Latent Prints Methods Manual

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1 Scope

This Methods Manual includes the technical procedures for examining friction ridge impressions, evidence handling, digital enhancement, database entry, report writing and the development and perseveration of latent prints from evidence.

This manual is arranged according to protocols for various types of substrate materials and residues encountered in latent print processing. In some instances when procedures which fall into the general processing guidelines for a particular substrate are inappropriate or destructive due to other factors, can be modified so as to accomplish the best possible processing sequence for that specific item. Extensive effort has been made to ensure that the routine procedures described herein will produce accurate and valid analytical results. However, not all possible analyses encountered in casework can be appropriately covered in a methods manual, nor can all possible variations to a described procedure be included. Therefore, an analyst may use a non-routine procedure not specifically stated in this manual, provided that the conditions are followed in the "Method Validation" section of the Quality Manual.

Uncertainty of measurement does not apply to Latent Prints due to the significant qualitative aspects of the method.

2 References

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- Laboratory Quality Assurance Manual, Ohio BCI Crime Laboratory, current revision
- Latent Fingerprint Chemical Reagent Techniques Guide, Chesapeake Bay Division IAI, 2010
- Latent Print Detail Technical Procedures, Las Vegas Metropolitan Police Department Forensic Laboratory, 2021
- Latent Prints Quality Manual, Idaho State Police Forensic Services, 2016
- Latent Prints Technical Manual, Washington State Patrol Crime Laboratory Division, 2021
- Manual of Fingerprint Development Techniques, Home Office, Police Scientific Development Branch, 2001
- Standard for Friction Ridge Examination Conclusions, Organization of Scientific Area Committees (OSAC) Friction Ridge Subcommittee, 2018

- Standard for the Application of Blind Verification of Friction Ridge Examinations; Document #14, Scientific Working Group on Friction Ridge Analysis, Study, & Technology (SWGFAST), 2012
- Best Practice Recommendation for the Resolution of Conflicts in Friction Ridge Examination, ANSI/ASB 142, First Edition, 2022
- *Foster & Freeman's DCS®5 Fingerprint Enhancement System User Manual*
- *Foster & Freeman's Crime-lite® 8X4/Mk4*

3 Terms and Definitions

ACE-V:
The acronym for Analysis, Comparison, Evaluation, and Verification; an examination methodology.

ADAMS:
The acronym for Authenticated Digital Asset Management System; browser-based application used for the storage, tracking and organization of digital images in case documentation.

AFIS:
The acronym for Automated Fingerprint Identification System, a generic term for a finger/palm print matching, storage, and retrieval system.

Alternate light source (ALS):
A light source used to excite luminescence of latent prints, body fluids, chemical reagents, etc.

Analysis:
The first step of the ACE-V method. The interpretation of observed data in a friction ridge impression in order to categorize its utility.

Anatomical source:
An area of friction ridge skin from an individual from which an impression originated.

Anchor point:
A feature present in the latent print that allows an examiner to reliably determine the anatomical location of the unknown impression. Usually a core or a delta but can also be a major crease, a vestige, or some other characteristic ridge flow to assist during comparison.

Arch:
A pattern type in which the friction ridges enter on one side of the impression and flow, or tend to flow, out the other side with a rise or wave in the center.

Artifact:
Any information not present in the original object or image, inadvertently introduced by image capture, processing, compressions, transmission, display, or printing.

Bifurcation:
The point at which one friction ridge divides into two friction ridges.

Blind verification:
A type of verification in which the subsequent examiner(s) has no knowledge of the original examiner's decisions, conclusions or observed data used to support the conclusion.

Characteristic:
Distinctive details of the friction ridges (also known as features).

Clarity:
Visual quality of a friction ridge impression.

Comparison:
The second step of the ACE-V method. The search for and detection of similarities and differences in observed data between two potentially corresponding friction ridge impressions.

Competent:
Possessing and demonstrating the requisite knowledge, skills, and abilities to successfully perform a specific task.

Conclusion:
Determination made during the evaluation stage of ACE-V, including source identification, support for same source, inconclusive, support for different source and source exclusion.

Conflict:
A condition in which two or more examiners disagree on a sufficiency decision or source conclusion.

Control:
A known standard or preparation for checking or verifying a test reagent.

Core:
The approximate center of a fingerprint pattern.

Correspondence:
An observation of the type, orientation, and relative spatial relationship of friction ridge details and other information in agreement; an accumulation of similarities between two impressions resulting in an overall conformity or agreement.

Crease:
A line or linear depression on palmar and plantar surfaces that accommodates flexion. These include major (primary) creases which form prior to ridge development and secondary creases, also referred to as “white lines” which form after ridge development.

DCS5:
The acronym for Digital Capture System; hardware/software system produced by Foster+Freeman used for digital photography complemented with enhancement software which can store, track and organize digital images for case documentation

Delta:
The point on a friction ridge at or nearest to the point of divergence of two type lines, and located at or directly in front of the point of divergence.

Discrepancy:
The presence of friction ridge detail in one impression that does not exist in the corresponding area of another impression.

Discriminability:
The degree to which information in an impression can be used to reliably distinguish between impressions made by different sources. The discriminability of an impression encompasses its features’ quantity, spatial arrangement, clarity, and rarity.

Dissimilarity:
A difference in appearance between two friction ridge impressions.

Distortion:
Variances in the reproduction of friction skin caused by factors such as pressure, movement, force, and contact surface. (See also Appendix V).

Elasticity:
The ability of skin to recover from stretching, compression, or distortion.

Elimination prints:
Exemplars of friction ridge skin detail of persons known to have had legitimate access to an object or location.

Evaluation:

The third step of the ACE-V method. The weighting of the aggregate strength of the observed similarities and differences between the observed data in the two friction ridge impressions in order to formulate a source conclusion.

Exclusion:
See source exclusion.

Exemplars:
Recording of the friction ridge skin of an individual registered electronically, by ink, or by another medium (also known as known prints).

Fingerprint:
An impression of the friction ridges of all or any part of the finger

Focal Points:
A feature used to limit search parameters, including but not limited to the core, delta, creases, target group, scar or other distinctive ridge flow

Friction ridge:
A raised portion of the epidermis on the palmar or plantar skin.

Friction ridge detail/Features:
The combination of ridge flow, ridge characteristics and ridge structure of friction ridge skin, as observed and reproduced in an impression.

Furrows:
Valleys or depressions between friction ridges.

Hypothenar:
The ulnar side of the palm below the distal transverse crease.

Identification:
See source identification.

Impression:
Friction ridge detail deposited on a surface or the result of ridge detail removing a matrix from a surface.

Incipient ridge:
A friction ridge not fully developed that may appear shorter and thinner than fully developed friction ridges.

Incomplete:

The determination during comparison that the exemplars are inadequate in either quantity or quality.

Inconclusive:
The conclusion that the observations do not provide a sufficient degree of support for one proposition over the other. Any use of this conclusion shall include a statement of the factor(s) limiting a strong conclusion.

Insufficient ridge detail:
An impression(s) of the friction ridge skin that does not contain sufficient data to support a reliable conclusion. Also referred to as no value.

Interdigital:
The region of the palm distal to the ulnar side of the distal transverse crease and radial side of the proximal transverse crease.

Known prints:
See exemplars.

Latent Print:
An impression of the friction ridge skin recorded under accidental or uncontrolled circumstances. For this document, “latent print” also refers to a patent print, plastic print or inked prints on documents.

Lift:
An adhesive or other medium used to transfer and retain a friction ridge impression from a substrate.

Live Scan:
Electronic recording of friction ridges.

Loop:
A pattern type in which one or more friction ridges enter upon one side, recurve, touch or pass an imaginary line between delta and core and flow out, or tend to flow out, on the same side the friction ridges entered.

Lower joint (of the finger):
The hinged area that separates segments of the finger.

Major case prints:
A recording of all friction ridge detail appearing on the palmar sides of the hands. This includes the extreme sides of the palms, joints, tips, and sides of the fingers (also known as complete friction ridge exemplars).

Matrix:
The substance that is deposited or removed by the friction ridge skin when making an impression.

Minutiae:
The point where a friction ridge begins, terminates, or splits into two or more ridges.

NGI:
The acronym for Next Generation Identification which is the FBI's AFIS system; the updated version of IAFIS.

No match:
A negative result for a database search; it does not mean that no matching print exists in the database. This is differentiated from a source exclusion.

Not conducive:
Prints could be developed on an item; however, it is not likely (e.g. pens, pad locks, lug nuts, etc.)

Not suitable:
Item is unable to be processed as prints would not develop on the substrate (e.g. fabric)

OBIS:
The acronym for Ohio Biometric Identification System – a system used and maintained by the state of Ohio for the storage, retrieval and matching of finger and palm print records.

Observed data:
Any demonstrable information observed within an impression that an examiner relies upon to reach a decision, conclusion or opinion. This has historically been expressed as "features" or "minutiae," but the use of the broader term "observed data" is inclusive of other types of data that may be considered beyond minutiae, such as quality, scars, creases, edge shapes, pore structure, and other friction ridge features.

Palmprint:
An impression of the friction ridges of all or any part of the palmar surface of the hand.

Patent print:
Friction ridge impression of unknown origin, visible without development, a type of latent print.

Pattern force area:

A region of friction ridge skin in which minutiae of a particular type are forced to form due to the flow of the ridges.

Pattern type:
Fundamental shape of the ridge flow: arch, loop, whorl.

Plastic print:
Friction ridge impression of unknown origin that is impressed in a soft substrate to create a three-dimensional impression, a type of latent print.

Pores:
Small openings in the skin through which perspiration is released.

Preliminary examination:
An abbreviated examination of evidence in which all of the ridge detail present on an item was not analyzed for sufficiency or the processing of the item has been truncated. This may be utilized once a probative association has been made in the case.

Probability:
Probability is an expression of the chance that a particular event occurs. For the purposes of this manual, probability is subjective – the degree of belief or confidence placed in the occurrence of an event by the professional judgement of an individual based on the available evidence.

Quality:
The clarity of information contained within a friction ridge impression.

Quantity:
The amount of information contained within a friction ridge impression.

Rarity (of a feature type):
The frequency that a type of feature is encountered in a population (its prevalence), either in isolation or in conjunction with other information about its local context.

Reagent:
Substance used in a chemical reaction to detect, examine, measure, or produce other substances.

Ridge flow:
The direction of the friction ridges. May lack a classifiable pattern.

Ridge path:
The course of a single friction ridge.

Simultaneous impression:
Two or more friction ridge impressions from the same hand or foot deposited concurrently.

Source:
The individual who deposited a friction ridge impression(s).

Source exclusion:
The conclusion that the observed data provides extremely strong support for the proposition that the evidence originated from a different source and the likelihood for the proposition that the evidence arose from the same source is so remote as to be considered a practical impossibility; or the evidence exhibits fundamentally different characteristics.
This may also be referred to as exclusion.

Source identification:
The conclusion that the observed data provides extremely strong support for the proposition that the evidence originated form the same source and the likelihood for the proposition that the evidence arose from a different source is so remote as to be considered a practical impossibility.
This may also be referred to as identification.

Spatial relationship:
Proximity of characteristics to each other.

Stock solution:
Concentrated solution diluted to prepare a working solution.

Substrate:
The surface upon which a friction ridge impression is deposited.

Sufficient (Sufficiency):
The determination that there is adequate data (quantity and quality of detail) in a friction ridge impression for some further process such as: retention in the case, further analysis by a forensic scientist, comparison with exemplar prints, or searching in AFIS.

Support for Different Source:
The conclusion that the observed data provides more support for the proposition that the evidence originated from different sources rather than the same source; however, there is insufficient support for a Source Exclusion. The degree of support may range from limited to strong or similar descriptors of the degree of support. Any use of this conclusion shall include a statement of the factor(s) limiting a stronger conclusion.

Support for Same Source:
The conclusion that the observed data provide more support for the proposition that the evidence originated from the same source rather than different sources; however, there is insufficient support for a Source Identification. The degree of support may range from limited to strong or similar descriptors of the degree of support. Any use of this conclusion shall include a statement of the factor(s) limiting a stronger conclusion.

Target group:
A set of friction ridge features selected as a starting point during comparison.

Thenar:
The radial side of the palm circumscribed by the thenar crease.

Tolerance:
A means of expressing the variation that is allowable in two impressions originating from the same source due to the elasticity of the skin and differences in deposition and lateral pressure, twist, substrate, matrix, development medium, environmental factors, or post deposition damage.

Utility
The usefulness of an impression for a further step in the examination process, such as comparison or database entry.

Verification:
The independent check of a conclusion by another qualified analyst.

Whorl:
A fingerprint pattern type that consists of one or more friction ridges that make, or tends to make, a complete circuit, with at least two deltas.

Working solution:
Solution at the proper dilution for processing.

Writer's palm:
The ulnar edge ("blade") of the hypothenar and interdigital region of the palm that typically rests on a surface when a person is writing by hand.

4 Evidence Examination

All evidence will be handled in accordance to the Quality Assurance Manual - Laboratory Practices for Evidence Handling.

The analysis start date is the day the first item of evidence is opened. If no evidence is submitted (e.g. additional comparisons & AFIS re-searches) the analysis start date will be the day additional work began. This date will be documented in the case notes.
The analysis end date is the issue date on the report when the examination is completed and submitted for Technical Review. If the review process causes the analyst to conduct additional examinations, the analysis end date will be adjusted to the date the case is resubmitted for Technical Review. Administrative or clerical changes to the case file do not change the analysis end date.

4.1 Safety Considerations

Standard laboratory safety practices apply to all methods described in this manual (see the Laboratory Safety Manual). Additional safety considerations are described in individual methods, as necessary.

4.2 Instrumentation

Latent print examination equipment utilizes a large array of items which include those specifically designed for residue detection and those modified or adapted for the specialized needs of evidence processing.

- Specialized Light Source (e.g Alternative Light Source, flood lights, quartz lamps, fluorescent light boxes, fiber optic illuminators, ultraviolet, fluorescent light sources, and infrared viewing systems)
- Hand Magnifiers and lighted magnifiers
- Digital Cameras- single-lens-reflex (SLR) format with mega pixels of five or higher. The cameras can be mounted, in the laboratory, to a copy stand and operated from a host computer. These images are stored as RAW or TIF files and can be further enhanced with programs such as Adobe Photoshop.
- Cyanoacrylate Fuming Chambers are enclosures that can be sealed in order to contain the cyanoacrylate fumes and provide the appropriate environment for processing the evidence. Most often these are containers such as aquariums with Plexiglas lids or some other type of enclosure that has been manufactured by the user to accommodate the evidence to be processed. Humidity is usually provided for by placing a warm container of water in the enclosure. Heat for the volatilization of the cyanoacrylate ester is provided for by the light bulbs, hot plates or other devices that produce appropriate levels of heat. A vacuum chamber may also be used in casework. A vacuum chamber causes volatilization of the cyanoacrylate ester by pressure rather than heat and does not require the addition of humidity.

- Heat/Humidity Chambers- Environmental chambers or cabinets which permit adjustment of temperature and relative humidity are required to assure the maximum potential from selected processing procedures.

Additional essential instrumentation or equipment is listed in individual methods, as necessary.

4.3 Latent Print Case Approach

4.3.1 Objectives of Latent Print Casework

The objectives of testing in the latent print section include:

- Examining submitted evidence for latent finger, palm, and foot prints.
- Providing written examination of results (i.e., negative, insufficient/no value, sufficient, source identification, support for same source, inconclusive, support for different source, incomplete and source exclusion).
    - Negative-No friction ridge details observed
    - Insufficient/No Value-An impression(s) of the friction ridge skin that does not contain sufficient data to support a reliable conclusion.
    - Sufficient-The determination that there is adequate data (quantity and quality of detail) in a friction ridge impression for some further process such as: retention in the case, further analysis, comparison with exemplar prints, or searching in AFIS.
    - Inconclusive- The conclusion that the observations do not provide a sufficient degree of support for one proposition over the other. Any use of this conclusion shall include a statement of the factor(s) limiting a stronger conclusion.
    - Source Identification- The conclusion that the observations provide extremely strong support for the proposition that the evidence originated from the same source and the likelihood for the proposition that the evidence arose from a different source is so remote as to be considered a practical impossibility.
    - Source Exclusion- The conclusion that the observations provide extremely strong support for the proposition that the evidence originated from a different source and the likelihood for the proposition that the evidence arose from the same source is so remote as to be considered a practical impossibility; or the evidence exhibits fundamentally different characteristics.
    - Support for Same Source - The conclusion that the observations provide more support for the proposition that the evidence originated from the same source rather than different sources; however, there is insufficient support for a Source Identification.
    - Support for Different Source - The conclusion that the observations provide more support for the proposition that the impressions originated

from different sources rather than the same source; however, there is insufficient support for a Source Exclusion.
    - Incomplete - The known exemplars used during the comparison were determined to be insufficient and/or poor quality; therefore, the scientist is unable to reach a definitive conclusion. When acceptable exemplars are provided, the comparison can be completed.

- Providing effective communication of examination results in the form of court room testimony.

