being used are commercially prepared.

5.7.2 Instrumentation:

5.7.2.1 A CA fuming chamber, either atmospheric or vacuum, is required.

5.7.3 Minimum Standards and Controls:

5.7.3.1 Cyanoacrylate ester has an indeterminable shelf life and may be used as long as it remains in a semi-liquid state and has a positive reaction with the test impression.

5.7.3.2 Apply a test impression to a non-evidentiary item. Follow the procedure listed below to process the test impression along with the item(s). Terminate the processing once the test impression has reached optimal development.

5.7.4 Procedure or Analysis:

5.7.4.1 Follow the instrument manufacturer's instructions for optimal processing conditions.

5.7.4.2 Terminate the processing once the test impression has reached optimal development.

5.7.4.3 Review the item(s) for any developed impressions.

5.7.4.4 Capture impressions for analysis and further examination.

5.8 1,8 Diazafluoren-9-One (DFO)

DFO reacts with amino acids in perspiration, and once the reaction is completed, the developed impressions will fluoresce using an ALS.

5.8.1 Preparations:

5.8.1.1 DFO Stock Solution

Chemicals Required

- 1 g DFO
- 200 mL Methanol
- 200 mL Ethyl acetate
- 40 mL Glacial acetic acid

Directions

1. Combine the ingredients and stir for approximately 20 minutes or until the DFO is dissolved.

5.8.1.2 DFO Working Solution

Chemicals Required

- 1560 mL Petroleum Ether

Directions

1. Dilute the stock solution to 2L with Petroleum Ether.

5.8.2 Instrumentation:

5.8.2.1 A laboratory oven, dry iron, photographic heat press, or hair dryer is recommended. An ALS is required for visualization of developed impressions.

5.8.3 Minimum Standards and Controls:

5.8.3.1 DFO stock and working solution shall be stored in a dark bottle and have a shelf life not exceeding six months.

5.8.3.2 Apply a test impression to a porous item similar to the evidence being processed or use a test strip. Follow the procedure listed below to process the test impression/strip. If the impression /strip fluoresces, the working solution can be used to process evidence.

5.8.4 Procedure or Analysis:

5.8.4.1 Item(s) may be dipped or sprayed.

5.8.4.2 Once processed with DFO, the item(s) must be dried in an oven at approximately 100 degrees C for 20 minutes.

5.8.4.3 If an oven is not available, a dry iron may be used.

5.8.4.4 Review the item(s) for any developed impressions using an ALS with appropriate goggles.

5.8.4.5 DFO fluoresces best with blue-green light and can be viewed using orange barrier filters.

5.8.4.6 Capture impressions for analysis and further examination.

5.9 Gentian Violet (GV)

GV is a solution that results in a color change when in contact with skin cells or other residues left in the adhesive material.

5.9.1 Preparation:

5.9.1.1 GV Working Solution

Chemicals Required

- 1 g GV
- 1 L R/O or DI water

Directions

1. Combine the ingredients.

5.9.2 Instrumentation:

5.9.2.1 None noted.

5.9.3 Minimum Standards and Controls:

5.9.3.1 GV working solution has an indefinite shelf life.

5.9.3.2 Apply a test impression on a surface similar to the evidence being processed. Follow the procedure listed below to process the test impression. If the test impression turns purple, the working solution can be used to process evidence.

5.9.4 Procedure or Analysis:

5.9.4.1 Immerse the item(s) in the solution for approximately 30 seconds while agitating.

5.9.4.2 Rinse the item(s) with a gentle flow of cold R/O or DI water.

5.9.4.3 These steps can be repeated to improve contrast.

5.9.4.4 Review the item(s) for any developed impressions.

5.9.4.5 Capture impressions for analysis and further examination.

5.10 Leucocrystal Violet (LCV)

LCV is used to enhance impressions that have been deposited in blood or other protein-based substances on either porous or non-porous items.

5.10.1 Preparation:

5.10.1.1 LCV Solution #1: Stock Solution A

Chemicals Required

- 10 g 5-Sulfosalicylic Acid
- 100 mL R/O or DI water

Directions

1. Dissolve 5-Sulfosalicylic acid in R/O or DI water.

5.10.1.2 LCV Solution #1: Stock Solution B

Chemicals Required

- Stock Solution A
- 400 mL 3% Hydrogen Peroxide

Directions

1. Add Stock Solution A to Hydrogen Peroxide.

5.10.1.3 LCV Solution #1: Working Solution

Chemicals Required

- 0.75 g LCV
- Stock Solution B

Directions

1. Add LCV to Stock Solution B and stir the solution vigorously.

5.10.1.4 LCV Solution #2

Chemicals Required

- 10 g 5-Sulfosalicylic Acid
- 500 mL 3% Hydrogen Peroxide
- 3.7 g Sodium Acetate
- 1 g LCV

Directions

1. Dissolve 5-Sulfosalicylic acid in 3% Hydrogen Peroxide.
2. Dissolve Sodium Acetate and LCV in 3% Hydrogen Peroxide solution.
3. Stir the solution vigorously.

5.10.2 Instrumentation:

5.10.2.1 None noted.

5.10.3 Minimum Standards and Controls:

5.10.3.1 LCV stock solutions shall not exceed one year.

5.10.3.2 LCV working solution shall not exceed thirty days.

5.10.3.3 Deposit a test impression with a small amount of animal or synthetic blood on a surface similar to the item(s) to be processed. Follow the procedure listed below to process the test impression once the blood is dry. If the test impression turns violet, the working solution can be used to process evidence.

5.10.4 Procedure or Analysis:

5.10.4.1 Ensure the blood is dry before proceeding with application.

5.10.4.2 Apply the solution to the item(s) by spraying, immersion or washing the solution over the item(s).

5.10.4.3 Review the item(s) for any developed impressions.

5.10.4.4 Capture impressions for analysis and further examination.

5.11 7-(P-Methoxybenzylamino-4-Nitrobenz-2-Oxa-1,3-Diazole) (MBD)

MBD is a dye stain that enhances impressions previously developed with CA. MBD is applied to the object and visually examined utilizing an ALS.

5.11.1 Preparation:

5.11.1.1 MBD Solution #1

Chemicals Required

- 0.12 g MBD
- L Methanol

Directions

1. Combine the ingredients and continue to stir the solution until all powder is dissolved.

5.11.1.2 MBD Solution #2: Stock Solution

Chemicals Required

- 1 g MBD
- 1 L Acetone

Directions

1. Combine the ingredients and continue to stir the solution until all powder is dissolved.

5.11.1.3 MBD Solution #2: Working Solution

Chemicals Required

- 10 mL MBD Stock Solution
- 30 mL Methanol
- 10 mL Isopropanol
- 950 mL Petroleum Ether

Directions

1. Combine the ingredients in the order listed. Do not place on a magnetic stirrer.

5.11.2 Instrumentation:

5.11.2.1 An ALS is required for visualization of developed impressions.

5.11.3 Minimum Standards and Controls:

5.11.3.1 MBD stock solution has an indefinite shelf life.

5.11.3.2 MBD working solution shall not exceed six months.

5.11.3.3 Follow the procedure listed below to process a test impression previously deposited and developed with cyanoacrylate ester. If the test impression fluoresces, the working solution can be used to process evidence.

5.11.4 Procedure or Analysis:

5.11.4.1 Apply the solution to the item(s) by immersion, spray canister or squirt bottle.

5.11.4.2 Allow the item(s) to dry completely.

5.11.4.3 Review the item(s) for any developed impressions using an ALS with appropriate goggles.

5.11.4.4 MBD fluoresces best with blue to green light and can be viewed using orange or red barrier filters.

5.11.4.5 Capture impressions for analysis and further examination.

5.12 MRM 10

MRM 10 is a combination dye stain that enhances impressions previously developed with CA. MRM 10 is applied to the object and visually examined utilizing an ALS at various wavelengths.

5.12.1 Preparation:

5.12.1.1 R6G Stock Solution

Chemicals Required

- 1 g R6G
- 1 L Methanol

Directions

1. Combine the ingredients.

5.12.1.2 BY40 Stock Solution

Chemicals Required

- 2 g BY40
- 1 L Methanol

Directions

1. Combine the ingredients.

5.12.1.3 MBD Stock Solution

Chemicals Required

- 1 g MBD
- 1 L Acetone

Directions

1. Combine the ingredients.

5.12.2 MRM 10 Working Solution

Chemicals Required

- mL R6G Stock Solution
- 3 mL BY40 Stock Solution
- 7 mL MBD Stock Solution
- 20 mL Methanol
- 10 mL Isopropanol
- 8 mL Acetonitrile
- 950 mL Petroleum Ether

Directions

1. Combine the ingredients in the order listed.

5.12.3 Instrumentation:

5.12.3.1 An ALS is required for visualization of developed impressions.

5.12.4 Minimum Standards and Controls:

5.12.4.1 The stock solutions have indefinite shelf lives.

5.12.4.2 MRM 10 working solution shall not exceed six months.

5.12.4.3 Follow the procedure listed below to process a test impression previously deposited and developed with cyanoacrylate ester. If the test impression fluoresces, the working solution can be used to process evidence.

5.12.5 Procedure or Analysis:

5.12.5.1 Apply the solution to the item(s) by immersion, spray canister or squirt bottle.

5.12.5.2 Allow the item(s) to dry completely.

5.12.5.3 Review the item(s) for any developed impressions using an ALS with appropriate goggles.

5.12.5.4 MRM 10 fluoresces within the same range as its component dye stains and can be viewed using the appropriate barrier filters.

5.12.5.5 Capture impressions for analysis and further examination.

5.13 Ninhydrin (NIN)

NIN or triketo-hydrindene hydrate, is an extremely sensitive indicator of alpha-amino acids, proteins, peptides and polypeptides. The reaction produces a violet to blue-violet coloring of these substances and is effective even with older deposits and/or minute amounts of amino acids. NIN processing is normally confined to porous items which are not water-soaked and do not contain inherent animal proteins. NIN coloration is not permanent, and while some impressions have remained visible for years, others have faded in a matter of days.

5.13.1 Recommended Preparations (0.5% concentration):

5.13.1.1 Petroleum Ether Solution

Chemicals Required

- 10 g NIN
- 60 mL Methanol
- 80 mL 2-Propanol (Isopropyl Alcohol)
- 1860 mL Petroleum Ether

Directions

1. Dissolve NIN crystals in Methanol.
2. Add 2-Propanol to NIN/Methanol solution and stir.
3. Add NIN/ Methanol/2-Propanol solution to Petroleum Ether and stir.

5.13.1.2 Acetone Solution

Chemicals Required

- 25 g NIN
- 1 L of Acetone

Directions

1. Dissolve NIN crystals in Acetone.

5.13.1.3 Heptane Solution

Chemicals Required

- 33 g NIN
- 220 mL Ethyl Alcohol (use Absolute Ethanol, DO NOT use Denatured Ethanol)
- 1 L Heptane

Directions

1. Dissolve NIN in Ethyl alcohol.
2. Remove 220 mL of Heptane from bottle.
3. Add NIN/Ethyl Alcohol solution to Heptane and stir.

5.13.2 Commercially prepared NIN, including those formulations containing HFE, may be used; no specific preparation is needed.

5.13.3 Instrumentation:

5.13.3.1 A humidity chamber or a steam iron may be used to control the heat and relative humidity to accelerate the development of impressions after processing.

5.13.3.2 If using a humidity chamber, the chamber should be set at no greater than 80 degrees Celsius/176 degrees Fahrenheit and between 60% and 80% relative humidity.

5.13.4 Minimum Standards and Controls:

5.13.4.1 NIN shall be stored in a dark bottle and have a shelf life not exceeding one year.

5.13.4.2 Apply a test impression to a porous item similar to the evidence being processed or use a test strip. Follow the procedure listed below to process the test impression/strip. If the test impression/strip turns purple, the working solution can be used to process evidence.

5.13.5 Procedure or Analysis:

5.13.5.1 Item(s) may be dipped, sprayed or washed.

5.13.5.2 Allow the item(s) to dry for a minimum of 1 hour prior to the application of heat or steam.

5.13.5.3 Place the item(s) in the heat/humidity chamber or the item may be steam ironed.

5.13.5.4 Check the item(s) periodically to monitor the impression development and to avoid saturating the item with water vapor.