4.3.2 Limited Examination Approach

As appropriate, the Forensic Scientist may perform limited or preliminary examinations of evidence submitted and latent prints analyzed. This may mean that only selected evidence is examined, selected latent prints are examined, that certain individuals are compared or a combination of the above. The Forensic Scientist considers case circumstances and evidence types to select the evidence that is tested initially. For instance, if latent lifts are submitted, these may be examined before processing whole evidence items submitted for the case. If no identification is made to the latent lifts or if case circumstances dictate, the scientist may proceed with examining additional evidence items that require latent print processing.

Depending on the case circumstances, testing may stop once a probative identification is made. A probative identification could be:

- Identification made to a listed subject(s)
- Identification from database search

When a limited examination occurs, the case notes and report must reflect what evidence was not examined and what impressions or exemplars were not compared.

4.3.3 Basis of Identification

Present on the palmar surfaces of the hands and the plantar surfaces of the feet are areas of skin which are morphologically different from the skin located on the rest of the body. This skin is rough and corrugated, with raised portions known as friction ridges. Along these friction ridges are minute sweat pores, which exude sweat that coats the ridges. When an individual touches a surface, a reproduction of the friction ridge design may be left behind on that surface. Latent prints are those accidental, or unintentional, impressions. There is no way to determine the sex, age, or race of an individual based upon fingerprints. Similarly, the age of the fingerprint itself cannot be determined. Friction ridge identification is based upon the following premises:

- Papillary ridges form on the palmar surfaces of the hands and the plantar surfaces of the feet during fetal development. They remain persistent

throughout the life of the individual, except when damaged by scarring or certain diseases.
- No two individuals will share the exact same arrangements of friction ridge skin (papillary ridges).

4.4 Types of Evidence

The Forensic Scientist is primarily responsible for the detection and preservation of friction ridge skin impressions. A latent print is an impression of the friction ridge skin recorded under accidental or uncontrolled circumstances.

Latent: print made by perspiration or other substances on the skins surface that are typically invisible and require development.

Plastic: print that is impressed in a soft substrate to create a three-dimensional impression.

Patent: print that is visible without development, usually made by contamination of the skin with a substance such a blood, paint, ink, etc.

Inked print on document: print of an individual recorded in ink on document such as check or court paperwork.

For the purposes of this manual, the prints above will be referred to as latent prints.

Occasionally, impressions from an unknown individual may be submitted for identification. These include but are not limited to inked exemplars, photographs of friction ridge skin, and casting material (e.g. Mikrosil, AccuTrans).

5 Evidence Handling Practices

Items submitted for examination may include latent lifts, digital images and items for processing. When a portion of the evidence is preserved for future examination (e.g. lifts, digital images) it will be treated as evidence. Images taken in the laboratory and used as examination documentation are not considered evidence.

5.1 Marking of Latent Print Evidence

Latent Lifts

Areas of interest should be preserved with digital images (by photographing or scanning the lift). The areas will be designated with an arch/bracket/circle near the impression

with a notation of the associated impression number. The following numbering system is used:

- Parent item – Lift # –letter (e.g. 1-1a or 1-1A)
- A letter is needed of all impressions deemed sufficient and/or borderline

Processing items

Once processing is completed, areas of interest are identified and preserved for further examination. These areas will be designated with an arch/bracket/circle near the impression with a notation of the associated lift/photo number. The following numbering system is used:

- Work product (lift, photos): Parent item – Object # – Lift/Photo # –letter (e.g. 1-1-1a or 1-1-1A)
- A letter is needed of all impressions deemed sufficient and/or borderline

When labeling an item with case information or marking an area of interest, care must be taken not to mark the item of evidence in such a manner as to affect another examination. Therefore, if marking the item would have deleterious effects, or if the item does not lend itself to marking, the overall documentation photo in the notes will be labeled.

Each latent print that is determined to be sufficient for comparison will be marked as follows:

- Fingerprint - An arch over the top of a fingerprint
- Palm print - A bracket under a palm impression
- Lower joint - Parallel lines on both sides of a lower joint
- Impression - A circle around any impression where orientation and/or anatomical source cannot be determined
- Toe print - An arch over the top of the print with the notation “toe” documented in the case notes
- Foot print - A bracket at the bottom of the foot print with the notation “foot print” documented in the case notes

Marking of the sufficient impression for comparison is not necessary on images of the impression, so long as additional documentation is completed within the case record. For example, if orientation of the image depicted is not correct or unknown in the image, then a notation of such will be made.

5.1.1 Possible Collecting Officer Prints

Areas of ridge detail on a lift may sometimes be left by the individual who created the lift. When ridge detail is observed on a lift possibly from the collecting lifting officer (e.g. on the edge of the tape) it will be examined for sufficiency. If possible collecting officer

prints are sufficient, add a comment to the notes (e.g. “possible officer prints”), and include a statement requesting these elimination standards in the report.

Suspected officer print examination for sufficiency is <u>not needed</u> when:

- the ridge detail has been marked through as a strike-out (indicating that these are the prints of the lifting officer); or
- the ridge detail is within the back-fold of the tape
- the ridge detail is outside of the lifting area (i.e. lift from CD – impression is outside the curved edge)

5.1.2 Re-lifts

If there are duplicate lifts or photographs of the same latent print and only one of them is needed for the examination, the best lift or photograph will be marked. Reports should include the conclusions for all lifts/images used for comparisons.

- If the lift is labeled “re-lift” (i.e. duplicate), shows signs of distortion/background noise to indicate a re-lift, multiple digital images of the same area, or is a digital image of a lift where the sufficiency/clarity is not as good of quality as the original lift, ensure that the case notes indicate which lift(s)/image is used for comparisons.
    - This can be achieved by noting: “1-2 = apparent re-lift, not used for comparisons” or “Same as 1-2, not used for comparisons”
- Alternatively, if the re-lift/image is not sufficient for comparisons, ensure that the case notes indicate this.
    - This can be achieved by noting: “1-2= apparent re-lift, insufficient”

5.2 Preservation of Impressions

- Impressions suitable for capture developed during processing will be preserved using at least one method (i.e. lifts or digital images). An original impression will be defined as being the first ridge detail (impression) to be captured or otherwise preserved on an article by an examination or processing technique. If the same ridge detail (impression) is visualized through the use of an additional processing technique, this capture/preservation will be defined as being a duplicate impression.
    - This can be documented as “1-1-1(2) or 1-1-1(WL)”

- Digital images of latent impressions for comparison, which serve as the primary preservation of impressions or those necessary to enhance a previously preserved latent print will be archived in the Foray ADAMS Latent Case Management server.

    - These images need not be in a one-to-one format, but will include a measurement device and be taken in .TIF or .RAW format
        - This includes photographs as well as scanned images
- Digital images of impressions for comparison taken by a latent print forensic scientist are uploaded to ADAMS must have a unique identifier that corresponds back to the item of evidence
    - This can be achieved by naming the image with the case# and/or item # before uploading the image to ADAMS or by editing the Exhibit Name within ADAMS.
    - Additional information can also be added to the Description box within ADAMS (e.g. description of lift location)

5.3 Disposition of Evidence

- All lifts, photographs, and negatives received from an outside agency will be returned to the submitting agency for retention.
- All lifts, developed by the Forensic Scientist on items of evidence, will be returned to the submitting agency. If the lifts are of value, they will be placed in a new package and sampled in LIMS. If the lifts are not of value, they may be placed back into the original item's packaging.
- Evidence in digital format is stored utilizing a secure software program (e.g., ADAMS, Storage Area Network (SAN)) or secure hardware. Alternately, it may be printed or burned to a CD or DVD and then packaged, sealed and labeled appropriately and stored in one of the locations indicated above.

5.4 Examination Documentation

- Documentation will be maintained for every case submitted on the provided section notes.
    - Use of abbreviations is permitted if they are found on the list contained in Appendix III and IV.
- The documentation will contain at minimum the information set forth in the ANAB Accreditation Requirements.
    - Another competent forensic scientist shall be able to determine from the notes each examination activity conducted, the sequence of those activities, and the results of those activities.
- Digital images for documentation of items submitted for processing will be included as part of the case record. Annotation of these images in the notes include at a minimum the case number, item number, and analyst initials
    - Images need not be in a one-to-one format but should include a measurement device. They may be in .TIF, .RAW, or .JPG.
    - Images of items submitted for processing should be taken prior to processing in order to document the condition the item was received in

(i.e. tape pieces separated during examination) and kept as part of the case record.

- Documentation must include which prints were analyzed, compared, and evaluated and the conclusions reached.
    - Analysis documentation must detail the sufficiency of the print for comparisons, features observed, complexity and the location of any notable distortion for all prints determined to be sufficient or borderline. This can be documented using the Analysis Worksheets.
    - Documentation of minutiae features will be marked with colored dots, anchor points and distortion will be marked with shaded areas
    - Documentation must include the justification for sufficiency decisions involving complex and poor quality prints (borderline decisions).
    - Additional documentation may be needed for any impression deemed advanced on the complexity table below:

Complexity Table

Factors		
Anatomical Source	Self-evident	Not self-evident
Orientation	Self-evident	Not self-evident
Anchor Present	Yes	No
Feature type used	Predominantly Primary	Predominantly Secondary/Tertiary
Quality	Predominantly clear	Predominantly ambiguous
Quantity	Abundant	Limited
RATING	BASIC	ADVANCED

Definitions

- Anatomical Source – Anatomical region of ridge detail (finger/palm/tip/foot etc.) is discernible
- Orientation – Additional information, such as shape, ridge flow, or an anchor is present to aid in determining proper rotation and/or search area
- Anchor- Core, delta, major crease, scar, vestige, or any other characteristic ridge flow
- Self-evident – Able to be seen by those with very rudimentary training
- Primary features – Distinct level 2 detail (bifurcations, ending ridges, dots, open fields, etc.)
- Secondary features – Incipient ridges, scars, creases
- Tertiary features – Pores, edge contour, simultaneity, spatial relationship
- Ambiguous – May be viewed differently at a different time (intra-variability) or by others (inter-variability)
- Abundant – More data than needed, others may use different features (due to various options)
- Limited – All data is consumed, others have no choice but to use all of the same features

- Comparison documentation must include features used to draw the conclusion. This can include minutiae in common, target areas, anchor points and notable distortion. This can be documented using the Comparison Worksheet.
    - Documentation of minutiae features in common will be marked with colored dots
    - Additional features observed during comparison will be marked in a different color

    - Target areas must be indicated for source exclusion conclusions
    - Incomplete comparisons must include the nature of the exemplar insufficiency
        - Incomplete comparisons with corresponding detail should also indicate which area of the exemplar shows correspondence
- Additional documentation during comparison may be needed if any of the following conditions or scenarios are present:
    - Deviation from analysis
        - Three or more features marked during comparison are not consistent with how they were documented during comparison
        - Distortion previously noted during analysis is reassessed during comparison and is affecting the quality or reliability of information needed to render a conclusion. Reanalysis may be needed
    - Latent or exemplar lacking clarity
        - The visual quality of the latent or exemplar is poor
    - Limited detail
        - All data is consumed, others have no choice but to use all of the same features
    - Not easily searchable
        - The observed data do not provide strong indications of the anatomical source of orientation of the print, and/or the print is lacking an anchor
- Verification documentation must include the verifier's initials, verifier's conclusion and the date of the verification. This can be documented on the Comparison Worksheets.
- Legible records (photographs, scans or photocopies) of all latent print impressions of value for comparison purposes, whether developed in the lab or submitted preserved, must be retained as part of the examination documentation. However, it is not required that legible records of latent prints with no value for comparison or which were not examined be maintained in the case record.
- When a comparison is performed, the AFIS/FBI obtained or legible reproduction of the submitted known exemplars must be retained as part of the case record.
- A comparison quality copy of submitted exemplars must be retained in ADAMS
- When annotations are made on original evidence, latent print lifts or photographs/digital images of latent prints, the lifts and/or the photograph/digital images with the annotations or a legible copy must be retained as examination documentation in the case record. Annotations may include, but are not limited to, designations of latent prints of value, markings regarding an identification, etc. Reproductions are not necessary for routine annotations such as case number, date, etc.

- Documentation of sufficient/borderline sufficient prints must include AFIS/suitability and entry information, when applicable.
- For each AFIS/ NGI search performed, a candidate list will be generated and maintained within the examination documentation.

5.4.1 Name For Comparisons

- When a submitting agency provides a new name for comparison, the following documentation actions are performed:
    - The name of the individual is added to LIMS (as "Other") unless otherwise directed by the submitting agency as a suspect, victim, or elimination
    - A LP assignment is created and/or the evidence to be compared is selected
    - A case conversation record is created to document the requested comparison
      The BCI staff who received the name is responsible to email the assigned LP scientist and/or LP supervisor of the additional name received.

5.4.2 Record Section Searches

Individuals listed in the case may be looked up in the BCI and/or FBI Records Section in order to obtain exemplars for comparison. Searches may be conducted using identifying information, such as name, date of birth, social security number and BCI/FBI number. Record Section searches and results should be documented in the case notes and report.

If no record is found, the OHLEG (Ohio Law Enforcement Gateway) search result can be saved as part of the case documentation. The name and identifying information used for the record section search should be included on the report. If a social security number is used, it must be reported in the following format: XXX-XX-####.

Occasionally, multiple exemplars under one BCI number contain different names. The name listed on the exemplars used for comparison should be listed on the report. Other names can also be included on the report as an alias (i.e. AKA). The use of an alias is not needed for formatting or the use of a suffix (e.g. Nick Jonas Chopra vs Nick Jonas-Chopra or John Smith vs John Smith, Jr.)

5.4.3 LIMS Notes Entry

An entry into the LIMS Notes page provides statistical information for each LP Assignment as follows:

Description	Value
Items Submitted	Number of items, as listed on the submission sheet,

	assigned to the scientist or latent print section.
Items Examined	Number of items, found in submitted items, examined by the scientist. This includes exemplars used for comparison.
Images Produced	Number of enhanced digital images retained in ADAMS.
Lifts Submitted	Number of lifts submitted. This includes digital images submitted by an agency.
Lifts Produced	Number of lifts produced via processing. Does not include photographed images.
AFIS Finger	Number of fingerprints searched in AFIS.
AFIS Finger Hits	Number of fingers identified from AFIS searches.
AFIS Finger IDs	Number of individuals identified from AFIS finger searches. Individuals, not fingers.
AFIS Palm	Number of palm prints searched in AFIS.
AFIS Palm Hits	Number of palms identified from AFIS searches.
AFIS Palm IDs	Number of individuals identified from AFIS palm searches. Individuals, not palms.
NGI Finger	Number of fingerprints searched in NGI.
NGI Finger Hits	Number of fingers identified from NGI searches.
NGI Finger IDs	Number of individuals identified from NGI finger searches. Individuals, not fingers.
NGI Palm	Number of palm prints searched in NGI.
NGI Palm Hits	Number of palms identified from NGI searches.
NGI Palm IDs	Number of individuals identified from NGI palm searches. Individuals, not palms.
ULDB#	Number of AFIS images entered into the unsolved latent database.
ULDB ID	Number of individuals identified, i.e. BCI records. Individuals, not impressions.
Identifications	Number of identifications. Total identifications, not individuals.
Verifier	Verifying examiner's identification number.
Enhancement	Y/N – chemical/physical enhancements methods used.
Physical Comparison	Y/N – unknowns compared to knowns.

6 Image Enhancement

Image enhancement is any process intended to improve the visual appearance of an image. This includes processes that have a direct counterpart in the conventional silver-

based photographic laboratory and those that can be accomplished only by using a computer. Conventional photographic lighting techniques, filtration, film properties and processing chemical/techniques can all be accomplished through digital imaging. The electronic enhancement of the images, once captured, can be done with various types of hardware and software and is termed image enhancement. Currently available software provides many ways to improve contrasts or remove background interference and thereby improve the captured image. An application such as Fast Fourier Transformation (FFT) allows the scientist to enhance ridge structure while decreasing background interference. Improvements in image storage and in output or printing devices have increased the utility of imaging for latent print casework.

The potential for obtaining results, previously unattainable, makes this technology necessary. The use of BCI provided software and hardware imaging systems are described in the training/operations manual provided by the vendor(s). The scientist will become proficient in the use of these imaging systems through training and experience. The application of these systems are case dependent and at the discretion of the scientist.

6.1 Standards and Controls

Perform appropriate equipment maintenance to insure quality of performance and that they are operating in their proper capacity.

See Appendix I—Standards and Controls.

6.2 Enhancement Procedure

1. Latent print image processing (enhancement) will be done through the provided program(s).
2. Log onto the appropriate system program.
3. Import selected image(s) into the digital asset management system. No enhancement ~~may~~ *should* be performed outside the system. *Any enhancements that occur outside of the digital asset management system must be accompanied by an audit trail reflecting the enhancements made.*
4. Select the case containing the images that need to be processed.
5. Select the image(s) and click Process. The program will make a copy (Working Image) of the original image and import it into the image processing program. Process the Working Image using the tools provided in the image enhancement program.
6. All processes applied to the Working Image will be recorded using the “Enhanced Image History” tool. *External enhancements will be documented via generated audit trail and included in the digital asset management system.*
7. Processing techniques approved for use include, but are not limited to, brightness, contrast adjustment, dodging and burning, Levels, Curves, Color Balance, Hue/Saturation and Invert. Additionally, using Mode, channels and filters is

acceptable. Filters include but are not limited to FFT, Dust & Scratches, Reduce Noise, Unsharp Mask, and Sharpen Edges.

8. Tools prohibited for use on Working Images are those that add or delete content from the image. These include, but are not limited to, Rubber Stamp, Airbrush, Paintbrush, Paint Bucket, Eraser and Blur.
9. After the Working Image has been processed, the image processing program is exited and the changes to the image are saved (unsuccessful or unproductive enhancement attempts do not require retention). The processed Working Image is imported back into the tracking program. The image processing program will copy the enhanced history into the tracking program. *Images enhanced via external software must have an original image, working image and audit trail document included and retained within the digital asset management system.* At this point, the operator may continue processing additional images, exporting a processed image for printing or exiting the program.

6.3 Backup, Archiving and Retention

1. System backup is performed daily as a function of AGO network backup.
2. Any images from that case that will be archived to CD or DVD must use disks rated capable of a minimum 80 years transferred file storage life. Archived disks will contain, at minimum, the following information to be written on the clear inner ring of the disk:
   - Case number
   - Initials of scientist
   - Date created
   - Sampled item numbers
3. Any future comparison using digital images will occur using archived images stored in ADAMS or original printed images kept in the case file.

7 Processing Techniques

7.1.1 Visual

Visually examine all specimens to determine the best latent print development technique. Ensure that the surface is well illuminated. A photoflood light assembly ~~is~~ may be used to locate and photograph of prints on certain surfaces. Turn small article or move and adjust light to change the angle of illumination. Some prints may be visible only by oblique lighting. Any useful prints detected must be photographed before proceeding with any development process. Some friction ridge prints found by this method may not be detected by any other means. Use extreme care when handling articles to avoid damaging other prints that may not yet be apparent. Care must also be taken with some types of evidence, especially plastics, to position the light sufficiently distant from the evidence surface to prevent melting.

7.1.2 Fluorescence

Certain properties of perspiration, body oils, and/or foreign substances contained in latent print residue fluoresce when exposed to a laser or an alternate light source. A filter is used to block the incident light of the light source. No pre-treatment of the specimen is required; therefore, no alteration of the specimen occurs.

Use on all surfaces

- Nondestructive to specimen and subsequent examinations
- Detects prints on surfaces not suitable for powders or chemicals
- Detects prints not developed by other techniques

Procedure for conducting an examination

- Conduct examination in a dark room
- Aim expanded beam of light at object
- View object through an orange barrier or other appropriate colored filter
- Preserve ridge detail by photography

Use fluorescence examination after the application of the following chemicals:

- Fluorescent dye stains (Ardrox, Basic Yellow 40, Fluorescent Gentian Violet, MBD, MRM-10, RAM, Rhodamine 6G, etc.)
- DFO

7.2 Proper Sequences and Types of Processes

Correct processing techniques increases the probability of developing the best quality ridge detail. Adherence to the listed sequences ensures the best opportunity to develop all ridge detail and minimizes the chance of destroying prints. Surfaces on which prints are deposited can be divided into two basic categories-porous and nonporous. Non-porous evidence retains the print on the surface of the item. Some examples include plastic bags, glass, metal, finished wood. Porous evidence absorbs the print into the surface of the item. Some examples include checks, letters, money, cardboard and newspaper.

Listed in Table 1 are the recommended sequential processes for porous, nonporous, semi porous, and some unique and/or difficult surfaces. Depending on the circumstances, all of the recommended processes will not always be performed. This is left to the discretion of the scientist.

7.2.1 Selection of Processes

In addition to the type of surface, another determining factor in choosing the proper process is the residue of the latent print, including perspiration, blood, oil or grease, and dust. The condition of the surface also contributes to determining the correct processes. Such surface characteristics include dryness, wetness, dirtiness, and tackiness or stickiness.

Table 1	Fingerprint Development Techniques												
	Cyanoacrylate Ester Fuming	DFO	Magnetic Powder	Ninhydrin	Acid Yellow 7	Amido Black, Leucocrystal Violet	Fluorescent Gentian Violet, Gentian Violet	Wet Wop	Dye Stains	Powder	Sudan Black	Sudan Black, Gentian Violet	Small Particle Reagent
Porous Surfaces (e.g. untreated paper, unpainted or unvarnished wood, cardboard, etc.)		1		2									
Porous Surfaces (e.g. bloodstained)		1		2		3							
Semi-Porous Surfaces	1			3					2		4		
Semi-Porous Surfaces (e.g. photographs [paper side], glossy paper)	1	3	2	4					5				
Non-Porous Surfaces (e.g. plastic, glass, painted/varnished wood, etc.)	1								2	3		4	5
Non-Porous Surfaces (e.g. bloodstained)	2				3	1			4	5			
Adhesive Surfaces							3	2	1*				
Non-Adhesive, Non-Porous Surfaces (e.g. non-adhesive side of tape)								2	1*				
Wet Surfaces													1

*Requires Cyanoacrylate Ester fuming prior to use

8 Scientific Method

Analysis, Comparison, Evaluation and Verification (ACE-V) is the scientific method used in the comparison and identification of friction ridge impressions. ACE-V methodology is based upon assessed properties and attributes, rather than their measured value. ACE-V demonstrates that identifications are consistently and reliably effected based upon the properties of the friction ridge formations (i.e. clarity, type, shape, location, orientation, spatial relationships) in conjunction with the attributes of the friction ridge formations (i.e. distortion influences, assessment and tolerance levels).

A: Analysis
The first step, analysis, requires the scientist to examine and analyze all variables influencing the unknown impression in question.

C: Comparison
A systematic, cyclical approach to comparing the friction ridge features previously observed for correspondence to a known print.

E: Evaluation
The result of the comparison is the evaluation process or making a conclusion.

V: Verification
An independent examination is performed without any expectation on behalf of the verifying scientist (i.e. Analysis- Evaluation phases).

8.1 Analysis

Analysis is the assessment of an impression to determine suitability for comparison. The scientist performs qualitative and quantitative assessments of all potential features. The data to be considered during analysis may include:

- Overall shape and size of the impression
- Anatomical region and orientation
- Ridge flows, ridge counts and pattern regions
- Delta shapes and locations
- Minutiae and open fields
- Creases
- Edge shapes and pore positions
- Scar detail
- Incipient ridges
- Pattern force areas
- Temporary features (temporary damage or disease)
- Tolerance for within-source variability due to distortion

When conducting an analysis, the scientist considers overall pattern configuration and general ridge flow tendencies (level 1), ridge characteristics (level 2) and the shape, edges and pores of ridges (level 3). During analysis, the presence or lack of features such as cores, deltas, anchor points, and target data are observed. An assessment of distortion factors as well as the complexity of the impression is made. The scientist ultimately decides if there is sufficient quality and quantity of data to warrant a comparison.

8.1.1 Clarity

The degree of clarity exhibited by the latent print impression determines the level of tolerance that is acceptable to the scientist and influences the quantity of friction ridge features required for identification. A latent print impression exhibiting good clarity will depict unambiguous morphology throughout its overall pattern area, and amongst its friction ridge formations. Well-defined individual ridge paths, distinct friction ridge edges and incipient ridges are also characteristics of a latent print impression exhibiting good clarity

8.1.2 Distortion of Friction Ridge Detail

Factors such as pressure and movement may change the appearance of, or may create an artifact amongst, some friction ridge features. An assessment of any distortion existing in the unknown latent print impression is performed in the Analysis phase.

This aspect of analysis is an assessment of an area of friction ridge features in the unknown latent print impression. It is taken into consideration in the anticipation of finding apparent differences in the appearance, and sometimes arrangements, of the friction ridge features in the corresponding area in the known print. The scientist must study any distortion which is present in order to determine its cause, and the related influence on the appearance of the friction ridge features.

Factors affecting friction ridge impressions:

- Substrate/Surface (porous, non-porous, semi-porous, smooth, textured, curved)
- Matrix/Residue (natural secretions, contaminants such as blood, paint, grease, amount of residue)
- Transfer conditions/contact (pressure applied during contact, movement, skin pliability and elasticity, multiple touches, etc.)
- Environmental conditions (factors after deposition - protected/unprotected, exposure to moisture, heat, cold)
- Anatomical aspects (condition of the friction ridge skin)
- Detection techniques (visual, physical, chemical processing)
- Recording/preservation techniques (photography, lifting, ink, live-scan)

Definitions of distortion for documentation (see Appendix V for examples):

- Substrate distortion (SD) –distortion due to the surface
- Matrix distortion (MD) –distortion due to the residue
- Pressure distortion (PD) –distortion due to deposition pressure
- Tonal Reversal (TR) – change in appearance of the color of the ridges
- Continuity disruption (CD) – disconnected ridges (not caused by anatomical gap)
- Diffused ridges (DR) – lightening/thinning of ridges (usually caused by limited residue)
- Obscured region (OR) – Unusable area
- Slippage (SS) –distortion due to movement
- Misaligned ridges (MR) – area of ridge flow where ridges that don't naturally align
- Drag (DG) – movement during contact
- Swipe/Smear (SWP/SMR) – movement after contact
- Twisting (TW) – unnatural ridge flow due to torque
- Superimposed ridges (SR) – ridges from two impressions overlapping
- Double tap (DT) – subtle double impression due to partial lift off between touches/ repositioning of the skin on the surface without completely leaving the surface
- Second touch (ST) – overlapping impressions of the same ridge detail with complete lift off from surface
- Voids/Creases (VC) – creases observed and areas of an impression that are void of ridges
- Poor contrast (PCT) – difficulty distinguishing ridges from background
- Fragmented ridges (FRAG) – spotted/broken ridges

8.1.3 Sufficiency Determination Guidance

The latent print must have the minimum number of discernible minutiae (8-Fingerprints; 10-Tips/Lower joints/Palm prints; 12-Unknown impressions/Toe prints/Footprints) and one or more of the following criteria to be considered sufficient for comparisons:

- Discernible distal orientation
- At least one anchor point (e.g. core, delta, crease, scar)
- At least one region of robust and distinct target data

"Discernible" is dependent upon the analyst. Not all analysts can see the same information, so the minutiae must be discernible to the case analyst.

Due to the extreme variability of latent prints, impressions may be marked borderline at the discretion of the scientist. Additional documentation must be included to support the conclusion.

8.1.3.1 Borderline-Sufficient

Latent prints that do not meet the above-listed criteria may be marked suitable for comparison at the discretion of the scientist. For instance, the latent impression may have other significant data (e.g. incipient detail, scar details, or other highly selective minutiae) or high clarity. The scientist will document which data supported the print's suitability for comparison.

8.1.3.2 Borderline-Insufficient

Latent prints that meet one or more of the above-listed criteria may be marked unsuitable for comparison at the discretion of the scientist. For instance, the latent impression may have significant distortion or is otherwise deemed unreliable. The scientist will document which data supported the print's insufficiency for comparison.

The determination of sufficiency may be reviewed during the verification or technical review process. Any changes to sufficiency, as well as the reason for the change, must be documented in the case notes. If a disagreement between the original scientist and second scientist occurs, follow the Conflict Resolution Policy.

8.1.4 Analysis of Exemplars

Exemplar prints used for comparison are determined to be suitable, not suitable, or may be only partially suitable for comparison. Loss of suitability can occur when the capture or transmission of the prints has caused degradation. This can also occur when regions of the exemplars are unclear, incomplete or not recorded. Documentation of the reason for exemplar insufficiency should be included in the case notes.

8.2 Comparison

Comparison is the assessment of the relationship between the data in a latent print and the data in a set of exemplar prints to determine whether the latent print and the exemplar prints share similarities. Every recording of friction ridge skin is different. Thus, when comparing any two impressions, correspondence is not exact, but considers tolerances that are influenced by distortion factors and other environmental effects.

The exemplar impression should be analyzed and assessed for its complexity and utility for comparison. If a comparison cannot be completed because the exemplars required for a conclusive comparison are not available, the necessary exemplars should be requested to complete the current request.

8.2.1 Comparison Process – Manual Search

Comparison starts with the selection of target data in the latent print. Ideal target data is a region of robust and distinct detail that includes a focal point or is near a focal point. The exemplar prints are scanned to locate the target data. If the target data cannot be

located, new target data may be selected or the same target data may be searched with different parameters (e.g. different orientation or increased tolerance for variation in appearance of the target data). A systematic, cyclical approach will be performed to assess the targeted feature or details previously observed in the analysis phase for their correspondence or disagreement in the known print. New information observed during comparison is documented accordingly. This is a "back and forth" examination, working from the unknown to the known. The analyst formulates a conclusion that is based upon the cumulative weight of the data.

The scientist then formulates a tentative hypothesis (source identification, source exclusion, support for same source, support for different source, incomplete or inconclusive) that will be rigorously tested in the evaluation phase using forensic identification techniques such as ridge tracing, ridge counts and type lines.

Group Relationship Amongst Friction Ridge Features
The spatial and group relationship of the friction ridge features to each other is determined in two manners. First, their absolute value, which is the ridge count between the features (i.e. three intervening ridges). Second, the relative positions of the friction ridge features to each other (i.e. higher, lower, or adjacent to other features in the latent print impression).

8.2.2 Differences in Friction Ridge Features

Some loss/discrepancy of detail in the quality and quantity of information depicted by the friction skin features in both the unknown latent print impression and the known print is expected. The deposit of the latent impression is never expected to capture and depict all the quality and quantity of friction ridge skin features that exist in the known print. Knowledge of this issue provides the basis for the practice of incorporating limits for tolerance in the comparative process.

The use of techniques such as ridge counting and ridge tracing performed with respect to other friction ridge features in the immediate vicinity ~~is~~ may be helpful to understand the cause and nature of the dissimilarity.

If the cause for any difference is attributable to distortion, then the artifact created by such distortion would be within a scientist's tolerance for differences. These artifacts are simply appearances of the friction ridge features that are not exactly the same between the known and unknown impressions.

8.2.3 Tolerance Levels for Friction Ridge Feature Differences

Tolerance is the limit to which the scientist can accept differences in the appearance of the friction ridge features between the latent print impression and the known print.

Determinations are made based upon observation of the friction ridge features and their interaction with the surface/matrix, as to the cause of the difference.

The level of tolerance is set according to the degree of clarity exhibited by the latent print impression. A greater degree of clarity depicted by the latent print impression permits a lower level of tolerance. Thus, differences in the appearance of the friction ridge features are rendered less acceptable.

Conversely, for latent print impressions in which a lower degree of clarity is depicted, the tolerance level is set to a higher threshold. Thus, differences in the appearance of the friction ridge features are more acceptable. As the clarity decreases, the number of friction ridge features (and usually the physical size of the friction skin impression) required to effect identification must increase.

8.3 Evaluation

Evaluation is the formulation of a conclusion based upon analysis and comparison of the latent print to a set of exemplar prints. The scientist considers the cumulative weight of the data in the impressions in order to render a conclusion. An evaluation is made as to the significance of the agreement or disagreement of the details. Assessments are made for acceptable tolerance levels regarding the degree of clarity, and for distortions/variations in appearance of the friction ridge features, if present.

The manual comparison process is often an iterative process; the scientist is repeatedly searching through the exemplar prints using revised search parameters to converge on an accurate conclusion. This iterative process ends for a particular latent print when it is identified. The comparisons to any other subjects are discontinued and only the identification is noted and reported. If the manual process concludes without an identification – all conclusions to all subjects are recorded in the notes and reported.

The examiner will use all the known prints that are available, considering all the variations and differences in appearance noted between the prints. Follow the ridges in terms of exploring, counting and tracing their routes and the routes of the furrows. Determinations are made ~~of~~ regarding the qualitative and quantitative agreement of the observed details in terms of their depicted image clarity and the examiner's established tolerance levels.

The only case documentation exception is for AFIS. Conclusions to individuals manually compared prior to AFIS must be documented in the notes, regardless of whether or not an AFIS search results in an identification. If an AFIS search results in an identification, only the identification is reported for the latent print.

8.3.1 Source Identification

Source identification is the conclusion that a latent print and an exemplar print were made by the same source. This is the strongest degree of association between evidence

and a known reference. The cumulative weight of the data in the latent print and exemplar print must be sufficient to: 1) support the conclusion that the impressions were made by the same source and 2) reduce the possibility that the impressions were left by different sources to the point it can be disregarded.

For each comparison resulting in a source identification, the notes will reflect the anatomical region(s) and the name of the individual identified. Annotated images of the comparison will be documented (charted images) showing the detail found in agreement.

8.3.2 Support for Same Source

Support for Same Source is the conclusion that the latent print has detail in agreement with the exemplar prints; however, it is insufficient to identify the source due to the quality or quantity of the detail in the latent print. There is data to support the conclusion that the latent print and the exemplar print were made by the same source; however, the selectivity of the available corresponding data is not strong enough to disregard the possibility that another source could have left the print. The degree of support may range from limited to strong or similar descriptors of the degree of support. Any use of this conclusion shall include a statement of the factor(s) limiting a stronger conclusion.

8.3.3 Inconclusive

Inconclusive results occur when the analyst cannot determine whether or not there is detail in agreement between a latent print and a set of exemplar prints and the analyst has determined that additional exemplars will not permit a definitive conclusion. An inconclusive result may occur if the detail in the latent print is near or below the level of the “suitability” threshold.