5.13.5.5 After a minimum of 12 hours, review the item(s) and document any additional impressions that developed.

5.13.5.6 If using a heat/humidity chamber to achieve optimal development, it is not necessary to wait 12 hours.

5.13.5.7 Capture impressions for analysis and further examination.

5.14 Oil Red O (ORO)

ORO is a fat-soluble dye that is sensitive to the lipid component of residue. Staining with ORO will produce a dark red to brown coloring of lipids and fats on porous surfaces. ORO is insoluble in water, as are the lipids it stains, enabling it to be used on porous items that have been wet.

5.14.1 Preparation:

5.14.1.1 ORO Working Solution

Chemicals Required

- 1.54 g ORO powder
- 770 mL Methanol
- 9.2 g Sodium Hydroxide
- 230 mL R/O or DI water

Directions:

1. Dissolve ORO powder in Methanol and stir.
2. Dissolve Sodium Hydroxide in water and stir.
3. Add Sodium Hydroxide solution to ORO solution and stir.
4. Filter combined solution.

5.14.2 Instrumentation:

5.14.2.1 A shaker table is recommended during staining to ensure the entire item remains immersed.

5.14.3 Minimum Standards and Controls:

5.14.3.1 ORO shall be stored in a dark bottle and have a shelf life not exceeding one year.

5.14.3.2 Apply a test impression using natural sebaceous residue to a porous item similar to the evidence being processed. Follow the procedure listed below to process the test impression. If the test impression turns red to brown in color, the working solution can be used to process evidence.

5.14.4 Procedure or Analysis:

5.14.4.1 Immerse each item(s) to be processed in the ORO staining solution. Impressions generally develop between five and ninety minutes, depending on the lipid content.

5.14.4.2 Place the tray with the staining solution and item(s) on a shaker table to ensure immersion.

5.14.4.3 Remove the item(s) from the ORO staining solution and drain.

5.14.4.4 Immerse the item(s) in a tray of continuously running DI water to neutralize the pH of the porous substrate.

5.14.4.5 Remove the item(s) from the water and dry completely.

5.14.4.6 Review the item(s) for any developed impressions.

5.14.4.7 Capture impressions for analysis and further examination.

5.15 Physical Developer (PD)

PD is reactive with the lipid content of the residue and is specifically for the examination of wet or water-soaked porous items. Impressions appear as dark gray images which increase in contrast. This technique utilizes sensitive reactions that precipitate silver to the non-sebaceous material present in the residue.

5.15.1 Preparations:

5.15.1.1 Maleic Acid Pre-wash Solution

Chemicals Required:

- 1 L R/O or DI water
- 25 g Maleic Acid

Directions

1. Add Maleic Acid to R/O or DI water.
2. Stir until dissolved with a magnetic stir bar previously rinsed with R/O or DI water.

5.15.1.2 Detergent Stock Solution

Chemicals Required

- 1 L R/O or DI water
- g n-Dodecylamine Acetate
- mL Surfactant

Directions

1. Add n-Dodecylamine Acetate to R/O or DI water and stir with a magnetic stir bar previously rinsed with R/O or DI water. If some of the n-Dodecylamine Acetate sticks to the weigh boat, the weigh boat can be immersed in the solution.
2. Add 3 mL Surfactant to the n-Dodecylamine Acetate solution. Place the weigh boat in the solution as the surfactant will adhere to the weigh boat.
3. Stir for thirty minutes.
4. Remove the weigh boat(s).
5. This solution must not be used for at least 24 hours. If solids are present after 24 hours, discard and remix.

5.15.1.3 Buffered Ferrous/Ferric Redox Solution

Chemicals Required

- 1000 mL R/O or DI water
- 30 g Ferric Nitrate
- 80 g Ferrous Ammonium Sulfate
- 20 g Citric Acid

Directions

1. Pour 900 mL of R/O or DI water into a beaker and stir with a magnetic stir bar previously rinsed with R/O or DI water.
2. Add Ferric Nitrate to R/O or DI water and stir until dissolved.
3. When Ferric Nitrate has fully dissolved, add Ferrous Ammonium Sulfate and stir until dissolved.
4. When Ferrous Ammonium Sulfate has fully dissolved, add Citric Acid and stir until dissolved.
5. Stir until the Citric Acid is fully dissolved and then stir for an additional five minutes.

5.15.1.4 Silver Nitrate Solution

Chemicals Required

- 50 mL R/O or DI water
- 10 g Silver Nitrate

Directions

1. Add Silver Nitrate to R/O or DI water and stir until dissolved.

5.15.1.5 Physical Developer Combined Working Solution

Chemicals Required

- 40 mL Stock Detergent Solution
- Buffered Ferrous/Ferric Redox Solution
- Silver Nitrate Solution

Directions

1. Add Stock Detergent Solution to Redox Solution and stir.
2. Examine Silver Nitrate solution to ensure all solid material has dissolved. Stir as needed.
3. Add Silver Nitrate solution to Redox/Stock Detergent solution and stir for two minutes.

5.15.1.6 Photofix Rinse Solutions

5.15.1.6.1 Rinse 1

Chemicals Required

- Four or five drops Polymax Fixer per L of R/O or DI water
- R/O or DI water

Directions

1. Add Polymax Fixer to R/O or DI water in a glass or plastic tray.

5.15.1.6.2 Rinse 2

Chemicals Required

- One part Photographic Fixer
- Nine parts R/O or DI water

Directions

1. Add Photographic Fixer to R/O or DI water in a glass or plastic tray.

5.15.1.7 Bleach Solution

Chemicals Required

- One part Bleach
- One part R/O or DI water

Directions

1. Combine bleach and R/O or DI water.

5.15.2 Instrumentation:

5.15.2.1 All glassware and utensils must be dedicated to the technique to avoid reagent contamination.

5.15.2.2 Certain rubber products and glove types may cause contamination and should not be used and/or come in contact with the item(s) of evidence after the pre-wash.

5.15.2.3 Plastic rinse trays may be used but must be clean.

5.15.2.4 Plastic or bamboo tongs without serrated edges are recommended for item handling.

5.15.3 Minimum Standards and Controls:

5.15.3.1 The stock solutions have a one-year shelf life.

5.15.3.2 The PD combined working solution is unstable and shall be discarded after use.

5.15.3.3 Apply a test impression to a porous item similar to the evidence being processed. Follow the procedure listed below to process the test impression. If the test impression turns dark gray, the working solution can be used to process evidence.

5.15.4 Procedure or Analysis:

5.15.4.1 Immerse item(s) in Maleic Acid pre-wash solution in a glass tray for five to ten minutes or until bubbles are no longer given off.

5.15.4.2 Pre-wash is necessary to avoid reagent contamination.

5.15.4.3 Immerse item(s) in the PD working solution and gently rock the tray.

5.15.4.4 Impression development time will vary and can be as little as one minute or up to twenty minutes.

5.15.4.5 Keep the item(s) separated and be careful not to crease or extensively handle the item(s). Monitor development closely to avoid over processing.

5.15.4.6 Remove the item(s) when optimum contrast is observed.

5.15.4.7 Rinse the item(s) of evidence using either the water rinse or two-step Photofix rinse.

5.15.4.8 Water rinse

5.15.4.8.1 Immerse item(s) of evidence in a tray with continuous gentle running R/O or DI water.

5.15.4.9 Photofix rinse

5.15.4.9.1 Immerse item(s) of evidence in the Photofix Rinse 1 solution for 30 seconds.

5.15.4.9.2 Transfer the item(s) of evidence into Photofix Rinse 2 solution for three minutes.

5.15.4.9.3 Wash the item(s) in running water for three to five minutes.

5.15.4.10 Allow the item(s) of evidence to dry while lying flat.

5.15.4.11 The item(s) can be blotted carefully with blotter paper to speed the drying process if the item(s) are not fragile.

5.15.4.12 If needed, a bleach rinse may be used to improve the contrast of the impression.

5.15.4.13 All impressions should be photographed before proceeding with this step.

5.15.4.14 Immerse item(s) of evidence in the bleach solution for two to three minutes.

5.15.4.15 Rinse item(s) of evidence in running R/O or DI water for two to three minutes.

5.15.4.16 Review the item(s) for any developed impressions.

5.15.4.17 Capture impressions for analysis and further examination.

5.16 Rhodamine 6G-Ardrox-MBD (RAM)

RAM is a combination dye stain that enhances impressions previously developed with CA. RAM is applied to the object and visually examined utilizing an ALS at various wavelengths.

5.16.1 Preparation:

5.16.1.1 R6G Stock Solution

Chemicals Required

- 1 g R6G
- 1 L Methanol

Directions

1. Combine the ingredients in the order listed.

5.16.1.2 MBD Stock Solution

Chemicals Required

- 1 g MBD
- 1 L Acetone

Directions

1. Combine the ingredients in the order listed.

5.16.1.3 RAM Working Solution

Chemicals Required

- 3mL R6G Stock Solution
- 2 mL Ardrox
- 7 mL MBD Stock Solution
- 20 mL Methanol
- 10 mL Isopropanol
- 8 mL Acetonitrile

- 950 mL Petroleum Ether

Directions

1. Combine the ingredients in the order listed.

5.16.2 Instrumentation:

5.16.2.1 An ALS is required for visualization of developed impressions.

5.16.3 Minimum Standards and Controls:

5.16.3.1 RAM working solution shall not exceed six months. RAM working solution may separate after 30 days; if after stirring or shaking the solution it still separates, discard the solution.

5.16.3.2 Follow the procedure listed below to process a test impression previously deposited and developed with cyanoacrylate ester. If the test impression fluoresces, the working solution can be used to process evidence.

5.16.4 Procedure or Analysis:

5.16.4.1 Apply the solution to the item(s) by immersion, spray canister or squirt bottle.

5.16.4.2 Allow the item(s) to dry completely.

5.16.4.3 Review the item(s) for any developed impressions using an ALS with appropriate goggles.

5.16.4.4 RAM fluoresces within the same range as its component dye stains and viewed using the appropriate barrier filters.

5.16.4.5 Capture impressions for analysis and further examination.

5.17 Rhodamine 6G (R6G)

R6G is a dye stain that enhances impressions previously developed with CA. R6G is applied to the object and visually examined utilizing an ALS.

5.17.1 Preparation:

5.17.1.1 R6G Methanol Solution #1

Chemicals Required

- 0.0048 g R6G
- 1 L Methanol

Directions

1. Combine the ingredients and stir the solution until all of the powder is dissolved.

5.17.1.2 R6G Methanol Solution #2: Stock Solution

Chemicals Required

- 0.48 g R6G
- 1 L Methanol

Directions

1. Combine the ingredients and stir the solution until all of the powder is dissolved.

5.17.1.3 R6G Methanol Solution #2: Working Solution

Chemicals Required

- 10 mL R6G Stock Solution
- 1 L Methanol

Directions

1. Combine the ingredients.

5.17.1.4 R6G Aqueous Solution #1

Chemicals Required

- 0.0048 g R6G
- 1 L R/O or DI water
- 3 - 6 drops Surfactant

Directions

1. Combine the ingredients and continue to stir the solution until all powder is dissolved.

5.17.1.5 R6G Aqueous Solution #2: Stock Solution

Chemicals Required

- 0.48 g R6G
- 1 L R/O or DI water

Directions

1. Combine the ingredients and continue to stir the solution until all powder is dissolved.

5.17.1.6 R6G Aqueous Solution #2: Working Solution

Chemicals Required

- 10 mL R6G Aqueous Stock Solution
- 1 L R/O or DI water
- 3 - 6 drops Surfactant

Directions

1. Combine the ingredients.

5.17.2 Instrumentation:

5.17.2.1 An ALS is required for visualization of developed impressions.

5.17.3 Minimum Standards and Controls:

5.17.3.1 R6G solutions have a six-month shelf life.

5.17.3.2 Follow the procedure listed below to process an impression previously deposited and developed with cyanoacrylate ester. If the test impression fluoresces, the working solution can be used to process evidence.

5.17.4 Procedure or Analysis:

5.17.4.1 Apply the solution to the item(s) by immersion, spray canister or squirt bottle.

5.17.4.2 Allow the item(s) to dry completely.

5.17.4.3 Review the item(s) for any developed impressions using an ALS with appropriate goggles.

5.17.4.4 R6G fluoresces best with blue-green to green light and can be viewed using orange or red barrier filters.

5.17.4.5 Capture impressions for analysis and further examination.

5.18 TapeGlo™

TapeGlo™ is a fluorescent dye stain that develops impressions on the adhesive side of tape.