For each comparison resulting in an inconclusive result, the notes will reflect the name of the individual(s) and the reason for the inconclusive result. Annotated images of the comparison(s) will be documented (charted images).

8.3.4 Support for Different Source

Support for Different Source is the conclusion that the observed differences support that the latent print and exemplar prints were made by different sources; however, the selectivity of the lack of corresponding data is insufficient to support a source exclusion. The latent impression lacks an anchor point or an obvious focal point, definitive orientation and/or anatomical source. The degree of support may range from limited to strong or similar descriptors of the degree of support. Any use of this conclusion shall include a statement of the factor(s) limiting a stronger conclusion.

8.3.5 Source Exclusion

Source exclusion is the conclusion that a latent print and a set of exemplar prints were made by different sources. The cumulative weight of the data in the latent print and the exemplar prints must be sufficient to support the conclusion that the impressions were made by different sources.

- During the comparison phase, multiple target groups are observed where 1st and 2nd level detail are used in conjunction to evaluate features. The latent must have an anchor point determined. If no anchor point can be determined a conclusion of Inconclusive or Support for Different Source will be used. An anchor point is usually a core or a delta but can also be a major crease, a vestige, or some other characteristic ridge flow. Each feature in a comparison must be considered without giving any one feature an infinite weight to override the conclusion. An exclusion finding is declared when at least 2 target groups from different areas on the latent have sufficient features in disagreement.

In order to render an exclusion, the analyst must ensure that all necessary anatomical regions are clearly recorded for comparison within the exemplar prints.

For each comparison resulting in a source exclusion, the notes will reflect the name of the individual(s) excluded. Annotated image(s) will highlight the target groups utilized for the comparison.

8.3.6 Incomplete

An “incomplete” result will occur when the exemplar prints are inadequate (quantity or quality). The latent print may or may not have limited detail in agreement with the exemplar prints. Additional exemplars of the friction ridge skin will be required and may permit the analyst to reach a definitive conclusion.

For each comparison resulting in an incomplete result, the notes will reflect the name of the individual and the additional exemplars needed to complete the comparison. If any detail is found in agreement, it should be documented (charted images) to also include the anatomical region where the agreement was observed.

8.3.7 Not Compared

A latent print may not be compared to exemplars for a variety of reasons, including lack of exemplars, probative source identification, or database hit. “Not compared” is a utility decision made for a particular exemplar or set of exemplars and does not include when multiple exemplars are being compared at the same time and an identification is made.

For each exemplar not compared, the notes will reflect the reason why.
Exemplars submitted that are not compared must be reported out as “not compared”.

Exemplars obtained from the Records Section that are not compared must be documented in the case record, but are not required to be listed in the report as “not compared”.

8.4 Consultations

Forensic Scientists are encouraged to consult one another during all phases of casework. Examples of consultations that may occur during the analysis or comparison include: sufficiency, anatomical region, orientation, target group selection, variability in appearance, search parameters, and distortion interpretation. Consultations can also take place when determining the utility of the impression for comparison (e.g. if the impression lacks an anchor point, the search will likely be very time consuming, and the conclusion reached after comparison would likely still result in an incomplete finding) or whether an impression is AFIS quality. The case notes must reflect who was consulted, the latent prints involved, the date of the consultation, and the result of the consultation.

8.5 Verification

Verification is the independent check of a conclusion and must be performed prior to reporting (verbal or releasing report). Verifications must be performed for all conclusions: source identification, support for same source, incomplete, inconclusive, support for different source and source exclusion. If a print is identified, other conclusions to the print do not need to be verified.

The Verification procedure can be applied as an adversarial scientific experiment biased towards invalidating the conclusion established by the original scientist. After the second scientist confirms and accepts the conclusion of the original scientist, the procedure of confirming a finalized conclusion has been demonstrated as being repeatable and reliable.

8.5.1 Verification Documentation

For each latent print verified, the case notes must reflect the conclusion of the verifying scientist, the date of the conclusion, and the verifying scientist’s initials. If the verifying scientist concurs with the findings of the case scientist, the date and the initials are sufficient for each print reviewed.

8.5.2 Blind Verification

Blind verification is an independent examination of one or more friction ridge impressions at any stage of the ACE process by another competent examiner who is provided with no or limited contextual information, and has no expectation or knowledge of the determinations or conclusions of the original examiner. Blind verifications cannot be performed by an examiner who has consulted on the print(s) to

be blind verified, has knowledge of the evaluation conclusion(s), or has detailed case information.

A supervisor will initiate a blind verification and provide images necessary to complete and document the process. The images will be the same, or of the same quality, as the original and will be presented with no markings or annotations related to the impression. Additional information such as substrate, matrix, and development technique may be provided. The blind verifier may request images (digital copy of the original and/or digitally processed image(s) from the original examination) from the coordinator and may also request to consult with another examiner. The coordinator will identify examiners with no prior knowledge of the conclusion(s). The consultation must be documented the case record.

Blind verification can be used to test the reproducibility of sufficiency determinations, conclusions, and verification decisions. Blind verification can also focus on tonal reversal, anatomical aspects, orientation, presence or absence of features, effect of the substrate, distortion effects, and assessment of the quality of the latent print. Blind verification may be used in situations where a single identification and/or single exclusion exists in casework or for complex print examinations (sufficiency determination, source identification or exclusion).

All verifications will be completed prior to release of results (verbal or written). If a blind is conducted, a separate verification is not required. Any discrepancies will be handled by the coordinator, procedures established in the Laboratory Quality Assurance Manual must be followed.

8.5.3 Technical Review

The Technical Review procedure will be followed according to the Lab Quality Assurance Manual.

In the event of disagreement during the technical review process, follow the Conflict Resolution Policy.

8.5.4 Conflict Resolution

Conflict resolution may be needed when examiners disagree on sufficiency decisions or comparison conclusions. The original examiner and second examiner should attempt to resolve the conflicting decisions via consultation with an attempt to arrive at mutually agreed upon decision or conclusion that is best supported by the observed data. If agreement is achieved, the conflict resolution process concludes and is documented in the case record. If agreement is not achieved, the disagreements shall be documented in the case record and the conflict resolution process should be elevated to the

Laboratory Supervisor. Once the Laboratory Supervisor is involved, another qualified examiner may be consulted and blind verification process may be utilized.

8.5.4.1 Documentation

The level of documentation needed for conflict resolution will vary according to the nature of the conflict. For all conflict resolutions, documentation should include:

- The nature of the conflict
- The sufficiency and/or comparison conclusions of all examiners involved
- Image mark-ups of the data used to support the conclusions (documentation that contains data not used for analysis must be marked as such)
- Dates and outcomes of consultation meetings
- Any changes to sufficiency decisions or comparison conclusions

9 Interaction with DNA Analysis

Evidence is often submitted to the laboratory for both latent print examination and DNA analysis. Ideally, both scientists should work the case together making joint decisions on the best way to collect samples. However, some cases require that latent print examinations occur first or the request for DNA comes after latent print examination has already occurred. In order to ensure successful recovery of DNA, both the Latent Print Forensic Scientist and the DNA Forensic Scientist need to be aware of the effects that processing may have on the ability to recover DNA evidence.

Studies have shown that most latent print reagents and/or forensic light sources do not affect recovery of DNA from samples such as blood and saliva. They can, however, affect the amount of DNA recovered, especially when the sample was originally limited. Several processing methods have been shown to be detrimental to DNA recovery. Processes such as short wave UV light, heat (including steam iron, heat/humidity chambers) can denature DNA. In contrast, samples processed with UV light used after cyanoacrylate ester fuming had no adverse effect on DNA. Prior use of DFO or ninhydrin is believed to "set" the DNA on the substrate. Amido Black (Methanol) can also "set" the DNA on the substrate making it difficult to remove from the substrate. Exposure to some chemicals over long periods of time can affect the integrity of the DNA molecules. Techniques used to apply a process can also be detrimental to the recovery of DNA. Magnetic powders contain iron, which may inhibit PCR. Other powders do not inhibit DNA profiling, but if improperly applied, can introduce contamination. Proper technique shall be followed to prevent such conditions. Extensive rinsing of an item that has not been subjected to cyanoacrylate ester fuming can result in loss of DNA material.

Care should be taken when processing evidence shared with the DNA section. Proper evidence handling and storage practices are followed to prevent loss, cross transfer, contamination and/or deleterious change.

Dedicated brushes will be used for processing items which may be later processed for DNA. A new, disposable brush and clean powder must be used for each item. When finished, any brushes and remaining powder will be disposed of. Contaminated powders will not be returned to stock containers.

Heat/humidity chambers can be used for porous items which may be later processed for DNA; however, the temperate should not exceed 85˚C.

The following chart is to be used as a guideline to achieve the best results of sample recovery from evidence.

9.1 Suitable Latent Print Processes

Latent Print Process	Suitable for Recovery of DNA	Reference
Alternate Light Source	Acceptable	1, 2, 12, 17, 18
Acid Yellow	Acceptable	20
Amido Black (Methanol)	Acceptable	4, 5, 6, 10, 11, 14
Amido Black (Water)	Acceptable	4
Ardrox	Acceptable	11
Basic Yellow 40	Acceptable	17
Cyanoacrylate Ester	Acceptable	2, 6, 7, 8, 10, 11, 12, 14, 15, 18
DFO	Use with care	4, 5, 6, 9, 11, 17
Fluorescent Gentian Violet	Acceptable	*
Gentian Violet	Acceptable	6, 7, 11, 14, 15, 18
Heat Press	Not Acceptable	**
Heat/Humidity Chamber	Acceptable (56-90^{o}C range)	19
Leucocrystal Violet	Acceptable	4, 6, 14
Magnetic powder	Use with care	10, 11
MBD	Acceptable	*
MRM-10	Acceptable	2
Ninhydrin	Acceptable	5, 6, 9, 10, 11, 14, 15
Powder	Use with care	2, 6, 8, 10, 11, 14, 15
RAM	Acceptable	6
Rhodamine 6G	Acceptable	7, 10, 11, 14
Small Particle Reagent	*	*
Steam Iron	Not Acceptable	**
Sudan Black	*	14
Thermal Paper Wash	Acceptable	*
Un Du©	Not Acceptable	14
UV light	Use with care	1, 10, 11
Wet Wop	Acceptable	*

*No current research available concerning DNA recovery.
**General knowledge of DNA has revealed that heat will cause denaturation.

9.2 References

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10 Casework AFIS/NGI

Automated Fingerprint Identification System (AFIS) is a laboratory instrument that can be used to perform searches of inked, latent and deceased finger and palm prints for identification within the State of Ohio database. It provides candidate lists and images for comparison to aid in identification of those cases selected for AFIS processing. The use of the AFIS instrumentation is a highly technical and complex undertaking. Training in the use and application of this equipment is contained in the Integrated Biometric Workstation Latent User Guide. Additional technical information and guidance is contained in the Best Practices for Latent Examiners. Additionally, searches can be sent to the FBI's Next Generation Identification (NGI), formerly referred to as the Integrated Automated Fingerprint Identification System (IAFIS).

Prints that have not been identified with known fingerprints/palm prints are evaluated for AFIS and run at the scientist's discretion. Prints may also be run in NGI at the scientist's discretion or agency request.

10.1 Criteria for database search/entry

- The pattern type is determinable within one reference pattern for fingers. Palm region must be determinable. Latent prints that contain only the delta must have robust and highly discriminating features present.
- Fingerprints must have at least 8 minutiae that are easily discernible, and palm prints must have at least 10. The impression must meet the sufficiency for comparison criteria as defined in this manual. Easily discernible minutia are those that are visible with minimal enhancement or ridge tracing, typically marked in green during analysis.
- The encodable minutia should form a cluster. Do not include latent prints containing only linearly arranged minutiae (pattern force area) or with scattered pockets of minutiae.

10.2 LCMS Case Creation and AFIS Entry

Entry of impressions for searching is done through the Latent Case Management System (LCMS). Each case added to the LCMS must include the following information:

- BCI Case number
- Investigating Agency
- Date of Crime
- ORC
    - If there is no applicable ORC (i.e. LINK cases or death investigations), "Other" may be used

Evidence images are acquired in the LCMS Evidence tab. Prior to selection of a latent for searching, the image must be calibrated. Calibration can be done:

- In ADAMS Web prior to using AFIS Connect to add the image to the LCMS
- Within LCMS using the calibrate tool to measure via ruler (preferred) or via ridge count

Latent areas captured for searching must be in the distal orientation (if known) and have minimal to no skew. Latent number, impression ID, and latent type must be entered.

Latent print markup is at the discretion of the scientist; refer to the Best Practices for Latent Examiners document for more detail. The following aspects must be considered when marking an impression and running a search:

- Placement and rotation of core (fingers only)
    - If position or orientation is unknown or not visible, place the core/axis in the most likely position
- Placement and direction of minutia markers
    - Note for palms: Palms only have one feature extraction type. Because of this, avoid marking features such as crossovers, dots, and small independent ridges if possible.
- Clarity and reliability of minutia marked
- Zoning of unused or unreliable areas
- Selection of search tolerance
- Target database

10.3 Evaluation of AFIS/NGI Search Results

A scientist will be provided a list of candidates for comparison in the Ohio AFIS and/or the NGI. Candidates produced by manual searches (Latent Inquiry (LI), Latent Palm Inquiry (LIP), Remote Latent Inquiry (REMOTE_LI), and Remote Latent Palm Inquiry (REMOTE_LIP)), are to be compared with the latent print until the list is exhausted or a candidate is identified. Candidates produced by auto searches (Auto Latent Inquiry (AUTO_LI) or Auto Latent Palm Inquiry (AUTO_LIP)) are to be compared until a candidate is identified or the first 20 candidates are compared. If no candidate for comparison is generated from an auto search, a manual search must be done.

All manual database search results, where no hit is identified, are ~~verified~~ reviewed by a qualified peer during technical review. The following criteria are considered:

- Core/axis placement
- Encoded minutia
- Zoning
- Search tolerance
- Database selection

All candidate lists are retained in the case record. Case notes must show which latents were searched, the database(s) queried, the results of the search, and if any latents were registered in the ULDB.

Laboratory reports must include number of latents searched, the database(s) queried, if a candidate was produced from a search, and if any latents were registered in the ULDB.

10.3.1 Unsolved Latent Print Database (ULDB)

Prints that are not identified will be registered in the Unsolved Latent Print Database (ULDB) if the following criteria are met:

- The victim has been eliminated from the latent print (if possible)
- The latent print must meet the minimum sufficiency criteria for comparisons
- The latent print must meet the minimum AFIS entry criteria
- The latent print is probative to the investigation

10.3.1.1 Evaluation of ULDB Search Results

ULDB entries are continuously searched against new exemplars that are entered into the database. All search candidates are to be evaluated until a hit is identified.

If a hit is made in the ULDB and the digital image is stored in ADAMS, the digital image is compared to exemplars and reported to the investigating agency. If a hit is made in the ULDB and the digital image was not previously archived in ADAMS, a scientist must request the original evidence to be returned for re-exam before releasing any information regarding the potential identification.

Documentation of the hit will be printed and included in the case record. Once a ULDB print has been identified and verified, it will be removed from the ULDB.

At times, it may be possible for a latent print to hit to another unknown latent print. Documentation of the hit will be printed and included in the case record. If this situation involves two BCI cases, the cases will be cross-referenced in LIMS. If the hit occurs to an outside agency, the agency will be contacted.

10.3.1.2 ULDB Retention

ULDB entries will be removed from the database in accordance to the established retention schedule associated with the offense type. The following table demonstrates commonly encountered offense types, but is not an exhaustive list:

Retention Schedule	Offense Type

125 years (BCI-ADM-25)	Death Related or Missing Persons
50 years (BCI-ADM-23)	Serious Offenses –Non-Death (i.e. assault, drug trafficking, kidnapping, arson, sex offenses, fraud, theft offenses valued at greater than $1,000.00 and aggravated thefts
15 years (BCI-ADM-26)	Misdemeanor Crimes, low level offenses

11 Report Writing

Latent Print section reports shall meet content and format requirements for reporting of results as specified in the BCI Laboratory Quality Assurance Manual. The following guidelines are intended to help achieve uniform content and style in the technical reports. Departures from the statements below will at times be necessary to accommodate specific circumstances. Reporting that is accurate, grammatically correct, and easily understood by non-scientific readers shall be acceptable.

11.1 Report creation

Reports are created through use of the LIMS report wizard or Microsoft Word Macro. Scientists shall use the wizard statements provided. It is recognized, the report wizard and/or macro does not cover all possible reporting scenarios. LIMS wizard or macro generated reports may be amended, as necessary, to effectively describe/clarify a reporting element or make a grammatical correction.

11.2 Report Content and Layout

The Latent Print section lab reports typically include a table that includes the following information: items examined/not tested/created, description of evidence, findings and comparison conclusions. The table is followed by a remarks section and analytical detail describing the method of testing used on the evidence.

- **Submitted Items**- List all items received in numerical order
- **Description-** Provide an item description that uniquely identifies the item. For example, if the submission sheet description is “credit cards”, the report should differentiate each card so the investigating agency can clearly distinguish the cards. For example, “Visa credit card, Mastercard credit card, etc.”
- **Findings-** The report details the examination findings (e.g. insufficient, number of finger/palm/latent prints, not examined, preliminary examination, etc.).