5.18.1 Preparation:

5.18.1.1 Follow manufacturer's recommendations for any preparation.

5.18.2 Instrumentation:

5.18.2.1 A soft-bristle brush may be used for application.

5.18.3 Minimum Standards and Controls:

5.18.3.1 The manufacturer's shelf-life recommendations shall be followed.

5.18.4 Procedure or Analysis:

5.18.4.1 Immerse, spray or brush the item(s) with the solution to completely cover the surface.

5.18.4.2 Allow the suspension to remain on the item(s) for 10 to 15 seconds.

5.18.4.3 Gently rinse with R/O or DI water

5.18.4.4 Review the item(s) for any developed impressions using an ALS with appropriate goggles.

5.18.4.5 TapeGlo™ fluoresces best with blue light and can be viewed using orange barrier filters.

5.18.4.6 Capture impressions for analysis and further examination.

6 PHYSICAL PROCESSING METHODS

6.1 Use of Physical Processing Methods

6.1.1 Any of the listed preparations may be used at the examiner's discretion.

6.2 Powder, Fluorescent

6.2.1 Powdering is the application of applying finely ground, colored powder to an item to make impressions visible. The powder binds to moisture, oil, and other residues. Fluorescent powders were developed specifically to be luminescent, excited by light sources emitting blue-green light.

6.2.1.1 Preparations:

6.2.1.1.1 No specific preparations are needed as the powders are commercially prepared.

6.2.1.2 Instrumentation:

6.2.1.2.1 Brushes are required for application of the powder.

6.2.1.2.2 An ALS is required for visualization of developed impressions.

6.2.1.3 Minimum Standards and Controls:

6.2.1.3.1 Fluorescent powder has an indeterminable shelf life; however, if clumping of the powder is observed, it shall be discarded.

6.2.1.3.2 Fluorescent powder should not be exposed to high humidity or moisture as this may cause clumping of the powder. Store fluorescent powder in a manner that minimizes this exposure.

6.2.1.4 Procedure or Analysis:

6.2.1.4.1 Coat the ends of the brush bristles with powder and gently tap several times to remove excess powder.

6.2.1.4.2 With the brush handle in a nearly perpendicular position to the surface, lightly and delicately move the bristle ends over the surface. Impressions will develop in contrast with each light pass until no further development can be observed.

6.2.1.4.3 Excessive powder will cause a fill between the details. This fill can be removed with continued brush strokes until the impression is as free of extraneous powder as possible.

6.2.1.4.4 Extraneous residue on the surface may cause a general painting effect, which can obscure impression detail. A lift of the area can sometimes remove the extraneous residue and permit a second, higher quality application of powder that may offer better contrast between the impression and the background.

6.2.1.4.5 Review the item(s) for any developed impressions using an ALS with appropriate goggles.

6.2.1.4.6 Capture impressions for analysis and further examination.

6.2.1.4.7 If lifting is required, process with standard powder prior to lifting.

6.2.1.4.8 Lift impressions using an appropriate method (gel lifter, adhesive lift, tape, etc.).

6.2.1.4.9 Capture lifted impressions for analysis and further examination.

6.3 Powder, Magnetic

Powdering is the application of finely ground, colored powder to an item to make impressions visible. The powder binds to moisture, oil, and other residues. Magnetic powders are powder-coated, fine iron filings subject to magnetic attraction.

6.3.1 Preparations:

6.3.1.1 No specific preparations are needed as the powders are commercially prepared.

6.3.2 Instrumentation:

6.3.2.1 Magnetic applicators are required for application of the powder.

6.3.3 Minimum Standards and Controls:

6.3.3.1 Magnetic powder has an indeterminable shelf life; however, if clumping of the powder is observed, it shall be discarded.

6.3.3.2 Magnetic powder should not be exposed to high humidity or moisture as this may cause clumping of the powder. Store magnetic powder in a manner that minimizes this exposure.

6.3.4 Procedure or Analysis:

6.3.4.1 Pick up the magnetic powder with the end of the magnetic applicator.

6.3.4.2 Without touching the surface with the applicator, lightly and delicately move the powder over the surface. Impressions will develop in contrast with each light pass until no further development can be observed.

6.3.4.3 Excessive powder can sometimes be removed by passing the magnetic applicator, without powder, near the surface to pick up the extra powder.

6.3.4.4 Review the item(s) for any developed impressions and capture any developed impressions prior to lifting.

6.3.4.5 Lift impressions using an appropriate method (gel lifter, adhesive lift, tape, etc.).

6.3.4.6 Capture impressions for analysis and further examination.

6.4 Powder, Standard

Powdering is the application of finely ground, colored powder to an item to make impressions visible. The powder binds to moisture, oil, and other residues.

6.4.1 Preparations:

6.4.1.1 No specific preparations are needed as the powders are commercially prepared.

6.4.2 Instrumentation:

6.4.2.1 Brushes are required for application of the powder.

6.4.3 Minimum Standards and Controls:

6.4.3.1 Standard powder has an indeterminable shelf life; however, if clumping of the powder is observed, it shall be discarded.

6.4.3.2 Standard powder should not be exposed to high humidity or moisture as this may cause clumping of the powder. Store standard powder in a manner that minimizes this exposure.

6.4.4 Procedure or Analysis:

6.4.4.1 Coat the ends of the brush bristles with powder and gently tap several times to remove excess powder.

6.4.4.2 With the brush handle in a nearly perpendicular position to the surface, lightly and delicately move the bristle ends over the surface. Impressions will develop in contrast with each light pass until no further development can be observed.

6.4.4.3 Excessive powder will cause a fill between the ridges. This fill can be removed with continued brush strokes until the impression is as free of extraneous powder as possible.

6.4.4.4 Extraneous residue on the surface may cause a general painting effect, which can obscure impression detail. A lift of the area can sometimes remove the extraneous residue and permit a second, higher quality application of powder that may offer better contrast between the impression and the background.

6.4.4.5 Review the item(s) for any developed impressions and capture developed impressions prior to lifting.

6.4.4.6 Lift impressions using an appropriate method (gel lifter, adhesive lift, tape, etc.).

6.4.4.7 Capture lifted impressions for analysis and further examination.

6.5 Small Particle Reagent (SPR)

SPR contains molybdenum disulfide, which is sensitive to lipids that may be present in residue. Processing with SPR is effective on non-porous items that were previously wet and as a secondary treatment of cyanoacrylate ester processed items.

6.5.1 Preparations:

6.5.1.1 Follow the manufacturer's instructions for pre-mixed solutions.

6.5.1.2 Surfactant Stock Solution

Chemicals Required

- 8 mL Surfactant such as Photo-Flo or an equivalent
- 500 mL R/O or DI water

Directions

1. Dissolve Surfactant into R/O or DI water

6.5.1.3 SPR Suspension Working Solution

Chemicals Required

- 10 g Molybdenum Disulfide

- 50 mL Surfactant Stock Solution
- 900 mL R/O or DI water

Directions

1. Add Molybdenum Disulfide to Surfactant Stock Solution slowly and stir continuously. A mixture that is creamy and free of dry powder is ideal.
2. While stirring continuously, add the Disulfide mixture to R/O or DI water.

6.5.2 Instrumentation:

6.5.2.1 None noted.

6.5.3 Minimum Standards and Controls:

6.5.3.1 SPR Suspension working solution shall have a shelf life not exceeding one year or, for commercially available products, the manufacturer's shelf-life recommendations.

6.5.3.2 Apply a test impression to a non-porous item similar to the evidence being processed. Follow the procedure listed below to process the test impression. If the test impression develops, the working solution can be used to process evidence.

6.5.4 Procedure or Analysis:

6.5.4.1 Immersion Application

6.5.4.1.1 Shake the working solution well and place it in a shallow tray that will allow for the item(s) to be completely submerged in the solution.

6.5.4.1.2 Stir the solution again before each item(s) is placed into the solution.

6.5.4.1.3 Place the item(s) in the solution as flat as possible in the tray.

6.5.4.1.4 Allow the item(s) to remain in the suspension for approximately 30 seconds. The molybdenum particles will settle on the item(s).

6.5.4.1.5 Turn the item(s) over and allow it to remain in the suspension for approximately 30 seconds.

6.5.4.1.6 Repeat procedure until all item(s) surfaces have been exposed to the solution.

6.5.4.1.7 Place the item(s) in a tray of water and rock the tray or flow water through the tray to remove excess SPR.

6.5.4.2 Wash Bottle Application

6.5.4.2.1 Spray a flow of SPR over the surface of the item(s).

6.5.4.2.2 Wash the surface of the item(s) with a light to moderate flow of water.

6.5.4.2.3 Allow the item(s) to dry.

6.5.4.2.4 Review the item(s) for any developed impressions and capture impressions developed prior to lifting.

6.5.4.2.5 Faint impressions may benefit from re-processing.

6.5.4.2.6 SPR lifts easily from dried, processed, non-porous surfaces.

6.5.4.2.7 Lift impressions using an appropriate method (gel lifter, adhesive lift, tape, etc.).

6.5.4.2.8 Capture lifted impressions for analysis and further examination.

6.6 Sticky Side Powder (SSP)

SSP consists of powder in suspension that binds to moisture, oil, and other residues. The suspension provides an effective delivery system for the powder.

6.6.1 Preparation:

6.6.1.1 SSP Working Solution

Chemicals Required

- Photo-Flo 200 or Surfactant
- R/O or DI water
- Sticky Side or other similar powder

Directions

1. Combine the Surfactant and R/O or DI water at a ratio of 1:1.
2. Add Sticky Side or other powder to the solution and stir until the mixture is a consistency of thin paint.

6.6.2 Instrumentation:

6.6.2.1 A soft-bristle brush could be used for application.

6.6.3 Minimum Standards and Controls:

6.6.3.1 SSP should be prepared as needed.

6.6.3.2 Apply a test impression on a surface similar to the evidence being processed. Follow the procedure listed below to process the test impression. If the test impression develops, the working solution can be used to process evidence.

6.6.4 Procedure or Analysis:

6.6.4.1 Immerse the item(s) in the suspension or paint the suspension on the sticky side of the tape using a soft bristled brush.

6.6.4.2 Allow the suspension to remain on the item(s) for approximately 10 seconds.

6.6.4.3 Remove the item(s) from the suspension and rinse excess suspension from the item(s) with a gentle flow of cold R/O or DI water.

6.6.4.4 These steps can be repeated to improve contrast.

6.6.4.5 Review the item(s) for any developed impressions and capture developed impressions prior to lifting.

6.6.4.6 Lift impressions using an appropriate method (gel lifter, adhesive lift, tape, etc.).

6.6.4.7 Capture impressions for analysis and further examination.

6.7 Wetwop™ / Wet Powder Solution

WetWop™ consists of powder in suspension that binds to moisture, oil, and other residues. The suspension provides an effective delivery system for the powder.

6.7.1 Preparation:

6.7.1.1 Follow manufacturer's recommendations for any preparation.

6.7.1.2 Instrumentation:

6.7.1.2.1 A soft-bristle brush may be used for application.

6.7.2 Minimum Standards and Controls:

6.7.2.1 The manufacturer's shelf-life recommendations shall be followed.

6.7.3 Procedure or Analysis:

6.7.3.1 Immerse the item(s) in the suspension or paint the suspension on the sticky side of the tape using a soft bristled brush.

6.7.3.2 Allow the suspension to remain on the item(s) for approximately 10 seconds.

6.7.3.3 Remove the item(s) from the suspension and rinse excess suspension from the item(s) with a gentle flow of cold R/O or DI water.

6.7.3.4 These steps can be repeated to improve contrast.

6.7.3.5 Review the item(s) for any developed impressions.

6.7.3.6 Capture impressions for analysis and further examination.

7 PRESERVATION TECHNIQUES

7.1 Introduction

7.1.1 In addition to digital imaging, preservation of impressions from items of evidence may include lifting and/or casting of any visible or developed impressions from items of evidence

7.1.1.1 Impression(s) shall be photographed or digitally captured prior to lifting or casting the impression(s).

7.1.1.2 The order and use of these individual techniques is determined by considerations such as substrate, components of the impression, etc.

7.1.2 Lifts/casts shall be treated as evidence and sub-itemed per the QM according to the evidence from which the impression was removed. These sub-items shall be added to the RFLE and created in LIMS.

7.1.3 Lifts/casts shall be labeled per the QM, to include the FS Lab#, item or sub-item #, initials of the person creating the lift/cast, and the date the lift/cast was created.

7.1.4 All lifts/casts created of impressions shall be returned to the submitting agency with the evidence per the QM.

7.2 Lifting

The order and use of these individual lifting techniques is determined by considerations such as substrate, components of the impression, which include type of residue, origin (dry or wet origin), and environmental conditions. If in doubt, treat all impressions as dry origin and apply the below methods. Multiple lifting attempts should be considered for best results.

7.2.1 It may be necessary to utilize various light sources, both white light and alternate light sources, to locate impressions on items of evidence prior to lifting.

7.3 Electrostatic Lifting Device

7.3.1 Introduction

Electrostatic lifting devices allow for impressions to be lifted from various surfaces and preserved for examination. Electrostatic dust lifting devices are useful for lifting dry origin dust and residue impressions. These devices utilize an electrostatic charge to transfer the dry origin impression onto a film for preservation.

7.3.1.1 In general, electrostatic dust lifting is the first lifting technique used as this process will not prevent the use of other subsequent lifting or enhancement techniques.

7.3.2 Preparation

The unit must be adequately charged before each use or contain a viable battery. A good supply of unused lifting film should be available. Never reuse lifting film.

7.3.3 Instrumentation

There are a number of electrostatic lifting devices and materials available. Consult the manufacturer’s guide for specific operating instructions.

7.3.4 Minimum Standards and Controls

If required, the electrostatic units must be sufficiently charged prior to use. Observation of the lifting film being compressed toward the surface during use will serve as a positive indication. The lifting film must be free of dust and other contaminants prior to use.

7.3.5 Procedure

7.3.5.1 Locate the impression to be lifted using appropriate lighting.

7.3.5.2 Cut a piece of lifting film that is larger than the impression.

7.3.5.3 Place the lifting film over the impression, with the black side down against the impression and the metalized side facing up.

7.3.5.4 Ensure the unit is properly grounded per the instructions of the particular unit.

7.3.5.5 Place the probe on the lifting film and turn the unit on. Use a roller to smooth the lifting film allowing it to make contact with the impression, if necessary.

7.3.5.6 Turn off the unit and wait several seconds for the film to discharge. Remove the film from the evidence by lifting one end and rising to the other end. Do not slide the film across the evidence.

7.3.5.7 To visualize the lifted impression, examine the lift in a dark room with a high intensity light source. Adjust the angle of the light source to observe the best contrast.

7.3.5.8 Photograph the impressions present on the lifting film using appropriate lighting.

7.3.5.9 Electrostatic dust lifts are fragile, and impressions can be destroyed by wiping across the surface and breaking the change. Care should be taken when handling and packaging.

7.3.5.9.1 Smaller lifts can be stored in individual, dust free containers such as file folders (non-plastic), clean boxes, etc.

7.3.5.9.2 Lifts may be carefully rolled with the non-lifting (metallic) surface on the outside. After rolling, the edge may be secured with a small piece of tape. The rolled lift can then be placed in a non-plastic tube.

7.3.6 Interpretation of Results

If the impressions are faint, photography can enhance and preserve the impression using various photographic and lighting techniques.

7.4 Lifts/Casts

7.4.1 Introduction

Adhesive coated materials or tapes can be used to lift impressions from surfaces. Lifts can be made of dust or residue impressions, wet origin impressions, and impressions developed with fingerprint powder.

Casting materials can be used to recover two-dimensional impressions and three-dimensional impressions. Casts can be made of impressions developed with fingerprint powder on two-dimensional surfaces and impressions made in pliable substrates.

7.4.2 Preparation

The substrate, components of the impression, and environmental conditions should be considered prior to selecting a lifting method.

7.4.3 Equipment

- Gelatin lifters
- Static lifts
- Adhesive lifters
- Fingerprint lifting tape
- Dental stone or other casting material
- Silicone (such as Mikrosil™)

7.4.4 Minimum Standards and Controls

7.4.4.1 Ensure the lifting material is free from foreign material prior to applying to the impression.

7.4.4.2 Label the lifts and casts with the case number, item number, date and initials.

7.4.4.3 All lifts and casts shall be digitally captured and compared to the original to ensure all detail was captured adequately.

7.4.4.4 All lifts and casts shall be treated as evidence and handled according to the Quality Manual.

7.4.5 Gelatin Lifters

7.4.5.1 Footwear-sized gelatin lifters are used for lifting dust, residue, blood, and wet origin impressions, as well as impressions developed with fingerprint powder.

7.4.5.2 Gel lifters are available in white, black, and clear.

7.4.5.2.1 White gel lifters provide greater contrast with impressions enhanced with dark colored powders or residue impressions.

7.4.5.2.2 Black gel lifters provide greater contrast with light colored powders or residue impressions.

7.4.5.2.3 Clear gel lifters normally do not provide good contrast and should only be used with a backing that provides adequate contrast.

7.4.5.3 Procedure

7.4.5.3.1 Select the appropriate color of lifter.

7.4.5.3.2 Remove the acetate cover carefully, as they may stretch when the cover is removed, and allow the gel lifter to rest until it returns to its original size before applying to the impression.

7.4.5.3.3 Lifted impressions should be photographed as soon as possible after collection and prior to replacing the acetate cover.

7.4.5.3.3.1 If the acetate cover was replaced prior to photographing, the side previously in contact with the gel lift should not be placed on the impression to prevent re-deposition of residue.

7.4.6 Adhesive Lifters

7.4.6.1 Adhesive lifters are available in white and clear. These lifters are used for lifting impressions developed with dark colored powder, however they are not recommended for lifting dust or residue impressions.

7.4.6.1.1 White backgrounds are recommended for clear adhesive lifters.

7.4.6.1.2 Clear adhesive on a clear background is not recommended.

7.4.6.2 Procedure

7.4.6.2.1 Cut the lifting material to a size that will adequately cover the area of interest. It is preferable to lift the entire impression with one piece of lifting material.

7.4.6.2.2 Lift the impression and adhere the appropriate backing or protective material.

7.4.6.2.3 Digitally capture without the acetate cover, whenever possible.

7.4.7 Static (vinyl) Lifts

7.4.7.1 Static lifts are used for lifting light-colored dust impressions from all types of surfaces.

7.4.7.1.1 Generally, the use of static lifts will not prevent subsequent lifting or enhancement techniques.

7.4.7.2 Procedure

7.4.7.2.1 Peel off white backing material. This will activate an electrostatic charge that will attract any dust residue impressions to the vinyl lift.

7.4.7.2.2 Lay the lift over the impression with the side from which the white backing was removed facing the impression, while holding or taping one end down.

7.4.7.2.3 Apply pressure evenly using a roller or hand.

7.4.7.2.4 Carefully lift away from the surface so as not to break the charge and damage the lifted impression.

7.4.7.2.5 To visualize the lifted impression, examine the lift in a dark room with a high intensity light source. Adjust the angle of the light source to observe the best contrast.

7.4.7.2.6 Photograph the impression present on the lifting film, using appropriate lighting.

7.4.7.2.7 Care should be taken when handling and packaging the static lifts.

7.4.7.2.8 Lifts can be stored in individual, dust free containers such as file folders (non-plastic), taped inside clean boxes, etc.

7.4.8 Rigid Casting

7.4.8.1 Dental stone or other similar material can be used to lift two-dimensional or three-dimensional impressions

7.4.8.1.1 Two-dimensional impressions such as mud and tire residues can be lifted with casting material from surfaces such as concrete, tile, and linoleum.

7.4.8.1.2 Dental stone or similar casting material can cast three-dimensional impressions in most substrates. A common three-dimensional impression seen in the laboratory may be in Biofoam.

7.4.8.2 Procedure – Two-dimensional casting

7.4.8.2.1 Mix according to instructions or recommended ratio for the product.

7.4.8.2.2 Place a cardboard frame or other release mechanism around the two-dimensional impression to aid in lifting the cast after drying.

7.4.8.2.3 Pour a thick layer of dental stone over the two-dimensional impression area and lift when dry.

7.4.8.2.4 Do not clean cast of a two-dimensional residue impression.

7.4.8.3 Procedure - Three-dimensional casting

7.4.8.3.1 Mix according to instructions or recommended ratio for the product.

7.4.8.3.2 If necessary, place a frame around the impression.

7.4.8.3.3 Pour the casting material beginning just outside the impression and allowing it to flow to fill the three-dimensional impression. It may be necessary to pour onto a spatula or other intervening device in order to break the fall and prevent any unnecessary damage to the impression.

7.4.8.3.4 Allow the casting material to harden before lifting.

7.4.8.3.5 For casts made of impressions in Biofoam, remove all the Biofoam material and clean the cast appropriately.

7.4.8.3.6 For casts made from other three-dimensional surfaces, it may be necessary to photograph any foreign debris prior to cleaning.

7.4.8.3.7 Casts should be allowed to completely cure and dry for approximately 48 hours prior to packaging in a rigid, breathable container, such as a cardboard box, to prevent damage.

7.4.9 Flexible Casting

7.4.9.1 Silicone casting materials such as Mikrosil™ can be used to lift impressions enhanced with powder from any surface, particularly textured surfaces.

7.4.9.2 Procedure

7.4.9.2.1 Mix according to manufacturer’s instructions and apply an even coating of the material over the impressions. Lift when material has cured (dry to the touch and easily releases from the surface). Consult the manufacturer’s recommendation for curing times.

7.4.9.2.2 Digitally capture using appropriate lighting techniques.

7.4.9.2.3 Package in a breathable container.

8 KNOWN STANDARDS

8.1 Introduction

The purpose for creating known standards (test impressions) from known footwear or tires is to record the characteristics on the outsole or tread and attempt to reproduce the conditions present when the questioned impression was made. Various techniques are non-destructive and not sequence dependent; it is at the examiner's discretion to choose the appropriate technique and continue to apply additional techniques as necessary to maximize results. The recording of known standards for footwear and tire tread design can be accomplished using these procedures. The quality of the comparison directly relates to the quality of the known standard. It is not required to create known standards if the images of the outsole or tire tread are sufficient for comparison (i.e., elimination based on design).

8.2 Preparation

Prior to making known standards, the examiner should recognize and preserve other relevant physical evidence and document and photograph the original condition of the outsoles, tires, and tread design. The examiner should select the method of making known standards based on the known footwear or tire, case circumstances, and products available.

8.2.1 A minimum of two known standards shall be created using two different methods to capture variability in different impressions. (e.g. dynamic vs. static, gel lifter vs. adhesive lifter).

8.2.1.1 Compare the known standards to each other and document if the characteristics are reproducing.

8.2.1.2 Verification is not required for standard-to-standard comparison.

8.3 Footwear Known Standards

8.3.1 Footwear known standards should record fine detail with appropriate contrast and/or three-dimensional features of accurate size, shape, clarity, and be suitable for use in the comparison process.

8.3.2 Relevant identifying information should be recorded on known standards, which may include the case number, item number, date created, initials and indication of left or right shoe (L or R).

8.3.3 Document the footwear brand, model, size and tag information, if available, in the examination documentation.

8.3.4 Initial known standards shall be made of the entire footwear. Test impressions of specific areas of the outsole may also be made if necessary for examination.

8.3.5 Excess dirt should be removed from the footwear with care so as not to damage the outsole. Remove any stone holds or other objects present within the design elements before test impressions are made. In some cases, test impressions may be made prior to removal of excess dirt from the outsole if necessary for the examination.

8.3.6 Document which of the below techniques were used to create the standard.

8.3.6.1 Clear or white adhesive lift or white gelatin lift and fingerprint powder or printer's ink

8.3.6.1.1 Apply an ample coat of fingerprint powder or ink to the footwear outsole. A light coat of a silicone spray may be applied prior to the application of the fingerprint powder.

8.3.6.1.2 Remove any excess powder by gently tapping the footwear onto a hard surface.

8.3.6.1.3 Remove the protective cover from the adhesive sheet or gel lifter. For the gel lifter, allow the gel lifter to relax for approximately 30 seconds before proceeding.

8.3.6.1.4 Lay the sheet or gel lifter adhesive side up on the surface where the impression will be made. A semi-soft surface, such as firm foam, can be used under the lifter to record the outsole details.

8.3.6.1.5 Make an impression (dynamic), while wearing the footwear, by stepping onto the adhesive sheet.

8.3.6.1.6 To create a static impression, press the adhesive against the outsole to obtain a complete recording of the outsole design.

8.3.6.1.7 Cover the impression with a clear protective cover.

8.3.6.2 Inkless Methods

8.3.6.2.1 Make an impression while wearing the footwear or pressing the outsole onto the inkless coater. The inkless coater may also be applied to the outsole using a roller and ensuring an even distribution of the inkless coater onto the entire outsole while preventing excess coating.

8.3.6.2.2 Step or press the outsole onto the treated paper.

8.3.6.3 Silicone spray, wipes or other suitable substances and magnetic fingerprint powder

8.3.6.3.1 Coat the outsole of the footwear with the selected substance.

8.3.6.3.2 Make an impression on a surface such as white paper or white cardboard.

8.3.6.3.3 Develop the impression with magnetic fingerprint powder.

8.3.6.3.3.1 An aerosol clear lacquer or other suitable protective coating can be applied to the developed test impression for preservation.