  If an evidence item, such as a bottle, is examined and a variety of results is obtained ranging from insufficient ridge detail to sufficient prints for comparisons, report the sufficient prints in the table and the remaining

insufficient and/or negative areas would not need to be mentioned. Likewise, if an item, such as a bottle, with some areas being insufficient and some negative, then the item would be reported in the table as being insufficient.

If latent lifts are submitted as a single item and there are both sufficient and insufficient/negative results, the results of each individual lift will be reported out. Lifts with the same result (i.e. insufficient) can be grouped together. If latent lifts are submitted as a single item and there are only insufficient/negative results, the overall item result will be reported out as insufficient.

If an evidence item is not examined, then "Not Examined" should be listed in the "Findings" column of the report for that item.

If an evidence item is only preliminarily examined (due to a probative identification being made or guidance from an investigating agency), then "Preliminary examination" should be listed in the "Findings" column of the report.

- **Comparison Conclusions-** Latent Print reports must include conclusions of all analytical work performed on evidence. This includes the comparison and disposition of all prints in the case (identified, exclusion), and the inability to complete a comparison due to exemplar insufficiency/poor quality or borderline latent sufficiency.

  Maintain the same order of your conclusion statements, for ease of reading the report (This can be dropped from the table, if not applicable):

  Source Identification
  Support for Same Source
  Inconclusive
  Support for Different Source
  -or-
  Source Exclusion(s)
  Incomplete

  When a source identification conclusion is made---that is the final conclusion reported for that print. Any conclusion results made prior to that ID are documented in the case notes.

  The specific finger/palm/etc. identified is documented in the case notes, but is not included in the report. The name listed in this section should list the full name as it is displayed on the exemplar.

"Not Compared" is listed under comparison conclusion for submitted exemplars that are not compared.

- **Table Footnote-** The footnote is used to explain any support for same source, inconclusive, support for different source and incomplete comparison results. The additional exemplar details may be edited as needed. A footnote can also be used to signify when a preliminary examination has been utilized in the case.

- **Remarks-**The remarks statements will include Record Section searches and exemplars obtained, requests for additional exemplars, items created that could be tested, and an evidence disposition statement.

Scenario	**Suggested Report Wording**
Record Searches and Obtained Exemplars	
Exemplars obtained from AFIS/NGI	Exemplars bearing the name of <Name>, BCI# <BCI#>, were obtained from the BCI Records Section and used for the comparison(s) detailed above. -or- Exemplars bearing the name of <Name>, FBI# <FBI#>, were obtained from the FBI and used for the comparison(s) detailed above.
Record Section Search-Need more info	A search of our Records Section for <Name> could not be completed with the information provided. Please submit <Exemplar Type> in order to complete this comparison.
Record Section Search-No record found	A search of our Records Section did not reveal any <Exemplar Type> for <Name>. Please submit these cards in order to complete this comparison.
Evidence Disposition	
Evidence disposition- no digital images preserved	The evidence is being returned to your department for retention.
Evidence disposition- digital images preserved with future comparisons	The evidence is being returned to your department for retention. Digital images were retained at BCI are available for future comparisons.

Evidence disposition – digital images preserved with no future comparisons	The evidence is being returned to your department for retention. Digital images were retained at BCI.
Evidence Resubmission and Exemplar Request	
Unidentified prints with evidence resubmission needed	Impression(s) remain unidentified. If future comparisons become necessary, please resubmit Item X along with subject and elimination <Exemplar Type>. Eliminations include victim(s), family members of victim(s), police officer(s), and other individuals who may have had contact with the submitted evidence.
Unidentified prints with no evidence resubmission needed	Impression(s) remain unidentified. If future comparisons become necessary, please submit subject and elimination <Exemplar Type>. Eliminations include victim(s), family members of victim(s), police officer(s), and other individuals who may have had contact with the submitted evidence.
Preliminary Examination ("preliminary exam" listed under findings)	Additional impressions remain available for analysis. If future examination becomes necessary, please submit a request.
Impressions not compared ("not compared" listed under comparison conclusion)	Impression(s) remain unidentified. If future comparisons become necessary, please submit a request.

- **Analytical Detail-**This section discloses the method(s) of testing used for each item submitted, the exemplars compared, the number of impressions searched in database(s), and any individuals' exemplars that were identified as a result of the search.

Scenario	**Suggested Report Wording**
Test Method	
Visual examination only	All non-exemplar items listed above were visually examined for the presence of latent prints.

Visual exam and processing of items – separate	All non-exemplar items listed above were visually examined for the presence of latent prints. Item X was examined using chemical and/or physical processing techniques.
Visual exam and processed items - together	Item X was visually, chemically and/or physically examined for the presence of latent prints.
Items previously tested (i.e. additional comparisons)	Item X was previously visually, chemically and/or physically examined for the presence of latent prints.
Comparisons	
Comparisons done for all impressions	All impressions suitable for comparison were compared to sufficient exemplars listed above.
Limited comparisons – not all impressions were compared	<insert number> impression(s) suitable for comparison was/were compared to sufficient exemplars listed above. -or- Select impressions suitable for comparison were compared to sufficient exemplars listed above.
Submitted exemplars not compared (“not compared” listed under comparison conclusion)	All impressions suitable for comparison were compared to sufficient exemplars listed above, unless otherwise indicated. -or- <insert number> impression(s) suitable for comparison was/were compared to sufficient exemplars listed above, unless otherwise indicated. -or- Select impressions suitable for comparison were compared to sufficient exemplars listed above, unless otherwise indicated.
Database Searches	
Impressions searched in both AFIS and NGI	X impressions were searched in the Ohio Automated Fingerprint Identification System (AFIS) and Next Generation Identification (NGI) system.

	-or- One (1) impression was searched in the Ohio Automated Fingerprint Identification System (AFIS) and Next Generation Identification (NGI) system.
Impressions searched in AFIS with some also searched in NGI	X impressions were searched in the Ohio Automated Fingerprint Identification System (AFIS). Of those, X impressions were searched in the Next Generation Identification (NGI) system.
Impressions searched in AFIS only	X impressions were searched in the Ohio Automated Fingerprint Identification System (AFIS).
No impressions suitable for AFIS or NGI	The impressions were not suitable for either an Ohio Automated Fingerprint Identification System (AFIS) or a Next Generation Identification (NGI) search. -or- The impression was not suitable for either an Ohio Automated Fingerprint Identification System (AFIS) or a Next Generation Identification (NGI) search.
No match from database searches	No individuals were compared as a result of database searches.
Hit from database searches – new name	The following individual(s) were compared as a result of database searches: <Name>.
Hit from database searches to listed name	No new individuals were identified. -or- The following individual(s) were identified: <Name>.
Suitable impressions not searched	X impressions were suitable for either an Ohio Automated Fingerprint Identification System (AFIS) and Next Generation Identification (NGI) search; however, they were not searched at this time.
AFIS DISCLAIMER Some or all impressions searched in AFIS not identified (not registered in ULDB)	NOTE: The AFIS and NGI databases continue to evolve daily with the addition of new exemplars. Therefore, if additional searches become necessary, please submit a request for an AFIS and/or NGI search.

Impression(s) registered in ULDB	X impressions were entered into the Unidentified Latent Print Database (ULDB).
Exemplar to Exemplar Comparisons	
Submitted exemplars comparison – identification	The exemplars from Items X and Y were compared to each other and were found to have originated from the same individual.
Submitted exemplars compared to obtained exemplars - identification	The exemplar from item X was compared with the BCI Records Section exemplar bearing the name of <Name>, BCI # <BCI #> The exemplars were found to have originated from the same individual.
Submitted exemplars searched in AFIS/NGI – identification	Ohio Automated Fingerprint Identification System (AFIS) and Next Generation Identification (NGI) system searches were performed for the exemplar from item X. <Name>, BCI #<BCI #> was identified as a result of database searches and the exemplars were found to have originated from the same individual.
Submitted exemplars comparison – exclusion	The exemplars from Items X and Y were compared to each other and did not originate from the same individual.
Submitted exemplars compared to obtained exemplars - exclusion	Exemplars obtained from the BCI Records Section bearing the name of <Name>, BCI# <BCI>, and the exemplars from Item X were compared to each other and did not originate from the same individual.
Submitted exemplars searched in AFIS/NGI – no match	Ohio Automated Fingerprint Identification System (AFIS) and Next Generation Identification (NGI) system searches were performed for the exemplar from item X. No individuals were identified as a result of database searches.
Miscellaneous Statements	
Item processed prior to submission	Examination results of Item X could have been affected by evidence handling prior to submission.
Item in poor condition	Examination results of Item X could have been affected by evidence condition prior to submission.
Amended report	This report replaces the original report issued by <Name> dated <Date> in its entirety.

Discrepancy Table	
Situation	**Action**
Item is different than stated on submission sheet – BCI error	Contact ER for corrected submission sheet. Use corrected information in report.
Item is different than stated on submission sheet – not BCI error	Leave item description as is followed by: **actually found to contain [correct item]**
Item contains evidence stated on submission sheet as well as additional items	Leave item description as is followed by: **also found to contain [additional items]**
Incorrect packaging type in LIMS	Edit LIMS description with correct packaging – add a case conversation. No corrected submission needed. Use corrected information in report.
Exemplars submitted – no name/illegible name on exemplars/packaging	Leave item description as submitted followed by: **-found to contain unlabeled exemplars/exemplars with illegible name**
Exemplars submitted – incorrect name on exemplars/packaging	Describe as: **found to be labeled…** or **found to be bearing the name of…**
Minor spelling mistakes (not a discrepancy)	Correct the error
Lift vs. lifts (not a discrepancy)	Just add/remove the “s” as needed
Item description needs more detail in report (not a discrepancy)	Leave item description as is. Use italics under description in report to add additional detail Examples: Chem item description as “unknown substance” FA item description as “firearm”

12 Procedure: Inherent Luminescence

12.1 Introduction

The use of alternate light sources in conjunction with various chemical techniques and dyes has proven very effective in visualizing latent impressions. Substances found in latent print residue may luminesce when illuminated by the proper wavelength of light and viewed with the appropriate filters. B-vitamin complexes, that are a natural component of perspiration, may be the cause of this reaction. Various contaminants such as cosmetics may become part of the latent print residue and may inherently luminesce as well. Additionally, certain materials such as Styrofoam and galvanized or zinc plated metal are observed to consistently produce impressions that will luminesce without the application of chemical processing or dyes. This inherent luminescence allows for examination of items that may be destroyed by other techniques.

12.2 Reagent Applicability

Adhesive surfaces
Blood Protein Enhancement
Nonporous surfaces
Porous surfaces
Wet surfaces

12.3 Safety Considerations

Proper safety precautions include avoiding skin exposure and wearing proper eye protection with appropriate optical densities shall be utilized when operating ultraviolet light sources or alternate light sources. Consult the appropriate users' manuals for the safe use and appropriate eye protection for the specific piece of equipment being utilized.

12.4 Instrumentation

Alternate Light Source
High-Intensity Ultraviolet Light
Laser

12.5 Standards and Controls

See Appendix I – Standards and Controls

12.6 Procedure

The procedure for this technique consists of examining the item with the alternate light sources using appropriate filtration. Common wavelengths used are 488nm, 510 nm, and 514.5 nm. In most cases the orange laser filters are appropriate for examination. Some success may be seen with the use of ultraviolet light sources and the various wavelengths produce by alternate light sources. The scientist should choose the appropriate filters and eye protection for these light sources and the wavelengths

selected. All observed impressions should be photographed using the appropriate films and filters.

12.7 Interpretation of Results

Items can be examined for inherent luminescence without the destruction of the item. In addition, many surfaces should be routinely examined using this technique as it has been shown to produce consistent results. The item being examined may luminesce and this background luminescence may improve the contrast of visible impressions much as the use of metal salt post treatment of ninhydrin developed impressions. This non-destructive process is a relatively simple technique that has been proven to be very successful in producing positive results.

12.8 References

- Dalrymple, Brian E.; J.M. Duff; E. Roland Menzel. “Inherent Luminescence of Fingerprints by Laser,” Identification News, January 1977, 22:1, 3-6.
- Menzel, E. Roland. Fingerprint Detection with Lasers; Marcel Dekker: NY, 1980; pg 108.

13 Procedure: Adhesive Surfaces

13.1 Fluorescent Gentian Violet

13.1.1 Introduction

Fluorescent dye staining was developed as a means of enhancing cyanoacrylate ester. The dye staining process can be used before and after the use of powders. Fluorescent dye stains are used to increase contrast of the superglue developed print and possibly make a weak print suitable for identification purposes through florescence examination. Caution must be used to avoid over processing with cyanoacrylate fumes. Excessive cyanoacrylate ester application may result in a loss of fine ridge detail resulting in excessive fluorescence. Often when a surface is textured, the application of fluorescent dye and use of photography can eliminate the background allowing only the fluorescent print to photograph.

Gentian violet (a.k.a. crystal violet) is used as a stain for epithelial cells and other latent print residues producing an intense purple color. This process has been shown to be effective on adhesive surfaces, especially tape. The developed print may be difficult to see on black electrical tape and a transfer method may be used to reveal the latent print. However, the fluorescent gentian violet formula can reveal a fluorescent latent print that can be photographed directly from the evidence.

13.1.2 Reagent Applicability

Adhesive surfaces
Nonporous surfaces
Fluorescent technique

13.1.3 Safety Considerations

Gentian violet
Ethyl alcohol
Rhodamine 6G

This procedure involves hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. Consult the appropriate SDS for each chemical prior to use.

13.1.4 Equipment

Scales, weigh boats, beakers, graduated cylinder, stirring bar and magnetic stirrer or other stirring device, and dark storage bottles.

Preparation

Stock Solution

GENTIAN VIOLET ----------1.5 g
ETHYL ALCOHOL----------100 ml

Combine ingredients and store in a dark bottle.

Working Solution

STOCK SOLUTION----------10 ml
DISTILLED WATER ----------500 ml
RHODAMINE 6G ----------0.5 g

Combine ingredients in the order listed.

13.1.5 Storage and Shelf Life

Solutions must be stored in sealed, dark glass bottles. Shelf life is indefinite for working solution.

13.1.6 Instrumentation

Alternate Light Source

13.1.7 Standards and Controls

Dye stains, such as fluorescent crystal violet/gentian violet, work by discoloring latent impressions composed of epithelial cells and sebum. The Standards and Controls for fluorescent gentian violet consist of placing test impressions on a non-porous, non-evidentiary item. Apply the fluorescent gentian violet to the item and view with the proper ALS wavelength. If the print is visualized, the fluorescent gentian violet is working properly. This testing must be performed for each working solution at the time of preparation and prior to use on evidence. Documentation of this testing will appear in the reagent prep log and in the case examination notes.

See Appendix I – Standards and Controls.

13.1.8 Procedure

Fluorescent Gentian Violet solution can be applied by dipping the adhesive side of tape into solution for a few seconds or by applying solution with a brush. Excess Gentian Violet can be removed by carefully rinsing with tap water. It is also recommended to dry the specimen with a dryer to reduce pooling of fluorescence that may interfere with examination of the latent print detail. Prints are viewed with a forensic alternate light

source between 525-570 nm using red goggles or at 485-450 nm using orange goggles. Photograph with appropriate colored filter.

13.1.9 Interpretation of Results

Visualize developed impressions with an ALS. Latent impressions on light colored tapes should be photographed directly. Contrast may decrease as the substrate dries. Stained impressions that fade may be improved by immersing the tape in a tray of clear water and photographing the impressions while the tape is submerged. Dark colored tapes may not present sufficient contrast to permit photographic recording of the actual impression, so use of sticky side tape powder techniques is recommended.

13.1.10 References

- Arima, T. "Development of Latent Fingerprints on Sticky Surfaces by Dye Staining or Fluorescent Brightening," Identification News, February; 1981.
- Kent, Terry, ed. Fingerprint Development Techniques. Derbyshire, England: Heanor Gate Publisher; 1993.
- Cowger, James F. Friction Ridge Skin Comparison and Identification of Fingerprints. Boca Raton, FL: CRC Press; 1993.

13.2 Gentian Violet

13.2.1 Introduction

Gentian violet (a.k.a. crystal violet) is a sensitive stain that reacts with epithelial cells and other portions of latent print residue transferred upon surface contact. The presence of sebum serves as an excellent transfer medium for sloughed epidermal cells and, as a result, gentian violet is usually effective on surfaces that readily hold the deposited sebum, such as the adhesive side of tapes. The high sensitivity of gentian violet produces an immediate reaction upon skin contact; therefore, leak proof gloves are required for examinations. Accidental staining of hands is relatively harmless but usually cannot be de-stained. Disappearance of discoloration is a result of cell sloughing.

13.2.2 Reagent Applicability

Adhesive surfaces
Nonporous surfaces

13.2.3 Safety Considerations

The Gentian Violet procedure involves hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. Consult the appropriate SDS for each chemical prior to use.

13.2.4 Equipment

Scale, weigh boats, beaker, graduated cylinder, a plastic stirring rod or magnetic stirrer, and clear or dark glass bottles.

13.2.5 Preparation

GENTIAN VIOLET----------1g
DISTILLED WATER ----------1000 ml

Combine ingredients and stir for approximately twenty-five (25) minutes.