8.3.6.4 Three-dimensional test impressions

8.3.6.4.1 Make an impression while wearing the footwear or by pressing the outsole into a three-dimensional substrate (e.g. Bio-Foam).

8.3.6.4.2 Casting material – mix according to instructions or recommended ratio for the product. Pour into the three-dimensional impression and allow to harden. Remove any excess material from the cured cast.

8.4 Tire Known Standards

8.4.1 Known tire standards should record fine detail with appropriate contrast and/or three-dimensional features of accurate size, shape, and clarity. Multiple people must be involved when making test impressions from known tires mounted on a vehicle. One person will need to place the vehicle in neutral, steer and stop the vehicle, a second person will need to transfer markings onto the test impression as the tire is rolling, and a third person will need to push the vehicle slowly.

8.4.1.1 If known tires are submitted, it is acceptable to create known standards with the tires not mounted on a vehicle.

8.4.2 Relevant identifying information should be recorded on test impressions which may include but is not limited to case number, item number, make, model, size, DOT number, tire location on the vehicle, rolling direction of the tire, date, preparer's initials.

8.4.3 The location of the tread wear indicators and/or tire segments should be noted on the tire.

8.4.3.1 These can be used for marking off the sidewall of the tire into sections and giving each section an alpha or numeric designator. The sections should be marked using the location of the tread wear indicators.

8.4.3.2 The location of the tread wear indicators and/or tire segments should be transferred to the test impression as it is rolled. This should be done by transferring the markings placed on the sidewall as stated in 8.4.3.1.

8.4.4 Test impressions should record the full and continuous circumference of a tire.

8.4.5 The test impression made for each tire should be longer than the circumference of the tire, by approximately 3 feet, to ensure that the entire noise treatment pattern is collected.

8.4.5.1 Alternatively, two test impressions may be made of each tire, offset 180 degrees of rotation, to ensure different start and end points.

8.4.5.2 Vehicles with dual tire assembly should have both tire test impressions made simultaneously as to ensure that the relationship of the noise treatment between the two tires is appropriately recorded.

8.4.6 Test impressions should be made with the tire mounted on a vehicle, preferably using the subject vehicle, while the vehicle is in neutral being pushed (not driven).

8.4.7 Excess dirt should be removed from the tread of the known tire with care so as to not damage the tread or remove any stone holds or other objects present within the design elements before test impressions are made. In some cases, test impressions may be made prior to the removal of excess dirt.

8.4.8 Document which of the following methods were used to create the known standards:

8.4.8.1 Printer's ink with clear film.

8.4.8.1.1 Prepare two sections of chart board, each of sufficient length to record a full rotation of the tire.

8.4.8.1.2 Apply printer's ink to one section of chart board.

8.4.8.1.3 Cut, position, and tape clear film on the second section of chart board.

8.4.8.1.4 Roll the vehicle so that the tire travels over the inked chart board and then onto the clear film.

8.4.8.2 Printer's ink with chart board.

Repeat 8.4.8.1, omitting the use of the clear film, so that the inked impression will be produced directly on the chart board.

8.4.8.3 Petroleum jelly or silicone wipes on clear film with magnetic fingerprint powder.

8.4.8.3.1 Apply a light coat of the chosen substance to the tire tread.

8.4.8.3.2 Cut, position and tape clear film onto the chart board.

8.4.8.3.3 Roll the vehicle over chart board which has been covered with clear film to transfer the tire impression to the clear film.

8.4.8.3.4 Mark the film with relevant information regarding the tire position and direction of travel.

8.4.8.3.5 Develop the impression with black magnetic fingerprint powder.

8.4.8.3.6 Remove excess powder from the film.

8.4.8.3.7 Apply aerosol clear lacquer or other suitable protective coating to the test impression.

8.4.8.4 Petroleum jelly or silicone wipes on chart board with magnetic fingerprint powder.

Repeat 8.4.8.3 omitting the use of the clear film, so that the impression will be produced directly on the chart board.

8.4.9 Known standards for elimination can include any of the methods listed above, or any other method suitable for recording design detail. Photography is suitable to record the design detail for some elimination conclusions. If the known tire tread is photographed, a scale must be placed on the same plane as the bottom of the tread and included in the photograph.

8.4.10 Proposed significant deviations from methods of recording known standards in this manual must be presented to the TRT for evaluation and Program Manager for approval.

8.4.11 Known standards should record the full rotation of the tire. Documentation for not recording the full rotation shall be included in the notes.

8.4.12 Excess dirt should be removed from the tire with care so as to not damage the tread.

8.4.13 Methods for making tire impressions should record fine detail with good contrast and be suitable for use in the comparison process.

8.4.14 Document tire brand, make, size, DOT number, and other relevant information in the examination documentation.

8.4.15 Petroleum jelly or silicone wipes on chart board with magnetic fingerprint powder

- Prepare two pieces of chart board, each of sufficient length to record a full rotation of the tire.
- Apply a light coat of chosen substance on the tire surface.
- Roll the tire over chart board.
- Label the chart board with relevant information regarding tire, position and direction of travel.
- Develop the impression with magnetic fingerprint powder.

8.4.16 Known standards for elimination can include any of the methods listed above, or any other method suitable for recording design detail. Photography is suitable to record the design detail for some elimination conclusions.

8.4.16.1 Proposed significant deviations from methods of recording known standards in this manual must be presented to the TRT for evaluation and Program Manager for approval.

8.5 Interpretation of Results

Compare the known standard(s) to the actual item to ensure adequate detail was captured for comparison purposes.

9 IMPRESSION EXAMINATION

9.1 Introduction

Impression examinations are conducted using the Analysis, Comparison, Evaluation and Verification (ACE-V) methodology, utilizing both qualitative and quantitative analysis. This process is applied regardless of the combination of impression types (unknown versus known, unknown versus unknown).

9.1.1 Impressions examinations are conducted utilizing images that best represent the evidence.

9.1.1.1 Images used in rendering conclusions shall be printed natural size (1:1) when possible. If no scale or size reference appears in the image, follow the procedure in Section 4. This includes all annotated images of unknown (questioned) impressions, knowns, and known standards used in analysis, comparison, evaluation, and verification.

9.1.2 Designated impressions shall be digitally captured and images retained as examination documentation.

9.1.2.1 Each impression captured for analysis shall be designated by a unique number based on the Item number and type of impression (footwear, tire track, patterned impression).

9.1.3 The right and left footwear shall be treated as separate objects and the results shall be recorded for each analysis, comparison and evaluation separately, as applicable.

9.1.4 If it is not possible to examine the original evidence, then examinations may be performed with the examination documentation images existing in the case file after a protocol deviation is approved as outlined in the Quality Manual.

9.1.5 Consultation is a discussion between examiners, generally related to the determination of value or a source conclusion.

9.1.5.1 Consultations between examiners shall be documented and include the specific impression(s) reviewed, nature, results and date of the consultation and the name or initials of the consulting examiner. If the consultation is performed by an examiner in another laboratory location, documentation of the laboratory location will be included in the documentation.

9.1.6 Verifications must be completed prior to communicating the source conclusions to the submitting agency, either verbally or in writing.

9.2 Analysis

Analysis is the overall observation and interpretation of data present in the impression(s). Contemporaneous notes shall be documented using the Mideo software. Clarification techniques available in Photoshop may be used to achieve better visualization of the data present in images of the impression(s). Annotations on images may be done using printed 1:1 images or electronically using the tools available in Photoshop.

9.2.1 Examination of the questioned impressions shall be completed prior to the examinations of knowns to determine if there are sufficient gross design features and clarity to be suitable for use in comparison.

9.2.2 The analysis of questioned impressions shall include, but is not limited to, documentation of the following (if needed or utilized):

9.2.2.1 Substrate (porous, non-porous, semi-porous, smooth, textured, pliable etc.) suspected residue components (dry origin, origin, dust, dirt, blood, etc.), and sample preparation (cast cleaning, collecting of trace evidence, etc.)

9.2.2.2 Development and preservation techniques (photography, lifting, casting, chemical processing, physical processing, etc.)

9.2.2.3 Type of impression (footwear, tire track, pattern)

9.2.2.4 Area or region exhibited in the impression to include the following:

9.2.2.4.1 Full or Partial impression.

9.2.2.4.1.1 Full footwear impression; toe to heel with the medial and lateral sides visible.

9.2.2.4.1.2 Full tire impression; shoulder to shoulder visible. Record the number of Ribs and Grooves.

9.2.2.4.1.3 Partial footwear impression; Toe, Forefoot Arch area, Heel or Unknown.

9.2.2.4.1.4 Partial tire impression; number of Ribs and Grooves.

9.2.2.5 Class characteristics (design features, shapes, patterns, texturing, logo, etc.).

9.2.2.6 Interferences/limitations (distortion, surface interference, improper photography, etc.)

9.2.2.7 Characteristics of use (indications of wear, possible randomly acquired characteristic, etc.).

9.2.2.8 Quality of the impression.

9.2.2.8.1 High quality – the impression must have at least three of the following discernable criteria:

9.2.2.8.1.1 Clear definition of an edge or border (heel, toe, ball, arch, forefoot, lateral, medial, sidewall, edge).

9.2.2.8.1.2 At least four full, clearly discernable elements present (complete shape of element: circle, square, bar, zigzag line, polygon, tread element, treadwear indicator, etc.). If a pattern or network of is present, four or more repeating shapes that appear to be of manufacturer origin (four or more zig-zag peaks, four or more diamond or honeycomb enclosures, etc.).

9.2.2.8.1.3 Clear logo or text.

9.2.2.8.1.4 Obvious indications of wear consistent with general wear or outsoles in the heel, toe, or ball areas or tire tread elements.

9.2.2.8.1.5 Schallamach detail is visible.

9.2.2.8.1.6 A scale is present and properly located in the image to allow the image of the impression to be calibrated to natural size (1:1).

9.2.2.8.2 Low Quality – if the impression has two or less of the above listed criteria, additional analysis is required.

9.2.2.8.3 If only design/pattern is present, an impression must contain at least seven clearly discernable design elements or a pattern/network of at least seven repeating shapes (see 9.2.2.8.1.2).

9.2.3 Documentation of the observed data in impression images

9.2.3.1 Uniquely label each impression that is analyzed based on the item and type of impression.

Examples: 1FW1 would be used for Item 1 Footwear Impression 1

2TT2 would be used for Item 2 Tire Track Impression 2

3PI3 would be used for Item 3 Pattern Impression 3

9.2.3.2 Mark each of the characteristics observed during analysis as follows:

- Edge/border – Outline or shade area and label “Edge”, “Border”, “Edge/border”
- Elements/pattern of repeating shapes – Outline/shade/box in a minimum of the required quantity (high quality = 4 or more, low quality = 7)
- Logo/text – Outline the area and label “Logo”, “text”
- Wear – Outline or shade area and label “wear”
- Schallamach detail – Outline or shade area and label “Schallamach”
- Possible RACs – Circle/box or outline and label “PRAC”, “Poss. RAC”, “possible RAC”
- Scale – No marking needed if scale is present and properly placed. If no scale is present, note in examination documentation.

9.2.4 Determination of suitability for comparison

9.2.4.1 The impression is suitable for comparison (“of value for comparison”) due to adequate quality and quantity of observed data.

9.2.4.1.1 An impression that is suitable for comparison may result in any of the source conclusions outlined in Evaluation.

9.2.4.2 The impression is not suitable for comparison (“not of value for comparison”) due to the lack of adequate quality and quantity of observed data.

9.2.4.2.1 Another qualified examiner shall review all captured impressions that the examiner deemed not to be suitable for comparison. The review shall be documented in Mideo by completing the Consult/Review field in the Analysis Information tab.

9.2.4.2.2 If the suitability for comparison determination is not in agreement, the Difference of Opinion procedure shall be followed.

9.3 Comparison

Comparisons are conducted utilizing characteristics and features observed in Analysis. During the comparison, examination quality images (1:1) of the unknown or questioned impression, the known item (footwear or tire), if available, known standards, overlays of known standards and any images (1:1) of the unknown/questioned impression and known items used shall be included in the examination documentation. All images used during comparison shall accurately depict all characteristics that support the conclusion(s).

9.3.1 Visually compare questioned impressions with known item and images of the known item.

9.3.2 Visual comparison of design

9.3.2.1 If design is different, document, discontinue these procedures, and report accordingly.

9.3.2.2 If design is similar, prepare a known standard and continue with these procedures.

9.3.3 Compare the physical size and shape of the design/elements in the unknown (questioned) impression with the physical size and shape of the design/elements in the test impression and/or known shoes and/or tires by overlay and/or measurements.

9.3.3.1 Annotate the size and shape of design features present on images of the unknown (questioned) impression and overlays and/or images of the known items and known standards (if available).

9.3.3.2 If specific design and/or physical size and shape of design, to include noise treatment (pitch sequence) of tires, are different, document, discontinue these procedures, and report accordingly.

9.3.3.2.1 If physical size is different, consider scaling, perspective and other issues. If the differences can't be explained, discontinue this process and report accordingly.

9.3.4 Compare the wear pattern

9.3.4.1 Document the degree of wear, general wear, holes, position and orientation of wear, specific location of wear, and tears, if present.

9.3.4.2 If the position and degree of wear are different, document and evaluate possible wear changes between date of crime and date footwear or tires were recovered.

9.3.4.3 If the position and degree of general wear is similar or corresponds, continue with procedure.

9.3.5 Compare the randomly acquired characteristics

9.3.5.1 Document randomly acquired characteristics such as cuts, scratches, tears, holes, stone holds, abrasions and the acquisition of debris from random events, if present.

9.3.5.1.1 Documentation shall include the position, orientation, size and shape of the randomly acquired characteristics that contribute to the conclusion.

9.3.5.1.2 Due to varying circumstances, not all randomly acquired characteristics will reproduce in every impression. Therefore, the absence of a randomly acquired characteristic is not a basis for elimination and does not preclude identification.

9.4 Evaluation

Evaluation is the step of ACE-V where an examiner assesses the value of the details observed during the analysis and the comparison steps and reaches a source conclusion. Evaluation is the weighing of the strength of the observed similarities/correspondence and differences in the observed data between an unknown/questioned impression and a known item, or between two unknown/questioned impressions.

The following source conclusion opinions are rendered in impression examinations:

9.4.1 Elimination/Exclusion

Sufficient differences were noted in the comparison of class characteristics between the questioned impression and the known footwear or tire. The known footwear or tire was not the source and did not make the questioned impression.

9.4.2 Indications of non-association

The questioned impression exhibits dissimilarities when compared to the known footwear or tire, however, certain details or features were not sufficiently clear to permit elimination.

9.4.3 Limited association of class characteristics

Some similar class characteristics are present; however, there are significant limiting factors in the questioned impression that do not permit a stronger association between the impression and a known item. Factors may include, but are not limited to, insufficient detail, lack of scale, improper position of scale, improper photographic techniques, distortion or significant lengths of time between the date the incident occurred and when the footwear or tires were recovered that could account for a different degree of general wear. Some association is observed, however details available for comparison preclude a more discriminating conclusion. No confirmable differences were observed that could eliminate the footwear/tire.

9.4.4 Association of class characteristics

The class characteristics of design, physical size and shape correspond between the questioned impression and the known footwear/tire. Correspondence of general wear may be present. The known footwear/tire is a possible source of the questioned impression and therefore could have produced the impression; however, other footwear/tires with the same class characteristics observed in the impression are included as possible sources.

9.4.5 High degree of association

Observable correspondence of class characteristics of design, physical size and shape and general wear. For this degree of association, there must also exist 1) wear that by virtue of its specific location, degree and orientation, make it unusual and/or 2) one or more randomly acquired characteristics. The characteristics observed exhibit strong associations indicating the known footwear/tire is the source of the impression but are insufficient for identification. Other footwear/tires with the same characteristics could be included as the possible source only if they also display the same wear and/or randomly acquired characteristics observed in the questioned impression.

9.4.6 Identification

The questioned impression and the known footwear/tire share sufficient agreement of observable class and randomly acquired characteristics to conclude the known footwear/tire was the source of the questioned impression.

9.4.7 Inconclusive

Insufficient detail is present in the questioned impression and/or known standard to reach a conclusion of identification, exclusion or association.

9.5 Verification

Verification is the independent analysis, comparison and evaluation of a questioned impression with the known item and/or an image of the known item, the known standard and/or known overlays.

9.5.1 All comparison conclusions shall be verified by another examiner.

9.5.1.1 Verifications shall be documented.

9.5.2 Following the completion of the Evaluation, the primary examiner will provide the verifying examiner with examination quality images with impression designations indicated in the image.

9.5.2.1 Calibrated and clarified images containing no markings other than impressions designations shall be provided to the verifying examiner.

9.5.2.2 Images may be provided to the verifying examiner as printed (1:1) images or electronic copies of the images may be placed in a folder on the DFS shared drive. Images placed in a folder on the DFS shared drive should be deleted upon completion of the case.

9.5.2.3 The verifying examiner may request to be provided with original images in order to perform their own clarifications for better visualization of impression details. All images clarified by the verifying examiner shall be retained in the examination documentation.

9.5.2.4 The verifying examiner will conduct the Analysis, Comparison, and Evaluation steps for each impression and shall mark the characteristics used to render the conclusion on the images of the known and questioned impressions.

9.5.2.5 The verifying examiner shall label the images used to perform the comparison with the conclusion, date the examination was complete and their initials.

9.5.3 If the source conclusions are not in agreement, the Difference of Opinion procedure shall be followed.

9.6 Documentation Requirements

9.6.1 Document characteristics observed during the examination process that support conclusions.

9.6.2 The examiner shall label the images used to perform the comparison with the conclusion, date the examination was complete and their initials.

9.6.3 The following are suggested formats for annotations:

- A circle is drawn around a specific feature with a written explanation of the feature.
    - The written explanation should include the description of the class characteristics such as design, size or wear.
- Draw an outline around or brackets on each side of each impression to indicate the area that was analyzed and examined to render the reported conclusion.

9.6.4 If known footwear/tires are excluded as a source of the questioned specimen, an examination quality recorded copy of the outsole design or tread pattern must be maintained in the examination documentation.

9.6.5 Examination documentation must acknowledge impressions which were not analyzed, compared or evaluated.

9.6.6 Examination documentation created by the consulting/verifying examiner will be initialed by both the original and consulting/verifying examiner and included in the case file.

9.7 Difference of Opinion

9.7.1 Difference regarding suitability determinations

9.7.1.1 The examiners shall discuss the basis for their determination when a difference regarding suitability occurs. The discussion will result in 1) consensus the impression is suitable for comparison or 2) consensus the impression is not suitable for comparison.

9.7.1.2 When changes to the value determination are made and/or additional analysis is conducted following a review, the examination documentation shall include the reason for the change of opinion and/or additional analysis.

9.7.2 Difference regarding source conclusions

9.7.2.1 The original and verifying examiners shall discuss the basis for their conclusion when a difference regarding source conclusions occurs.

9.7.2.2 If consensus is not reached, an inconclusive source conclusion shall be reported on the CoA per QM Section 15 using the following language. The comparison of *1FW1* and *Item 2* is being reported as inconclusive due to lack of concordant results of duplicate analysis.

9.7.2.3 If consensus is not reached, the Physical Evidence PM and/or Director of Technical Services shall assign an examiner to evaluate the evidence to provide a quality assessment of the evidence items compared. The purpose of the evaluation is to provide a recommendation to the PM and/or Director of Technical Services as to the appropriateness of the non-consensus opinions and if both conclusions are sound.

10 FOOTWEAR AND TIRE TREAD MANUFACTURER SEARCHES

10.1 Introduction

10.1.1 Footwear and tire tread reference material can be used to determine the manufacturer's name and model associated with an unknown impression.

10.1.2 Manufacturer searches shall be conducted for unknown impressions determined to be suitable where known footwear/tires are not submitted and for unknown impressions that have been excluded to submitted known footwear/tires based on a difference in design/pattern.

10.1.3 The examination documentation shall include the specific reference material used to reach the reported conclusion.

10.1.4 The results of all searches shall be included on the CoA and the information retained as examination documentation. If the search results in a possible manufacturer, a printout shall be included with the examination documentation and provided with the CoA. Refer to section 10.5 for reporting of results.

10.1.5 It is not required to search an impression that contains a common class characteristic that would yield results that lack specificity to determine a manufacturer.

10.2 Determining Suitability for Manufacturer Searching

10.2.1 Determination of which impression(s) are suitable for a manufacturer search is made by the examiner. If a manufacturer search is not conducted, the reason as to why shall be documented in the examination documentation.

10.2.1.1 Manufacturer search suitability is a separate determination from the quality and analysis decisions on value and shall be documented separately.

10.2.1.2 If an impression is determined not to be suitable for a manufacturer search, the examiner shall consult with another qualified examiner. The consultation shall be documented in the examination documentation.

10.2.1.3 If an impression is determined not to be suitable for manufacturer searching, a statement shall be added in the Terminus Statements section of the Certificate of Analysis to include the reason(s) a search was not conducted.

For example: The 1FW1 impression was not subjected to a manufacturer search due to the limited or common design features exhibited in the impression.

10.3 Procedures

10.3.1 Tread Design Guide

10.3.1.1 The information is categorized alphabetically by manufacturer and is divided into tire types (i.e., passenger tires, small highway and light truck tires, medium and large highway truck tires, off-the-road, agricultural, ATV, motorcycle and truck retread designs).

10.3.1.2 A minimum search of the current year and two previous year's publications of the Tread Design Guide shall be performed.

10.3.1.3 If a possible manufacturer is located, a printout of the page from the Tread Design Guide with the manufacturer/model indicated shall be retained in the case file and included with the COA.

10.3.2 SoleMate®

10.3.2.1 The selection of the shape coding in the SoleMate ® software can affect the result of the search. If a potential match is not located, additional searches shall be performed.

10.3.2.1.1 A minimum of three searches shall be performed when a potential match is not found.

10.3.2.2 Searches shall be documented in the Manufacturer Search notes and include the search results and dates of the searches.

10.3.2.3 If the manufacturer/model is not located, a printout depicting the search parameters and potential matches for each search shall be reviewed by a second qualified examiner and retained in the case file.

10.3.2.4 If a potential manufacturer/model is located, a SoleMate® report containing an image of the outsole and manufacturer/model information shall be retained in the case file and included with the CoA.

10.3.3 Retail re-sellers

10.3.3.1 Online or physical stores are acceptable resources to locate a manufacturer of an unknown footwear outsole and tire tread patterns.

10.3.3.2 A minimum of five online retail re-sellers or manufacturer websites shall be searched.

10.3.3.3 Searches shall be documented in the Manufacturer Search notes and include the websites searched or physical stores visited, date(s) of the searches and the search results.

10.3.3.4 If a possible manufacturer/model is located, a printout of the footwear and outsole/tire tread and tire and model from the website located shall be retained in the case file and included with the CoA.

10.4 Verification of Search Results

10.4.1 When an examiner locates a possible manufacturer/model, the results will be reviewed by another qualified examiner.

10.4.1.1 The review shall be documented in the examination documentation and include the date of the review, the reviewer's name or initials, and the laboratory location where the review was conducted.

10.4.2 If a potential manufacturer/model is not located in any of the searches conducted by the examiner, another qualified examiner shall perform a subsequent search as outlined by the type of search conducted by the original examiner.

10.4.2.1 Tread Design Guide

10.4.2.1.1 If a potential manufacturer is not located by the examiner, a second examiner shall conduct at least one search of the Tread Design Guide from the past five years' publications.

10.4.2.1.2 The review shall be documented in the examination documentation and include the date of the review, reviewers name or initials, publication searched, and the laboratory location where the review was conducted.

10.4.2.2 Solemate®

10.4.2.2.1 If a potential manufacturer/model is not located in the Solemate database, a second examiner shall conduct at least one search.

10.4.2.2.2 This search shall be documented in the examination documentation and includes a printout of the parameters searched and potential matches for the search, date of the search, second examiner's name or initials, and the laboratory location where the review was conducted.

10.4.2.3 Retail re-sellers

10.4.2.3.1 If a potential manufacturer/model is not located by the examiner, a second examiner shall search a minimum of three retail re-sellers or manufacturer websites.

10.4.2.3.2 Results shall be documented in the examination documentation and include the re-sellers or manufacturer websites searched, dates of the searches, examiners name or initials, and the laboratory location where the review was conducted.

10.4.3 In an instance where the second examiner or verifier locates a potential manufacturer/model, the original examiner will review the search results and report the appropriate conclusion(s).