13.2.6 Storage and Shelf Life

Solution is stored in sealed, dark or clear glass bottles. Shelf life is indefinite.

13.2.7 Standards and Controls

Dye stains, such as Gentian Violet, work by discoloring latent impressions composed of epithelial cells and sebum. The Standards and Controls for gentian violet consist of

placing test impressions on a non-porous, non-evidentiary item. Apply the gentian violet to the item and if a purple impression is observed, the gentian violet is working properly. This testing must be performed for each working solution at the time of preparation and prior to use on evidence. Documentation of this testing will appear in the reagent prep log and in the case examination notes.

See Appendix I – Standards and Controls.

13.2.8 Procedure

1. Immerse item to be processed in the working solution in a large tray.
2. Allow the item to remain completely immersed for approximately 30 seconds while agitating.
3. Remove the item from the working solution and rinse excess stain from the item by washing with a gentle flow of cold tap water.
4. This process may be repeated until optimum contrast is reached between the impressions developed and the background.
5. Photograph any developed impressions.

13.2.9 Interpretation of Results

Developed latent impressions on light colored tapes should be photographed directly. Contrast may decrease as the substrate dries. Stained impressions that fade as the tape dries may be improved by immersing the tape in a tray of clear water and photographing the impressions while the tape is submerged.

Dark-colored tapes may not present sufficient contrast to permit photographic recording of the actual impression. Prior to the sticky side tape powder technique, a method that attempted to transfer the gentian violet stain to a glazed paper surface was one of the only methods available to attempt to visualize impressions on dark tape. While this method can be successful, the improved success with the sticky side tape powder technique makes it the preferred method when processing dark colored tapes and gentian violet does not produce the needed contrast.

13.2.10 References

- “Advances in Fingerprint Technology,” 2nd. Ed., Lee, H.C. & Gaensslen, R.E., CRC Press, Boca Raton, FL., 2001.
- Arima, T. "Development of Latent Fingerprints on Sticky Surfaces by Dye Staining or Fluorescent Brightening," Identification News, February, 1981.
- Chesapeake Bay Division: https://www.cbdiai.org/gentian-violet.html
- Cowger, James F. Friction Ridge Skin Comparison and Identification of Fingerprints. Boca Raton, FL: CRC Press; 1993.
- Kent, Terry, ed. Fingerprint Development Techniques. Derbyshire, England: Heanor Gate Publisher; 1993.

- "Manual of Fingerprint Development Techniques," 2nd. Ed., Home Office - Police Scientific Development Branch, White Crescent Press, Ltd., Luton, England, 2001.
- Processing Guide for Developing Latent Prints, U.S. Department of Justice, pg 12, 2000.
- Technical Notes, Lightning Powder Co. Inc., Salem, OR, 2000.

13.3 Un-Du©

13.3.1 Introduction

One of the most challenging surfaces on which to develop latent friction ridge detail is the adhesive surface of many different industrial and household pressure-sensitive adhesive tapes. There are many types of pressure-sensitive tapes available, including, but not limited to utility, packaging, electrical, surgical, masking, duct, and adhesive labels. Each have their own unique application, as well as differing adhesive properties.

Un-Du© is a commercial adhesive remover which is effective in removing stickers, tapes, and labels from most surfaces. It temporarily "neutralizes" the adhesive, allowing for easy separation from its applied position. Yet unlike other removers containing organic solvents, Un-Du© will not dissolve the adhesive. Preservation of the adhesive allows for subsequent latent print processing of the adhesive tape surface.

13.3.2 Reagent Applicability

Adhesive Surfaces
Nonporous surfaces

13.3.3 Safety Considerations

Un-du ©

These procedures involve hazardous materials. These procedures do not purport to address all of the safety problems associated with their use. It is the responsibility of the user of these procedures to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. Consult the appropriate MSDS for each chemical prior to use.

WARNING! FLAMMABLE!
Vapors can ignite with heat or open flames.
Always use in a well-ventilated area.
Consider a **SEVERE HAZARD!**

13.3.4 Equipment

Glass or metal tray and forceps

13.3.5 Storage and Shelf Life

Store at room temperature in the flammable cabinet. Shelf life is according to manufacturer's instructions.

13.3.6 Standards and Controls

See Appendix I—Standards and Controls.

13.3.7 Procedure

1. Apply several drops to the area stuck with the adhesive. The Un-Du© will cause the adhesive to release.
2. Gradually pull while still applying the Un-Du© until the tape has separated. It will take several drops for this to work.
3. The Un-Du© solution will evaporate very rapidly.
4. Allow to air dry.
5. Proceed with processing of adhesive surface.

13.3.8 Interpretation of Results

Un-Du© is a commercially available adhesive "neutralizer" which will allow for adhesive tapes to be removed from a surface for further latent print processing.

13.3.9 References

- Stimac, Jon T. "Adhesive Tape Separation with Un-du©." Technical Notes, Lightning Powder Co. Inc., Salem, OR, 2000.

13.4 Wet-Wop

13.4.1 Introduction

The use of powder suspensions to develop impressions on the sticky side of tape has proven to be an effective alternative to the Gentian Violet technique. Wet-Wop is used to process both the adhesive and non-adhesive sides of tapes and labels for friction ridge detail. It is purchased commercially prepared and comes in both black and white formulations.

13.4.2 Reagent Applicability

Adhesive surfaces
Nonporous surfaces

13.4.3 Safety Considerations

This procedure involves hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. Consult the appropriate MSDS for each chemical prior to use.

13.4.4 Equipment

Beaker or shallow dish and a soft bristle brush.

13.4.5 Storage and shelf life

According to manufacturer's instructions

13.4.6 Standards and Controls

Powders work by adhering and causing discoloration to latent print residues. The Standards and Controls for Wet-Wop consist of placing test impressions on an adhesive, non-porous, non-evidentiary item. Apply the Wet-Wop to the item and if the print is visualized, the Wet-Wop is working properly. This testing must be performed prior to use on evidence. Documentation of this testing will appear in the case examination notes.

See Appendix I – Standards and Controls.

13.4.7 Procedure

1. Shake bottle thoroughly.
2. Using a camel hair brush, apply the reagent to adhesive side of the tape with a painting action. Completely cover the surface.
3. Allow the mixture to remain on the item for approximately fifteen (15) to thirty (30) seconds.
4. Rinse with a gentle flow of cold tap water.
5. Allow the tape to air dry.
6. Photograph any developed impressions.

13.4.8 Interpretation of Results

This technique has been shown to be very productive and stable. Impressions developed by this powder technique do not readily fade; however, all suitable impressions must be photographed.

13.4.9 References

- Technical Notes, Lightning Powder Co. Inc., Salem, OR, 2001.

14 Procedure: Blood Protein Enhancement

14.1 Acid Yellow 7

14.1.1 Introduction

Acid Yellow 7 is a dye solution that is used for staining fingerprints made in blood. Prints in blood are colored yellow after treatment with Acid Yellow 7. They then fluoresce under blue/blue-green light. It works very well on non-absorbent backgrounds such as linoleum, glass, tiles or painted surfaces. Not recommended for porous items due potential background interference, but will work on certain porous items.

14.1.2 Reagent Applicability

Blood Protein Enhancement
Nonporous Surfaces

14.1.3 Safety Considerations

Acid Yellow 7
5-Sulfosalicylic acid
Glacial acetic acid
Ethanol

This procedure involves hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. Consult the appropriate SDS for each chemical prior to use.

14.1.4 Equipment

Scale, filter paper (or paper towels/tissue) weigh boats, beakers, graduated cylinder, squirt bottle, magnetic stirrer and stirring bar, and clear or dark storage bottles.

14.1.5 Preparation

<u>Blood Fixative</u>

5-SULFOSALICYLIC ACID, DIHYDRATE----------20g
DISTILLED WATER ----------1000ml

Add components to a beaker or flask and mix until dissolved using a magnetic stirrer.

Acid Yellow Working Solution

ACID YELLOW 7----------1g
ACETIC ACID (GLACIAL, 99%)----------50ml
ETHANOL (98% OR HIGHER)----------250ml
DISTILLED WATER ----------700ml

Add water first and dissolve the Acid Yellow 7 powder by swirling the beaker/flask or using a magnetic stirrer. Once the powder is dissolved, add ethanol and acetic acid (order not important).

Rinse Solution

ACETIC ACID (GLACIAL, 99%)----------50ml
ETHANOL (98% OR HIGHER)----------250ml
DISTILLED WATER ----------700ml

14.1.6 Storage and Shelf Life

Keep solutions in clean, sealed, clear or dark bottles.

14.1.7 Standards and Controls

Dye stains, such as Acid Yellow 7, work by discoloring latent impressions that are composed of blood proteins. The Standards and Controls for Acid Yellow 7 consist of placing a test impression on a non-porous, non-evidentiary item, with a blood standard and allowing it to dry. Apply the Acid Yellow 7 to the item turning the impression yellow and if the print fluoresces with the alternate light source, the Acid Yellow 7 is working properly. This testing must be performed for each working solution at the time of preparation and prior to use on evidence. Documentation of this testing will appear in the reagent prep log and in the case examination notes.

See Appendix I - Standards and Controls.

14.1.8 Procedure

Before staining, prints in blood should be fixed to prevent them from running.

1. Take a dry piece of absorbent paper that is sized to cover the print(s) and hold it directly over the print area. It should be parallel to the surface and just slightly above the surface.
2. Drop one edge of the paper to the surface and moisten heavily with the fixative solution, so that it is anchored.
3. Starting from the anchored edge, wet the paper progressively further while smoothing the wetted part onto the print and minimizing trapped air bubbles. Work carefully from one edge to the other.

4. Once the wet paper entirely covers the print(s), leave it there for a minimum of three (3) minutes. If the blood is a thick layer, leave the paper there for five (5) minutes or more.
5. Remove the paper. When the blood is relatively fresh, fixing will change the color from dark red to dark brown.
6. Excess fixative can be rinsed with water.

Staining:
1. Apply the solution with a squirt bottle or submerge article in solution.
2. Leave solution in contact with the print for one (1) to three (3) minutes.
3. Wash surface with the rinse solution.
4. Examine the print(s) using an alternate light source at 400-490nm using a yellow/light orange filter or long-wave UV with a clear filter. Print(s) will fluoresce green-yellow.
5. Print(s) can be photographed or lifted with a white gellifter. Before lifting with gellifter, be sure the area is completely dry. Leave lifter on print(s) for no more than one (1) minute.

14.1.9 Interpretation of Results

Acid Yellow 7 does not produce any enhancements of prints in blood when viewed in natural light, though there is some yellowing of the blood. On non-porous items, when viewed with an alternate light source, the prints will fluoresce green-yellow. Developed prints should be photographed. On occasion, the background fluorescence can interfere with the viewing of developed prints. These prints can be lifted with a white gellifter. Lifted prints should be photographed immediately, as the dye will diffuse in and across the surface of the filter. Lifting can be done more than once, with or without re-staining between lifts. Acid Yellow 7 does not develop latent fingerprints but can be used after Cyanoacrylate ester fuming and before other fluorescent dye stain application.

14.1.10 References

- Atkins, A. “Development of Bloody Latent Prints on Dark Surfaces.” July 27, 2007 Presentation at the International Association for Identification Conference by the US Army Criminal Investigation Laboratory. http://onin.com/fp/
- BVDA. “How to use Acid Yellow 7.” http://www.bvda.com/EN/prdctinf/en_acid_yellow_7.html
- Manual of Fingerprint Development Techniques 2nd. Ed., Home Office - Police Scientific Development Branch, White Crescent Press, Ltd., Luton, England, 2001.
- Sears, V.G.; Butcher, C.P. G.; Fitzgeral, L.A. “Enhancement of Fingerprints in Blood, Part 3: Reactive Techniques, Acid Yellow 7, and Process Sequences.” Journal of Forensic Identification 2005, Vol. 55, No. 6, p. 741-763.

14.2 Amido Black

14.2.1 Introduction

Amido black, or naphthalene black 10B, is a protein indicator particularly sensitive to proteins present in blood. While other techniques for the enhancement of blood impressions are available, they many pose serious health hazards or display a reaction for short durations. Amido black is a safer, permanent procedure that can be used on porous or nonporous surfaces. Amido black does prevent subsequent serological examination and, therefore, may only be used after serological examination of the evidence.

14.2.2 Reagent Applicability

Blood Protein Enhancement
Nonporous Surfaces
Post-Ninhydrin

14.2.3 Safety Considerations

Amido Black
Citric acid
5-Sulfosalicylic acid
Formic acid
Glacial acetic acid
Kodak Photo-Flo 600
Methanol
Sodium carbonate

This procedure involves hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. Consult the appropriate SDS for each chemical prior to use.

14.2.4 Equipment

Scale, weigh boats, beakers, graduated cylinder, squirt bottle, magnetic stirrer and stirring bar, and clear or dark storage bottles.

14.2.5 Preparation

Methanol Based Formula

AMIDO BLACK WORKING SOLUTION

AMIDO BLACK 10B ----------2g
GLACIAL ACETIC ACID----------100 ml
METHANOL ----------900 ml

Combine and mix with a stirring device for thirty (30) minutes.

Rinse 1

GLACIAL ACETIC ACID----------100 ml
METHANOL----------900 ml

Rinse 2

GLACIAL ACETIC ACID----------~~50~~ 100 ml
DISTILLED WATER ----------~~950~~ 900 ml

Water Based Formula

When applying Amido Black, the methanol based solution may be a problem on painted surfaces. Any blood on the surface must be dried thoroughly before applying this formula.

Citric Acid Solution

CITRIC ACID ---------- 38 g
DISTILLED WATER ---------- 2000 ml

Stir the solution until citric acid is dissolved.

Developer Solution

CITRIC ACID STOCK SOLUTION ---------- 1000 ml
AMIDO BLACK ---------- 2 g
KODAK PHOTO-FLO 600 ---------- 2 ml

Stir the Amido Black in the citric acid solution for approximately thirty (30) minutes. Then slowly add the Photo-Flo 600.

Rinse #1:

CITRIC ACID STOCK SOLUTION ---------- 1000 ml

Rinse #2:

DISTILLED WATER

Rinse solutions remove excess developing solution from background.

Alternate Formula

DISTILLED WATER	500 ml
5-SULFOSALICYLIC ACID	20 g
AMIDO BLACK	3 g
SODIUM CARBONATE	3 g
FORMIC ACID	50 ml
GLACIAL ACETIC ACID	50 ml
KODAK PHOTO-FLO 600 SOLUTION	12.5 ml

Dilute this mixture to 1L using distilled water. Although this mixture will be ready to use following dilution, allow the mixture to stand for several days prior to use for best results.

14.2.6 Storage and Shelf Life

Keep solutions in clean, sealed, clear or dark bottles. The methanol based formula has an indefinite shelf life. The water based formula has a shelf life of twelve (12) months, unless contaminated.

14.2.7 Standards and Controls

Dye stains, such as Amido Black, work by discoloring latent impressions that are composed of blood proteins. The Standards and Controls for Amido Black consist of placing a test impression on a non-porous, non-evidentiary item, with a blood standard and allowing it to dry. Apply the Amido Black to the item and if a blue-black impression is observed, the Amido Black is working properly. This testing must be performed for each working solution at the time of preparation and prior to use on evidence. Documentation of this testing will appear in the reagent prep log and in the case examination notes.

See Appendix I - Standards and Controls.

14.2.8 Procedure

All applications should be completed in a fume hood.

1. Blood proteins must be fixed prior to amido black application. This can be accomplished by:
   - Baking the item at 100˚C for 30 minutes. Heat-sensitive items may be baked at a lower temperature for a longer time or another fixing technique attempted. Items which need subsequent DNA analysis will not be heat treated.
   - If the blood proteins are dried, chemically fixing may be accomplished by:
     (a) Immersion of item in methanol for one (1) hour.
     (b) Immersion of item in 5-Sulfosalicylic acid.

2. Amido Black working solution is applied to the item for thirty (30) to ninety (90) seconds by:
   - Immersion of the item in the working solution, ensuring complete coverage of the area to be examined.
   - Using a squirt bottle.

   The working solution should be agitated before evidence application, as well as during the immersion process.

3. Rinse item with the first rinse solution followed by the second rinse solution until optimum contrast has been observed.
4. Allow item to air dry.
5. Developed impressions are then photographed.

14.2.9 Interpretation of Results

The blood impressions will be intensified and additional detail not previously visible may be revealed. Amido Black is extremely stable; however, developed impressions will be photographically preserved. Dried impressions which lose contrast may be re-immersed in the second rinse solution and photographed.

14.2.10 References

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- Processing Guide for Developing Latent Prints, U.S. Department of Justice, pg 14-17 & 43-44, 2000.
- Technical Notes, Lightning Powder Co. Inc., Salem, OR, 2001.

14.3 Leucocrystal Violet

14.3.1 Introduction

Leucocrystal violet (LCV) is a catalytic test for blood. LCV is a reduced or colorless form of crystal violet. When LCV and hydrogen peroxide come into contact with hemoglobin or its derivatives, a violet colored dye (crystal violet) is formed. This occurs through a catalyzed oxidation by peroxide.

Since crystal violet has an affinity for proteinaceous substrates, it will bind to the protein that has been fixed by the 5-sulfosalicylic acid limiting leaching or running of the dye impression.