10.5 Reporting of Results

10.5.1 The search results shall be reported in the Manufacturer Search Results section of the Certificate of Analysis.

10.5.1.1 The sources searched shall be reported.

10.5.1.2 Sources may include Solemate FPX, online resources, Tread design Guides (including the publication date), retail stores, etc.

10.5.1.3 If a manufacturer/model is located, the source where located shall be reported.

11 EXAMINATION DOCUMENTATION

11.1 Introduction

Examination documentation for impressions examinations includes contemporaneous note taking and image processing to include calibration and clarification as well as marking of features in images used to support conclusions.

11.1.1 Contemporaneous note taking shall be documented electronically using Mideo.

11.1.1.1 In the event Mideo is not available, hand-written note taking will be documented using forms 241-F100 Latent Print Section File Notes and 241-F101 Latent Print Section File Notes (continued), as needed.

11.1.2 Calibration and clarification of images shall be completed using the tools available in Photoshop.

11.1.3 Marking of features and documentation on images may be completed on printed images and/or electronically using the tools available in Photoshop.

11.2 Mideo

Mideo is designed to capture and/or generate all necessary contemporaneous notes associated with impressions casework electronically. Mideo is housed on a network that allows examiners to perform consultations or verifications for an examiner in a different lab site.

11.2.1 Each examiner is assigned a password protected account to access the system.

11.2.2 Every examiner has the capability to access every active case and all associated notes.

11.3 Data Entry

11.3.1 Information is recorded in Mideo via fieldsets associated with each file.

11.3.2 Each file name must be unique to allow it to be saved.

11.3.3 The case history log documents actions taken on each folder and file and by whom.

11.4 Removal of Copies

11.4.1 The original examiner will remove the case folder from Mideo after the case has been technically and administratively reviewed.

11.4.1.1 Each file needs to be removed from each folder before the folder can be deleted.

11.4.1.2 Each folder needs to be removed from the Case folder before the Case folder can be deleted.

11.5 Documentation

11.5.1 All evidence, received or created for impressions examination, will be documented using Mideo.

11.5.1.1 The case folder will be created in Mideo using the FS lab # followed by “IP” or “IMP” as the title.

11.5.1.1.1 The containers will be entered separately and described.

11.5.1.1.2 When a containerless item is received for examination, “No Container” will be used as the container.

11.5.1.1.3 The item(s) of evidence shall be created in the Evidence folder.

11.5.1.1.3.1 Basic Information

11.5.1.1.3.1.1 The Item or Sub-Item number is entered in the Name field.

11.5.1.1.3.1.2 The Item Description is entered in the Title field.

11.5.1.1.3.1.3 Further information can be entered in the Description field.

11.5.1.1.3.2 Custom Information

11.5.1.1.3.2.1 Additional documentation can be entered into the three tabs as appropriate.

11.5.1.1.3.2.2 The Item Details tab is used to document the type of evidence and the processing or examination to be completed.

11.5.2 Documentation of Case Approach and Examination

11.5.2.1 The case approach for the item(s) is documented in the Item Details tab in the Custom Information section of the item(s).

11.5.2.2 The type of item(s) is selected to further document the examination.

11.5.2.3 Once the item type has been selected, additional fields will be generated to fully document the examination for that evidence type, including processing, manufacturer searches, analysis, comparisons, evaluations, and verifications.

11.5.2.4 If an item is documented as “Received - not analyzed”, a reason must be provided.

11.5.2.5 If an item is determined not to be suitable for processing, a reason must be documented in Mideo notes.

11.5.2.6 When items of evidence contain multiple components, the test results for those components will be reported accurately, clearly, and unambiguously in the examination documentation and the CoA.

11.5.3 Examination Documentation

11.5.3.1 It is not necessary to generate a note page if it is not relevant to the case.

11.5.3.1.1 At a minimum, Inventory Notes and Caseworks Object History Report will be generated at the conclusion of each case.

11.5.3.1.2 It is preferable to create a PDF of the Caseworks Object History Report, burn it to a CD/DVD and attach it to the case file.

11.5.3.2 A case documentation CD/DVD containing the Caseworks Object History Report and all images used or generated in the laboratory shall be included in the case file.

11.5.3.2.1 Create the disc utilizing CD/DVD burner options that Close and Verify after burning is complete.

11.5.3.3 All generated Mideo note pages, printed images, overlays, and electronic images (original and clarified) are considered examination documentation and shall be included in the case file.

12 REPORT WORDING

12.1 Introduction

12.1.1 The following report formats will be used to the extent possible when reporting results to ensure consistency within the section.

12.1.2 When drafting report wording for evidence types not listed or when specific examples do not appear for a particular type of evidence, look first to existing wording that may be applied to the current situation. If a situation is so unusual that appropriate report wording is not available in the manual, it is expected that the Section Supervisor/Examiner shall consult with other Section Supervisors/Examiners for wording that may have been previously applied to the situation, as well as with the Physical Evidence Program Manager and/or Director of Technical Services.

12.1.3 Per the QM, deviations from a test method shall be included on the CoA.

12.1.4 The Results and Interpretation portion of the CoA is a summary of the pertinent information relating to the examination, analysis and conclusions of items listed. The Result and Interpretation section of the CoA will be sub-sectioned into the following parts, as appropriate for the case at hand:

12.1.4.1 **PROCESSING AND EXAMINATION:** This section details the processing examinations (e.g., visual, chemical and/or physical) and results for each item. The results shall include the number of impressions recovered from each item.

12.1.4.2 **ANALYSIS:** This section provides details related to the analysis conducted on each impression.

12.1.4.2.1 The designated number for each impression is the Item number followed by the letters “FW” (footwear), “TT” (tire tread), or “PI” (pattern impression) and a number which is sequential for the series of impressions captured on the item.

12.1.4.3 **COMPARISON RESULTS:** This section details the comparisons and evaluations of the impressions designated as of value for comparison in the Analysis section. This section shall be organized by impression number, with the impression number indicated on the left followed by all conclusions for that impression.

Examples:

1FW1 Identification—The 1FW1 impression was made by the Item 2 right shoe based on sufficient agreement of observable class and randomly acquired characteristics.

Exclusion—Sufficient differences were noted between the characteristics present in the 1FW1 impression and those present in the Item 2 left shoe.

12.1.4.4 **MANUFACTURER SEARCH RESULTS:** This section provides details related to manufacturer searches, including database searches, online searches, reference collection searches, etc. Details shall include the sources searched and the source in which the possible manufacturer/model was located. An image of the outsole from the source located shall be included with the COA.

12.1.4.5 **TERMINUS STATEMENTS:** This section contains applicable statements regarding information pertinent to the submitting agency.

12.2 Wording Examples

These examples are meant to provide guidance and should be adapted to the case at hand as appropriate.

There is no need to further describe the item beyond the number as that information is available in the evidence lists. It is acceptable to include the description again in the processing section if deemed necessary for clarification.

12.2.1 **PROCESSING AND EXAMINATION**: Statement of the processing and examinations performed on the Item(s) and the results of those processing techniques.

12.2.1.1 The below can be used for submitted lifts, casts, or other item(s) that are visually examined with no processing techniques applied.

Item 1 was visually examined and captured.

Item 2 was visually examined and viewed with (an) alternate light source(s).

12.2.1.2 The below can be used for an item that was physically and/or chemically processed with the intent to develop or clarify an impression.

Item 1 was visually examined and chemically/physically processed.

Item 1 was visually examined and physically processed.

Item 1 was visually examined, chemically/physically processed, and viewed with (an) alternate light source(s).

12.2.1.3 The below can be used for items that are visually examined and determined not suitable for further processing. The reason for no further processing should be included in the CoA.

Item 4 was visually examined and determined not to be suitable for processing due to XXX.

12.2.1.4 The below can be used to report the results of visual examination and/or processing.

12.2.1.4.1 No impression detail is visible:

- No impressions were observed.
- No impressions were observed or developed.

12.2.1.4.2 Impression detail is visible but not suitable for capture:

- No impressions suitable for capture or further analysis were observed (or developed).

12.2.1.4.3 Impressions are observed/captured:

- Two impressions were captured.

12.2.1.4.4 An impression was photographed and/or lifted:

- One impression was captured and lifted (Item 1A).
    - Item 1A was captured. No impressions suitable for further analysis were observed on Item 1A. (If the lift is not suitable for further analysis.)
- One impression was digitally captured and lifted (Item 2A).

- One impression was captured on Item 2A.

12.2.1.5 The below can be used for submitted knowns.

Item 1 (known footwear/tire) was visually examined, captured, utilized to create known standards *(sub item #s)* and used for comparison. Item(s) (sub-item #s of known standards) were captured and used for comparison.

12.2.1.6 The below can be used when impressions were captured or submitted but were not analyzed.

The remaining impressions were not analyzed.

12.2.1.7 The below can be used for images on submitted digital media.

Item 1 (disc) contains thirty-two images. Three images were preserved and designated 1A-1C. The remaining images did not contain impressions or represent the same areas/impressions depicted in 1A-1C and therefore were not examined.

Image 1A depicts one impression.

Images 1B and 1C each depict two impressions.

12.2.2 **ANALYSIS**: Result statement for the analysis performed on each impression preserved and documented in the **PROCESSING AND EXAMINATION** section. The type of impression (footwear, tire track, or pattern) should be clarified in the analysis statement, if able to be determined.

12.2.2.1 The below can be used when an impression is determined to be of value for comparison:

Item 1 – Three footwear impressions of value for comparison have been designated *1FW1, 1FW3 and 1FW5.*
Item 2 – Two footwear impressions of value for comparison have been designated *2FW1 and 2FW2*. *One pattern* impression has been designated *2PI1*.

12.2.2.2 The below can be used when preserved impressions were determined to be of no value for comparison:

Item 2 – the impressions captured were analyzed and determined to be of no value for comparison.

12.2.2.3 The below can be used when impressions are depicted on an item and also in an image:

Item 1, image 1A – One impression, which is the same impression present on *Item 4* (lift/cast), is of value for comparison and has been designated *1FW1*.

Item 4 – One impression, which is the same impression depicted in *Item 1*, *image 1A*, is of value for comparison and has been assigned the same designation of *1FW1*.

12.2.3 **COMPARISON RESULTS**: Statements related to the comparison results of the impressions designated to be of value for comparison. This section shall be organized by impression number and the conclusion indicated at the beginning of the statement.

Example:

1FW1: **Limited Association of Class Characteristics** – The class characteristics present in the *1FW1* impression are similar to the design and shape present in the *Item 2 left shoe*, however, due to the

limited nature of the impression a more discriminating examination cannot be performed. There are no confirmable differences that would exclude the *Item 2 left shoe* from being the source of the impression. Other footwear with the same class characteristics could be the source of the impression.

Exclusion: Sufficient differences were noted between the characteristics present in the *1FW1* impression and those present in the *Item 2 right shoe* to conclude that the *Item 2 right shoe* is not the source of the impression.

12.2.3.1 Identification

The *1FW1* impression was made by the *Item 2 right shoe* based on sufficient agreement of class and randomly acquired characteristics observed in the impression and the *Item 2 right shoe*.

12.2.3.2 Elimination/Exclusion

Sufficient differences were noted between the characteristics present in the *2FW1* impression and those present in the *Item 5 right shoe* to conclude that the impression was not made by the *Item 5 right shoe*.

12.2.3.2.1 If excluding only from a submitted known standard and not known tire/footwear was submitted:

Sufficient differences were noted between the characteristics present in the *3TT1/3FW1* impression and those present in the *tire/footwear* that produced the *Item 6* known standard to conclude that the impression was not made by the tire/footwear that produced *Item 6*.

12.2.3.3 Inconclusive

The comparison of *the 5FW1* impression to the *Item 6 left footwear* is inconclusive; the impression could not be associated with or excluded from the submitted footwear due to insufficient detail present in the impression.

12.2.3.4 Indications of non-associations

The *3FW2 impression* exhibits dissimilarities when compared to the *Item 6 left boot*, however, certain details or features are not sufficiently clear to permit an elimination.

12.2.3.5 Limited association of class characteristics

The class characteristics present in the *5FW1* impression are similar to the design and shape present in the *Item 6 right shoe*, however, due to *distortion* (limited nature of the impression, improper photography, etc.) present in the impression a more discriminating examination cannot be performed. There are no confirmable differences that would exclude the *Item 6 right shoe* from being the source of the *5FW1* impression. Other *footwear* with the same characteristics could be the source of the impression.

12.2.3.6 Association of class characteristics

The general wear and class characteristics present in *the 4FW1 impression* correspond with design, shape, physical size, and general wear present in the *Item 8 right shoe*; therefore the *Item 8 right shoe* is a possible source of the *4FW1* impression. Other footwear with the same class characteristics could have been the source of the *4FW1* impression.

12.2.3.7 High degree of association

The specific location, degree and orientation of the wear present in the *9TT1* impression corresponds with the wear present in the *Item 10 tire* impression. In addition to the wear correspondence there exist (add number) randomly acquired characteristic(s) in both the *9TT1* impression and the *Item 10 tire* that indicate a strong association that the *Item 10 tire* is the source of the *9TT1* impression, but the characteristics are insufficient for an identification. Other *tires* with the same characteristics could be the source of the impression if they also display the same wear and randomly acquired characteristic(s) observed in the impression.

12.2.4 Multiple Case Associations/ Cross-Comparisons

12.2.4.1 As requested, Item 1 was compared to *Item 2* submitted under *FS Lab # C12- xxxx (Richmond PD Case# 12-yyyy).*

- The comparison results, as outlined in the previous section, should be inserted here.

12.2.5 **MANUFACTURER SEARCH RESULTS:** Statements related to the suitability of impressions for manufacturer searching and results of manufacturer searches completed for suitable impressions.

12.2.5.1 If a manufacturer/model is located:

The footwear outsole design depicted in *1FW1* was searched utilizing Solemate FPX and online resources. As a result of the search of online resources, the possible source of the impression was determined to be a *New Balance 608V5*. An image of the outsole and/or shoe is enclosed.

The footwear outsole design depicted in the *1FW1* impression was searched utilizing Solemate FPX and online result of both searches, the possible source of the impression was determined to be a *Converse All-Star*. Images of the outsole and/or shoe are enclosed.

12.2.5.2 If no manufacturer is located:

The *footwear/tire* tread design depicted in *1FW1/1TT1* was searched utilizing Solemate FPX/2019-2025 Tread Design Guides, and online resources. The manufacturer of the questioned *footwear/tire* impression could not be determined.

12.2.5.3 Statement regarding impressions of value for comparison but not suitable for a manufacturer search:

The *1FW1* impression is of value for comparison but is not suitable for a manufacturer search due to the lack of specificity of characteristics present in the impression (common pattern, limited amount of detail, etc.). Please submit known f*ootwear*, if available for comparison.

12.2.6 **TERMINUS STATEMENTS:** This section contains applicable statements regarding information pertinent to the submitting agency.

12.2.6.1 The following statement shall be included on all reports:

Date(s) of Testing: mm/dd/yyyy – mm/dd/yyyy

Supporting examination documentation is maintained in the case file. The above listed methods are those approved for use at the time of analysis. Current methods can be found in the Impressions – Footwear and Tire Tread Procedure Manual, which can be found at www.dfs.virginia.gov/documentation-publications/manuals/ .

12.2.6.2 Request for known samples if only know standards were submitted.

The known *footwear/tire* should be submitted for a conclusive comparison to the impression(s) of value.

12.2.6.3 Statements regarding Digital Media (DM), lifts, casts, known standards generated in the laboratory:

The returned digital media, Item *DM1*, contains images of impressions evidence captured from Items *1, 3, and 6*. This item of evidence is being returned in container *2* and should be retained. Should further comparisons be required, *Item DM1* must be resubmitted along with known *footwear/tires*.

Known standards (Items *3A and 3B*) are being returned with the evidence in container and should be retained.

Lifts (Items *6A and 6B*) are being returned with the evidence in container *6* and should be retained. Should further comparisons be required, the original lifts and/or Item *DM1* must be resubmitted.

12.2.6.4 Disposition of evidence

Document the disposition in the CoA according to the Quality Manual.

12.2.6.5 For Multiple Case Associations/ Cross-Comparisons

12.2.6.5.1 For submitted knowns only place in the **Processing and Examination** section:

As requested, Items *103C1 - 103C4* were also used for comparison to impressions from Items *101A and 101B* submitted under FS Lab# *XXX-XXXX* (Agency Police Department case# *XXXXX-12345*).

12.2.6.5.2 Under **Comparison Results:**

As requested, the impressions from Items *1, 2 and 3* were compared to Items *12, 13, 14 and 15 footwear/tire(s)* submitted in FS Lab *C24-xxx* (*Richmond PD* Case# *24-yyy*).
The *1FW1* impression was made by the *Item 12* left shoe submitted in FS Lab# *XX-XXXX* (*Agency PD* case #*1234567*) based on sufficient agreement of observable class and randomly acquired characteristics.

Sufficient differences were noted between the characteristics present in the1FW1 impression and those present in the Item 12 right shoe and the Items 13, 14, and 15 footwear submitted in FS Lab# XX-XXXX (*Agency PD* case #123456) to conclude that the impression were not made by the Item 12 right shoe or Items 13, 14, and 15 footwear submitted in FS Lab# XX-XXX (*Agency PD* case #123456).

12.2.6.5.3 For **Terminus Statements:**

The documentation associated with Items *X, X*, submitted in FS Lab# *XXX-XXXX* (*Agency Police Department* Case# *XXXX-12345*) is maintained in that case file.

13 QUALITY ASSURANCE

13.1 Introduction

The purpose of this section is to provide a uniform Quality Assurance Program for the Impression Section of the Virginia Department of Forensic Science. It is to establish a baseline or reference point of reliability and system performance. Follow the procedures outlined in the Latent Print Procedures Manual for completing resolution testing of the digital cameras and scanners.

13.2 Reagents

13.2.1 Utilize at least Certified Analytical Reagent ACS grade chemicals, if available, and reverse osmosis (R/O) or deionized (DI) water. Commercially manufactured reagents are an approved alternative to laboratory prepared reagents. However, they still must meet the minimum standards and controls requirements for that particular reagent. The manufacturer's shelf-life recommendations for commercially available products shall be followed.

13.2.2 Reagents shall be labeled according to the QM and documented in the Reagent Preparation Log.

13.2.3 For each batch created, a performance check ensuring the reagent is working as intended, shall be performed and appropriately documented in the Reagent Preparation Log prior to use on evidence.

13.2.3.1 Batch numbers assigned in the Reagent Preparation Log are established by month/day/year (010121). The batch number must be placed on the original and working containers.

13.2.3.1.1 If multiple batches are created on the same day, an alpha character will be added to the batch number for clarity.

13.3 Test Strip Preparation

13.3.1 Dissolve 1 gram of Noreleucine in 100 mL of warm water. Saturate blotter paper with solution. Allow paper to air dry and then cut into strips. The test strips shall be stored in a bottle and have a shelf life not exceeding two years.

13.4 Powders

13.4.1 The date the powder container is opened is to be used as the batch number, established by month/day/year (010121). The batch number shall be placed on the original and working containers.

13.4.1.1 If additional containers are opened on the same day, an alpha character will be added to the batch number for clarity.

13.4.2 Utilize powders that are of a homogenous mixture, free of clumps and foreign debris. Contaminated powders shall not be returned to stock containers.

13.4.3 Utilize a dedicated brush for different colors or types of powder.

13.5 Evidence Handling

Evidence packaging and evidence shall be documented and marked as outlined in the Quality Manual.

13.6 Equipment

13.6.1 Balances

13.6.1.1 Balances shall be calibrated by an outside vendor annually that is accredited to ISO/IEC 17025 and whose scope of accreditation covers the calibration performed. New balances shall

be calibrated prior to being placed into service. Calibration certificates shall be evaluated by the Section Supervisor, Group Supervisor, or designee prior to placing the balance into service.

13.6.1.2 All balances shall be performance checked quarterly (every three months) for accuracy using ASTM Class 1 weights.

13.6.1.2.1 Weights used to check balance accuracy shall be re-certified every three years by an ISO/IEC17025 accredited vendor whose scope of accreditation covers the certification performed.

13.6.1.3 Record the weight displayed on the balance using the Latent Print Balance Log form 241-F104.

13.6.1.4 If the accuracy of a weight is outside the acceptable range listed in the table below, ensure the balance is level and clean prior to rechecking. If, after these actions, the weight check is still outside the acceptable range it shall be taken out of service and labeled as such until maintenance and/or calibration is performed by a qualified vendor.

BALANCE TYPE	BALANCE EXAMPLES	CHECK WEIGHTS
Toploading (± 0.01) gram	Mettler PE 1600 Mettler PB302 Ohaus Scout Pro SP202 Sartorius BP21005	1.00 (± 0.02) gram, 10.00 (± 0.05) grams, 100.00 (± 0.05) grams
Toploading (± 0.001) gram	Ohaus Explorer Mettler PB303	0.100 (± 0.002) gram 1.000 (± 0.002) gram 100.000 (± 0.05) grams

13.6.1.5 Records of calibration and performance check shall be maintained in the equipment maintenance log.

13.6.2 Cyanoacrylate fuming chambers

13.6.2.1 Follow the manufacturers' instructions and user manuals to obtain optimum results.

13.6.3 Humidity Chambers

13.6.3.1 Follow the manufacturer's specification for maintenance of the humidity chamber.

13.6.4 Alternate Light Source (ALS)

13.6.4.1 Follow the manufacturer's specification for maintenance of the ALS.

13.6.5 Resolution Testing

13.6.5.1 The procedures shall be done annually for each piece of equipment utilized to capture images of impressions, footwear outsoles, and tire tread.

13.6.5.2 Complete the Resolution Test workflow in Qualtrax for each piece of equipment tested, upload the original non-calibrated TIFF image. Once the original image files are uploaded to Qualtrax they can be removed from the location where they were initially stored.

13.6.5.3 Follow the procedures outlined in the Latent Print Procedures Manual for completing resolution testing of the digital cameras and scanners.

14 ABBREVIATIONS

The following is a list of abbreviations and acronyms commonly used by examiners in the Impression Section of the Latent Print Section. This list has been generated to assist in the interpretation of case file notes and is not a standardized list of required abbreviations. The abbreviations are appropriate written in either lower or upper case and they are appropriate with or without punctuation such as periods. Common chemical formulas, chemical, mathematical and shorthand abbreviations are equally acceptable and will not be listed here.

Agency Case Number	ACN
Alternate Light Source	ALS
Analysis, Comparison, Evaluation-Verification	ACE-V
Amido Black	AB
Aqueous Leuco Crystal Violet	LCV
Association of Class Characteristics	ACC
Bearing the Name	BTN
Black Powder	BP, blk. pdr.
Blind Verification	BV
Brown	Brn, BN
Central Laboratory	C or CL
Compared	Comp.
Comparison(s)	Comp(s)
Container	Cont./C
Crimescope	CS
Cyanoacrylate Ester	CA
1,8-Diazafluoren-9-one	DFO
Designated	Desig.
Developed	Dev.
Digital	Dig.
Digital Media	DM
Disposition	Dispo.
Elimination	Elim.
Envelope	Env.
Eastern Laboratory	T or EL
Evidence Receiving	ER
Excluded/Exclusion	Exc.
Facsimile	Fax
Fingerprint(s)	Fp(s), Fgpt.
Firearms Section	FX
Footwear	FW
Forensic Biology Section	SX
Gentian Violet	GV
Environmental (Humidity) Chamber/Cabinet	HC
High Degree of Association	HDA
Identification	Ø, ID.
Impression(s)	Imp(s), IP
Inconclusive	Inc.
Indications of Non-association	INA

Latent Print Section	LX
Left	L
Leucocrystal Violet	LCV
Limited Association of Class Characteristics	LACC, LAC
Luma-Lite	LL
Magnetic	Mag.
Magnetic Powder	MP
Manila	Man.
Mold Characteristics	MC
Negative(s)	Neg(s)
Ninhydrin	Nin, NIN
No Value	NV
Northern Laboratory	N, NOVA
Of Value	OV
Oil Red O	ORO
Pattern Impression	PI
Physical Developer	PD
Pick-up	PU
Possible	Poss.
Possible Randomly Acquired Characteristics	PRAC, Poss. RAC
Present	Pres.
Previous	Prev.
Processed	Proc.
Randomly Acquired Characteristics	RACs
Received	Rec.
Reverse	Rev.
Right	R
Schallamach	SM
Sealed Brown Box	SBB
Sealed Envelope	SE
Sealed Manila Envelope	SME
Sealed paper bag	SPB
Sealed brown paper bag	SBPB
Sealed plastic bag	SPLB
Sealed White Box	SWBX
Sealed yellow envelope	SYE
Silver Nitrate	SN
Sticky Side Powder	SSP
Submitted/submission	Sub.
Small Particle Reagent	SPR
Superglue	SG, Cyano
Tire Impression	TI
Tire Track	TT
Trace	TE
Visible	Vis.

Western Laboratory	W

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