14.3.2 Reagent Applicability

Blood Protein Enhancement
Porous surfaces
Post-ninhydrin
Nonporous surfaces

14.3.3 Safety Considerations

Leucocrystal violet
5-Sulfosalicylic acid
Hydrogen peroxide
Sodium acetate

This procedure involves hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. Consult the appropriate SDS for each chemical prior to use.

14.3.4 Equipment

Scales, weigh boats, beakers, magnetic stirrer and stirring bar or other stirring device, tissues or paper towels, sprayer and dark storage bottles.

HYDROGEN PEROXIDE 3%	1000 ml
5-SULFOSALICYLIC ACID	20 g
SODIUM ACETATE	7.4 g
LEUCOCRYSTAL VIOLET	2 g

Combine ingredients in the order listed and stir for approximately thirty (30) minutes.

Alternate Formula

5-SULFOSALICYLIC ACID	10 g
HYDROGEN PEROXIDE 3%	500 ml
LEUCOCRYSTAL VIOLET	0.70g

Commercial kits are available. Follow manufacturer's instructions for preparation.

14.3.5 Storage and Shelf Life

Solutions must be stored in sealed, dark bottles. The working solution will last for ninety (90) days at room temperature. If refrigerated, the shelf life can be extended to nine (9) months.

14.3.6 Standards and Controls

Dye stains, such as leucocrystal violet, work by discoloring latent impressions that are composed of blood proteins. The Standards and Controls for leucocrystal violet consist of placing a test impression on a porous, non-evidentiary item, with a blood standard and allowing it to dry. Apply the leucocrystal violet to the item and if a purple impression is observed, the leucocrystal violet is working properly. This testing must be performed for each working solution at the time of preparation and prior to use on evidence. Documentation of this testing will appear in the reagent prep log and in the case examination notes.

See Appendix I – Standards and Controls.

14.3.7 Procedure

Spraying is the most effective method of application. When spraying, use the finest mist possible because excess application may cause over development or running of the blood prints. Spray the target area, development will occur with thirty (30) seconds. After spraying, blot the area with a tissue or paper towel. After the area is dry, the proceeding steps can be repeated to possibly improve contrast.

When using the LCV process in direct sunlight, any developed prints will be photographed, as soon as possible, because photoionization may occur, resulting in unwanted background development.

14.3.8 Interpretation of Results

The blood impressions will be intensified and additional detail not previously visible may be revealed. While stained impressions are relatively stable, photographic preservation of developed latent impressions is recommended. Dried impressions which lose contrast may be re-immersed in the second rinse solution and photographed.

14.3.9 References

- Chesapeake Bay Division: https://www.cbdiai.org/leucocrystal-violet.html
- Everse, K.E. and E.R.Menzel. “Blood Print Detection by Fluorescence,” In: Menzel, E.R. ed. Fluorescence Detection. SPIE Proc.: (1987); 743:184-189.
- Gaensslen, R.E. Sourcebook in Forensic Serology, Immunology, and Biochemistry. Washington, DC: U.S. Government Printing Office; 1983.
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- Processing Guide for Developing Latent Prints, U.S. Department of Justice, pgs. 31-32, 2000.
- Sahs, P.T. “An Advancement in Blood Print Detection.” Journal of Forensic Identification, 1992; 42:412-420.
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14.4 Ninhydrin

14.4.1 Introduction

Ninhydrin or triketo-hydrindene hydrate is an extremely sensitive indicator of amino acids, which make up proteins, peptides, and polypeptides. The reaction produces a violet to blue-violet coloring, known as Ruhemann's purple, and is effective with older deposits having even minute amounts of amino acids. While ninhydrin can be used on any surface, processing is generally confined to porous items which have not been water-soaked or do not contain inherent non-human proteins.

14.4.2 Reagent Applicability

Blood Protein Enhancement
Porous surfaces
Raw wood surfaces

14.4.3 Safety Considerations

Acetone
Ethanol
Ethyl acetate
Glacial acetic acid
Isopropyl
Methanol
Ninhydrin
Petroleum ether
Vertrel XF

This procedure involves hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. Consult the appropriate SDS for each chemical prior to use.

DANGER!
EXTREMELY FLAMMABLE!
Petroleum Ether can vaporize quickly.
Readily forms flammable mixtures in air.
Consider an **EXTREME HAZARD!**
WARNING! FLAMMABLE!
Acetone and Ethanol vapors can ignite readily at room temperatures
Consider a **SEVERE HAZARD!**

14.4.4 Equipment

Scale, weigh boats, beakers, brushes, glass tray, graduated cylinder, sieve, magnetic stirrer and stir bar, oven or household iron, heat/humidity chamber, low wattage hair dryer, squirt bottle or spray device, and dark storage bottles.

14.4.5 Preparation

Ninhydrin is readily soluble in most organic solvents. Working solutions of ninhydrin are governed by the nature of the solvent and the strength of the solution. Concentrations of the ninhydrin solution may vary according to application, but generally a 0.5% to 1.0% weight to volume mixture produces the best results. A 0.5% concentration is recommended for routine porous item processing. Ethanol, methanol, petroleum ether and acetone have high damage potential but are acceptable for non-document porous material. Health and safety risks with these solvents require proper handling.

Recommended Preparation- 0.5%-1% concentration

Formula 1

NINHYDRIN ---------- 10 g
METHANOL ---------- 50 ml
ACETIC ACID ---------- 2.5 ml
PETROLEUM ETHER ---------- 2000ml

Mix thoroughly. Allow solution to separate and discard bottom layer.

Formula 2

Stock Solution

NINHYDRIN ---------- 20 g
ETHANOL ---------- 80 ml
GLACIAL ACETIC ACID ---------- 20 ml

Combine and mix with a magnetic stirrer until dissolved.

Working Solution

STOCK SOLUTION ---------- 30 ml
PETROLEUM ETHER ---------- 1000ml

Formula 3

NINHYDRIN ---------- 5.0 g
METHANOL ---------- 30 ml
ISOPROPYL ---------- 40 ml
PETROLEUM ETHER ---------- 930 ml

Dissolve ninhydrin crystals in methanol on a stirring device. Allow solution to separate and discard bottom layer.

Formula 4

NINHYDRIN ---------- 10 g
METHANOL ---------- 1000ml

Stir until dissolved.

Formula 5 (for latex gloves)

NINHYDRIN ---------- 4.25g
ETHANOL ---------- 28.5ml
HEPTANE ---------- 525ML

Place ninhydrin crystals in a beaker and add the ethyl alcohol. Mix with a magnetic stirrer. Cover beaker to prevent evaporation. Gently stir until the crystals are completely dissolved. Remove 25ml of heptane, set aside for later use. Add ninhydrin/ethanol mix to 500ml of heptane. Stir thoroughly. Add the last 25 ml of heptane and stir thoroughly.

Formula 6

Stock

NINHYDRIN ---------- 50 g
ETHANOL ---------- 450ml
ETHYL ACETATE ---------- 20ML
GLACIAL ACETIC ACID ---------- 50ml

Working

STOCK ---------- 114ML
VERTREL XF ---------- 2000ml

Formula 7 (for thermal paper)

NINHYDRIN ---------- 30-50 g
ACETONE ---------- 1500 ml

Soak blotter paper (printer paper) in solution. Allow to dry completely.

14.4.6 Storage and Shelf Life

Solution must be stored in a sealed, dark container. The stock solution has an indefinite shelf life. The working solution has a shelf life of approximately one year.

14.4.7 Instrumentation

A humidity/heat chamber or steam iron can be used to accelerate the development of prints by ninhydrin. Use chamber according to manufacturer's instructions with

humidity between 60-70%. The steam iron is placed several inches from the item allowing the steam to accelerate the development of the latent print on the processed item.

14.4.8 Standards and Controls

Ninhydrin works by discoloring latent impressions that are composed of amino acid secretions. The Standards and Controls for ninhydrin consist of placing test impressions on a porous, non-evidentiary item. Apply the ninhydrin to the item and subject it to the proper level of heat/humidity. If reddish-purple impressions are visualized, the ninhydrin is working properly. This testing must be performed for each working solution at the time of preparation and prior to use on evidence. Documentation of this testing will appear in the reagent prep log and in the case examination notes.

See Appendix I—Standards and Controls.

14.4.9 Procedure

All applications should be completed in a fume hood.

14.4.9.1 Dipping

1. Completely immerse each item to be processed in the working solution until the item is completely saturated, usually five seconds or less. The item can be manipulated using tongs or forceps.
2. Remove and allow the item to dry completely.
3. A humidity/heat chamber or steam iron is used to accelerate the process. Use chamber according to manufacturer's instruction. The steam iron is placed several inches from the item allowing the steam to accelerate the latent on the processed item.
4. Check the item periodically to monitor the impression development. Care should be taken not to saturate the item with water vapor.
5. Photograph any developed impressions.

14.4.9.2 Brushing, Spraying or Squirt Bottle

Larger items, which will not fit conveniently into processing trays, can be painted with the ninhydrin solution using a soft bristle brush. Two inch to four inch nylon paint brushes are adequate. Care must be taken to apply an even and thorough amount to all surfaces. Avoid spraying methods, except for very small items involving brief exposure. The health and safety risks from the use of aerosols are unwarranted when other methods are available. Items can be coated with solution using a squirt bottle in the same manner as dipping.

14.4.9.3 Thermal Papers

Place evidence between two blotter sheets and seal in a plastic bag. Place bag between two heavy items, such as books. At room temperature, leave items in a dark area for a

minimum of forty eight (48) hours to seven (7) days. A test print will be included with items.
Alternately, items can be processed with traditional ninhydrin formulas. Heat should not be applied, as the paper will begin to discolor at 60º C. However, if heat has been applied, acetone can be used to wash the discoloration from the evidence.

An alternative to the acetone wash is an ethanol/HFE dip. Combine 150ml of ethanol and 850 ml of HFE 7100. After application of ninhydrin, place the thermal paper in the solution for 30 seconds and allow it to air dry. If the discoloration remains, place in the solution again. This will process will work prior to and after exposure to heat and or/humidity. It also works post DFO.

A low wattage hair dryer (approximately 1200 watts) can be used to accelerate heat on thermal papers treated or untreated with ninhydrin. Prints will appear a grayish-black and should be photographed immediately. Care must be taken not to overheat the paper, as it will turn solid black.

14.4.10 Interpretation of Results

Ninhydrin coloration is not permanent, and while some impressions have remained visible for years, others have faded in a matter of days. Photographic preservation is essential and will be accomplished as soon as possible.

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- Stonebreaker, Lee. The Detail, June 16, 2003. http://clpex.com/
- Technical Notes, Lightning Powder Co. Inc., Salem, OR, 2000.

15 Procedure: Non-porous Surfaces

15.1 Ardrox

15.1.1 Introduction

Fluorescent dye staining was developed as a means of enhancing cyanoacrylate ester. The dye staining process can be used before and after the use of powders. Fluorescent dye stains are used to increase contrast of the superglue-developed print and possibly make a weak print suitable for identification purposes through florescence examination. Caution must be used to avoid over processing with cyanoacrylate fumes. Excessive cyanoacrylate ester application may result in a loss of fine ridge detail resulting in excessive fluorescence. Often when a surface is textured, the application of fluorescent dye and use of photography can eliminate the background allowing only the fluorescent print to photograph.

Ardrox P133D is an industrial penetrant, which was developed to detect small fractures in construction materials and possesses certain properties that can be successfully utilized in latent print processing. Ardrox P133D readily penetrates and remains in minute openings, yet is easily rinsed from surrounding surfaces. Also, it is highly luminescent with long wave ultraviolet light excitation.

Ardrox P133D staining was developed as a means of enhancing cyanoacrylate ester polymerized impressions. The properties of Ardrox are highly complementary to the cyanoacrylate ester process and often yield results that equal or surpass those of the Rhodamine 6G procedure. However, instances have occurred when Rhodamine 6G revealed impressions, with UV excitation, that were not stained by Ardrox P133D. Due to this lack of consistency, Ardrox P133D is delegated as an additional processing technique to be used in conjunction with other dye stains, such as Rhodamine 6G and MBD (7-P-methoxybenzylamino-4-nitrobenz-2-oxa-1-3-diazole).

15.1.2 Reagent Applicability

Fluorescent technique
Nonporous surfaces
Post-cyanoacrylate

15.1.3 Safety Considerations

Ardrox
Methanol
Petroleum ether
Acetone
Acetonitrile
Propanol and Isopropanol

Methylethyl ketone
These procedures involve hazardous materials. These procedures do not purport to address all of the safety problems associated with their use. It is the responsibility of the user of these procedures to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. Consult the appropriate SDS for each chemical prior to use.

WARNING!
FLAMMABLE!
Acetone, Ethanol, Isopropanol, Petroleum Ether, Propanol vapors can ignite at room temperatures.
Consider a **SEVERE HAZARD!**

15.1.4 Equipment

Scales, weigh boats, beakers, graduated cylinder, magnetic stirrer and stirring bar, dark storage bottles, and squirt bottles or spray device.

15.1.5 Preparation

Ardrox is liquid that can be diluted as an efficient staining solution for cyanoacrylate processed items. The items can be dried and then rinsed with water to remove background fluorescence.

Petroleum Ether Formula

ARDROX	1 ml
METHANOL	40 ml
PETROLEUM ETHER	60 ml

While the 40% methanol solution may cause some substrate damage, many surfaces, such as semi-porous items, benefit from the reduced alcohol mixture.

Alternate Petroleum Ether Formula

ARDROX	2 ml
ACETONE	10 ml
METHANOL	25 ml
ISOPROPANOL	10 ml
ACETONITRILE	8 ml
PETROLEUM ETHER	945 ml

Combine in order given.

Aqueous

ARDROX	1ml
DISTILLED WATER	50ml
METHYETHYL KETONE	40ml
ISOPROPANOL	9ml

Shake vigorously before application.

15.1.6 Storage and Shelf Life

Working solution can be stored up to six (6) months in sealed, clear or dark glass or plastic storage bottles.

15.1.7 Instrumentation

High Intensity Ultra Violet Light Source
ALS
Laser

15.1.8 Standards and Controls

Fluorescent stains work by discoloring latent impressions developed with cyanoacrylate ester. The Standards and Controls for Ardrox P133D consist of placing a test impression on a non-porous, non-evidentiary item and treating it with cyanoacrylate ester. Apply the Ardrox P133D to the item and view with the proper ALS wavelength. If the print is visualized, the Ardrox P133D is working properly. This testing must be performed for each working solution at the time of preparation and prior to use on evidence. Documentation of this testing will appear in the reagent prep log and in the case examination notes.

See Appendix I – Standards and Controls.

15.1.9 Procedure

All applications should be completed in a fume hood.

15.1.9.1 Petroleum Ether Formulas Application

Apply the solution to the item to be processed by immersion or squirt bottle.

1. Allow the solution to remain on the item for several minutes to insure proper adherence of the Ardrox to the cyanoacrylate developed impressions.
2. Examine the item using either an Ultra Violet lamp (280-365nm) or ALS (435-480nm) without rinsing to determine if background staining has occurred. If not proceed with the examination and photograph all developed impressions.
3. If background staining is observed and prevents adequate photographic preservation, expose the item to a light tap water rinse.
4. Allow the item to dry completely and examine with the appropriate light source.

5. Photograph any impressions observed using a 2-A haze, yellow colored or 515 bandpass filter.

15.1.9.2 Aqueous Formula Application

1. Apply the solution to the item to be processed by immersion or squirt bottle.
2. Allow to set until no solvent odor is present, approximately 30 seconds.
3. Rinse item under running tap water for approximately 30 seconds.
4. If tap water has high mineral content, give surface a quick rinse with distilled water.
5. Allow the item to dry completely and examine with the appropriate light source.
6. Photograph any impressions observed using appropriate film and filters.

15.1.10 Interpretation of Results

Items treated with the Ardrox solution can be examined with any long wave UV light source (range between 280 nm to 365 nm) or alternate light source (range 435 nm to 480 nm). Ardrox P133D developed prints appear as light impressions on dark backgrounds that should be preserved photographically with a 2-A haze, yellow colored or 515nm bandpass filter. In most cases, UV illumination is preferable, particularly to facilitate photography, however, low wattage black light bulbs are available that fit standard fluorescent light desk lamps and provide adequate illumination for Ardrox luminescence. Although Ardrox P133D and Rhodamine 6G can be used in any order, Ardrox staining is removed by methanol, while Rhodamine 6G will not be removed by a water rinse. Since excessive background staining with Rhodamine 6G cannot be removed, the use of Ardrox staining before Rhodamine 6G may be beneficial.

15.1.11 References

- Chesapeake Bay Division: https://www.cbdiai.org/ardrox.html
- Cummings, Harless, Mitch Hollars and Tim Trozzi. “Getting the Most from Cyanoacrylate Dyes,” Journal of Forensic Identification, 1993; 43 (1): 37-43.
- Kent, Terry, ed. Fingerprint Development Techniques. Derbyshire, England: Heanor Gate Publisher; 1993.
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15.2 Basic Yellow 40

15.2.1 Introduction

Fluorescent dye staining was developed as a means of enhancing cyanoacrylate ester. The dye staining process can be used before and after the use of powders. Fluorescent dye stains are used to increase contrast of the superglue-developed print and possibly make a weak print suitable for identification purposes through florescence examination. Caution must be used to avoid over processing with cyanoacrylate fumes. Excessive cyanoacrylate ester application may result in a loss of fine ridge detail resulting in excessive fluorescence. Often when a surface is textured, the application of fluorescent dye and use of photography can eliminate the background allowing only the fluorescent print to photograph.

Basic Yellow 40 is a yellow odorless powder dissolved in a solution for use as a fluorescent dye stain. It is also water-soluble. This stain has many uses in addition to its original use of dyeing acrylic fibers. Other chemical names: Yellow Brilliance, Maxilon BR Flavine 10 GFF, and Panacryl Brilliant Flavine 10 GFF.

15.2.2 Reagent Applicability

Fluorescent Technique
Nonporous surfaces
Post-cyanoacrylate

15.2.3 Safety Considerations

Basic Yellow 40
Acetonitrile
Propanol
Petroleum ether

This procedure involves hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. Consult the appropriate SDS for each chemical prior to use.

WARNING!
FLAMMABLE! Acetone and Petroleum Ether vapors can ignite at room temperatures. Consider a **SEVERE HAZARD!**

15.2.4 Equipment

Scales, weigh boats, beakers, graduated cylinder, magnetic stirrer and stirring bar, dark glass storage bottles, and squirt bottles.

15.2.5 Preparation

Basic Yellow is mixed in two (2) solutions: stock and working.

Stock Solution

BASIC YELLOW 40	0.1g
PROPANOL	60ml
ACETONITRILE	40ml

Combine the ingredients and stir on a stirring device until all the Basic Yellow 40 is dissolved.

Working Solution

STOCK SOLUTION	5ml
PETROLEUM ETHER	100ml

Combine ingredients in the order listed. This solution can be mixed manually.

Alternate Working Solution

BASIC YELLOW 40	1g
METHANOL	500 ml

15.2.6 Storage and Shelf Life

Store all solutions in sealed, dark glass bottles. The stock solution has an indefinite shelf life. The working solution can be kept up to six (6) months.

15.2.7 Instrumentation

Alternate Light Source

15.2.8 Standards and Controls

Fluorescent stains work by discoloring latent impressions developed with cyanoacrylate ester. The Standards and Controls for Basic Yellow 40 consist of placing test impressions on a non-porous, non-evidentiary item and treating it with cyanoacrylate ester. Apply the Basic Yellow 40 to the item and view with the proper ALS wavelength. If the print is visualized, the Basic Yellow 40 is working properly. This testing must be performed for each working solution at the time of preparation and prior to use on evidence. Documentation of this testing will appear in the reagent prep log and in the case examination notes.

See Appendix I – Standards and Controls.

15.2.9 Procedures

All applications should be completed in a fume hood.

The Basic Yellow 40 working solution can be applied by dipping or using a spray device or squirt bottle. This solution is applied to the item after cyanoacrylate fuming process and then examined under ALS in the 450 nm to 485 nm range using yellow or orange colored goggles or the Ultraviolet lamp around 365nm. Photograph results using a yellow or orange colored or 515(BP 35) bandpass filter.

15.2.10 Interpretation of Results

Prints developed, with Basic Yellow, usually appear as light impressions on dark backgrounds that should be preserved photographically.

15.2.11 References

- Chesapeake Bay Division: https://www.cbdiai.org/basic-yellow-40.html
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15.3 Cyanoacrylate Ester Fuming

15.3.1 Introduction

Cyanoacrylate esters are the active ingredients in the super bond adhesives and are available according to the type of alcohols used in manufacturing. Most cyanoacrylates are methyl or ethyl esters. Regardless of type, the esters volatilize into long chain molecules with a positive electrical charge. In an atmosphere of relatively high humidity, the cyanoacrylate ester molecules are attracted to fingerprint residue and polymerize upon the deposit.

Properties of the polymer are dependent upon the type of cyanoacrylate ester used. Both ethyl and methyl esters produce a visible white coating. Ethyl ester polymers are softer and less durable while methyl ester polymers can only be removed with solvents. However, the durable, hard property of the methyl ester appears to inhibit dye applications, especially Rhodamine 6G.

Any product containing ethyl ester will be more effective when subsequent UV or ALS dye applications are indicated. Cyanoacrylate ester fuming is highly effective with nonporous items made of plastics or metal. It is superior to any other method for the processing of gun metal.

15.3.2 Reagent Applicability

Nonporous surfaces

15.3.3 Safety Considerations

Cyanoacrylate ester

This procedure involves hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. Consult the appropriate SDS for each chemical prior to use.

Rapid volatilization, however, presents very serious health risks. High heat volatilization can produce hydrogen cyanide that is toxic even in small concentrations. Lower temperatures appear relatively safe and only increase development time by a matter of minutes. Chemically produced vapors are highly irritating and repeated contact with moist eyes can result in polymerization on the eye itself. Contact lens wearers are especially cautioned to avoid prolonged exposure to the fumes.

15.3.4 Equipment

Aluminum dish (disposable) or foil, light source (no more than 60 watt bulb) or thermostatically controlled heater, chamber or fish tank, electric cord with plug, rounded can to fit over light assembly, cup or glass of water.

15.3.5 Storage and Shelf Life

Material must be stored in sealed, commercial bottle in the refrigerator. Shelf life is indefinite.

15.3.6 Instrumentation

Cyanoacrylate Fuming Chambers

15.3.7 Standards and Controls

The Standards and Controls for cyanoacrylate ester fuming consist of placing test impressions on a non-porous, non-evidentiary item. Processing should be terminated when test impressions have reached optimum development. However, all items should be watched carefully as faster or slower development may occur. Test impressions must be done with each batch of items processed. Documentation of this testing will appear in the case examination notes.

See Appendix I – Standards and Controls

15.3.8 Procedure

Volatilization of cyanoacrylate ester at normal room temperature is relatively slow but is a viable procedure for evidence processing. Vapors must be contained, and a tank or plastic enclosure is most often used. A ratio of two drops of adhesive for every gallon of capacity or volume with relatively high humidity is usually effective. Polymerization may be retarded or prevented by low humidity. The addition of a cup of lukewarm water will improve the fuming results. Development time varies with the temperature, humidity, and the substrate being processed. Development of fuming cabinets which control the heat and humidity of the chamber have shown good results and are used to more precisely control the fuming process.

Application of heat greatly accelerates volatilization. Metal blocks or a hot plate can serve as the heat source but caution must be used to not over heat to the point where cyanide vapors can be produced. An aluminum dish or shaped foil is placed on the hot surface and the adhesive poured onto the aluminum. A cup of warm water is placed in the enclosure. Volatilization can be very rapid and development may be accomplished in as little as 10 minutes. Care must be taken to closely observe the process to insure that the item is not overdeveloped.

An alternative, which offers rapid development time with minimum health risk, is to use a light bulb as the heat source. A standard light receptacle is added to the processing tank, with a wire loop support fashioned to hold a watch glass approximately 1-inch above the light bulb. The adhesive is dropped onto the watch glass. A cup of warm water is placed in the enclosure. Once the container is covered tightly, the light is turned on. Rapid volatilization does not begin until the heat from the bulb penetrates the watch glass. Natural convection currents aid dispersal of the fumes and development is accomplished in about 15 minutes.

15.3.9 Interpretation of Results

Photographic preservation of all suitable polymerized impressions is recommended prior to any additional processing. Once the latent impressions are recorded, further processing can reveal impressions in which polymerization was too visually indistinct or did not occur. Powders and particulate developers are effective and often permit additional photographic and lifting preservation. Small particle reagent will sometimes adhere to faint impressions when powders will not. Small particle reagent and Alternate Light Source or UV dye application is effective after powder, as the liquid dye solution will normally wash away the particulate remnants. However, vinyl, rubber, oily guns, and hard plastics, especially those used in cash register drawers, may not be receptive to any powder method.

15.3.10 References

- "Chemical Formulas and Processing Guide for Developing Latent Prints," U.S. Dept. of Justice, pg. 47-48, 1994.
- Chesapeake Bay Division: https://www.cbdiai.org/cyanoacrylate-ester.html
- Kent, Terry, ed. Fingerprint Development Techniques. Derbyshire, England: Heanor Gate Publisher; 1993.
- Lee, Henry C. and R.E. Gaensslen, eds. Advances in Fingerprint Technology. New York, NY: Elsevier Science Publishers; 1991.
- Lee, Henry C. and R. E. Gaensslen. "Cyanoacrylate Fuming," Identification News, 1984; 34 (3): 8-14.
- Lennard, Christopher J. and Pierre A. Margot. "Sequencing of Reagents for the Improved Visualization of Latent Fingerprints," Journal of Forensic Identification, September/October, 1988; 38 (5):197-210.
- Manual of Fingerprint Development Techniques 2nd. Ed., Home Office - Police Scientific Development Branch, White Crescent Press, Ltd., Luton, England, 2001.
- Pounds, C.A. and R.J. Jones. "Physicochemical Techniques in the Development of Latent Fingerprints," Trends in Analytical Chemistry, 1983: 2 (8):180-183.
- "Processes Involved in the Development of Latent Fingerprints Using the Cyanoacrylate Fuming Method", Lewis, L., Smithwick, R., Devault, G., Bolinger, B., & Lewis, S., Jor. Forensic Sciences, Vol. 46, No., 2, March 2001, pp.241-246.
- Technical Notes, Lightning Powder Co. Inc., Salem, OR, 2001.

15.4 Fluorescent Gentian Violet

See PROCEDURE: ADHESIVE SURFACES

15.5 Gentian Violet

See PROCEDURE: ADHESIVE SURFACES

15.6 MBD

15.6.1 Introduction

Fluorescent dye staining was developed as a means of enhancing cyanoacrylate ester. The dye staining process can be used before and after the use of powders. Fluorescent dye stains are used to increase contrast of the superglue developed print and possibly make a weak print suitable for identification purposes through florescence examination. Caution must be used to avoid over processing with cyanoacrylate fumes. Excessive cyanoacrylate ester application may result in a loss of fine ridge detail resulting in excessive fluorescence. Often when a surface is textured, the application of fluorescent dye and use of fluorescent photography can eliminate the background allowing only the fluorescent print to photograph.

MBD is a fluorescent dye used to enhance cyanoacrylate developed friction ridge detail on various colored non-porous surfaces.

15.6.2 Reagent Applicability

Fluorescent technique
Nonporous surfaces
Post-cyanoacrylate

15.6.3 Safety Considerations

MBD (7-P-methoxybenzylamino-4-nitrobenz-2-oxa-1-3-diazole)
Acetone
Methanol
Isopropyl alcohol
Petroleum ether

These procedures involve hazardous materials. These procedures do not purport to address all of the safety problems associated with their use. It is the responsibility of the user of these procedures to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid

exposure to dangerous chemicals. Consult the appropriate SDS for each chemical prior to use.

WARNING!
FLAMMABLE!
Acetone and Petroleum Ether vapors can ignite at room temperatures.
Consider a **SEVERE HAZARD!**

15.6.4 Equipment

Scales, weigh boats, beakers, graduated cylinder, magnetic stirrer and stirring bar, dark glass or plastic storage bottles, and squirt bottles.

Preparation

Stock Solution

MBD	1 g
ACETONE	1000 ml

Combine the ingredients and stir on a stirring device until all the MBD is dissolved.

Working Solution

STOCK SOLUTION	10ml
METHANOL	30ml
ISOPROPANOL	10ml
PETROLEUM ETHER	950ml

The ingredients for the working solution must be combined in listed order. This solution can be mixed manually.

15.6.5 Storage and Shelf Life

Store all solutions in sealed, dark glass or plastic bottles. The stock solution can be stored indefinitely. The working solution can be stored up to six (6) months.

15.6.6 Instrumentation

Alternate Light Source
See Appendix III - General Instrumentation.

15.6.7 Standards and Controls

Fluorescent stains work by discoloring latent impressions developed with cyanoacrylate ester. The Standards and Controls for MBD consist of placing test impressions on a non-porous, non-evidentiary item and treating it with cyanoacrylate ester. Apply the MBD to the item and view with the proper ALS wavelength. If the print is visualized, the MBD is

working properly. This testing must be performed for each working solution at the time of preparation and prior to use on evidence. Documentation of this testing will appear in the reagent prep log and in the case examination notes.

See Appendix I – Standards and Controls.

15.6.8 Procedures

All applications should be completed in a fume hood.

MBD working solution can be applied by dipping or using a squirt bottle. This solution is applied to the item after cyanoacrylate fuming process and then examined under ALS at 435nm to 535nm using orange colored goggles. Photograph results using an orange barrier filter.

15.6.9 Interpretation of Results

Prints developed, with MBD, usually appear as light impressions on dark backgrounds that must be preserved photographically.

15.6.10 References

- Chesapeake Bay Division: https://www.cbdiai.org/mbd.html
- Cummings, Harless, Mitch Hollars and Tim Trozzi. “Getting the Most from Cyanoacrylate Dyes,” Journal of Forensic Identification, 1993; 43 (1): 37-43.
- Processing Guide for Developing Latent Prints, U.S. Department of Justice, pgs. 52-53, 2000.

15.7 MRM 10

15.7.1 Introduction

Fluorescent dye staining was developed as a means of enhancing cyanoacrylate ester. The dye staining process can be used before and after the use of powders. Fluorescent dye stains are used to increase contrast of the superglue developed print and possibly make a weak print suitable for identification purposes through florescence examination. Caution must be used to avoid over processing with cyanoacrylate fumes. Excessive cyanoacrylate ester application may result in a loss of fine ridge detail resulting in excessive fluorescence. Often when a surface is textured, the application of fluorescent dye and use of photography can eliminate the background allowing only the fluorescent print to photograph.

MRM l0 is a fluorescent dye used to enhance cyanoacrylate developed friction ridge detail on various colored non-porous surfaces. This process is best used on most plastics, Styrofoam packaging, and textured surfaces. The application of multiple dyes, in some cases, provides an opportunity for better performance than a singular dye. This dye stain is best used with an alternate light source versus an ultraviolet light.

15.7.2 Reagent Applicability

Fluorescent technique
Nonporous surfaces
Post-cyanoacrylate

15.7.3 Safety Considerations

Rhodamine 6G
Maxilon flavine 10GFF
MBD (7-P-methoxybenzylamino-4-nitrobenz-2-oxa-1-3-diazole)
Methanol
Isopropanol
Acetonitrile
Petroleum ether
Acetone

This procedure involves hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the uses of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. Consult the appropriate SDS for each chemical prior to use.

WARNING!
FLAMMABLE!
Propanol, Petroleum Ether, Acetone vapors can ignite at room temperature.
Consider a **SEVERE HAZARD!**

15.7.4 Equipment

Scales, weigh boats, beakers, graduated cylinder, magnetic stirrer and stirring bar or other stirring device, squirt bottle and dark glass or plastic storage bottles

15.7.5 Preparation

Prior to mixing the MRM 10 cyanoacrylate dye solution, three stock solutions A, B and C, must be prepared. All mixtures are in one liter solutions.

Stock Solution A
RHODAMINE 6G ---------- 1g
METHANOL ---------- 1000 ml

Place on a stirring device until all the Rhodamine 6G is dissolved.

Stock Solution B
MAXILON FLAVINE 10 GFF ---------- 2 g
METHANOL ---------- 1000 ml

Place a stirring device to dissolve the Maxilon Flavine 10GFF. Not all the Maxilon Flavine 10GFF will dissolve and there will be a settlement in the bottom of the storage bottle. This will not affect the working solution.

Stock Solution C
MBD ---------- 1g
ACETONE ---------- 1000 ml

MRM 10 Working Solution
STOCK SOLUTION A ---------- 3 ml
STOCK SOLUTION B ---------- 3 ml
STOCK SOLUTION C ---------- 7 ml
METHANOL ---------- 20 ml
ISOPROPANOL ---------- 10 ml
ACETONITRILE ---------- 8 ml
PETROLEUM ETHER ---------- 950 ml

Combine ingredients in the order listed. The working solution can be mixed manually.

15.7.6 Storage and Shelf Life

Stock solutions A, B, and C have an indefinite shelf life. Working solution has a shelf life up to six (6) months. Store all solutions in sealed, dark glass or plastic bottles.

15.7.7 Instrumentation

Alternate Light Source
High Intensity Ultra Violet Light Source
Laser

15.7.8 Standards and Controls

Fluorescent stains work by discoloring latent impressions developed with cyanoacrylate ester. The Standards and Controls for MRM-10 consist of placing test impressions on a non-porous, non-evidentiary item and treating it with cyanoacrylate ester. Apply the MRM-10 to the item and view with the proper ALS wavelength. If the print is visualized, the MRM-10 is working properly. This testing must be performed for each working solution at the time of preparation and prior to use on evidence. Documentation of this testing will appear in the reagent prep log and in the case examination notes.

See Appendix I – Standards and Controls.

15.7.9 Procedures

All applications should be completed in a fume hood.
MRM 10 working solution can be applied by dipping or using a squirt bottle. This solution is applied to the item after cyanoacrylate fuming process and then examined under ALS at 430 nm to 530 nm using orange goggles. Photograph results using an orange colored or 550(BP 35) bandpass filter

15.7.10 Interpretation of Results

Prints developed, with MRM 10, usually appear as light impressions on dark backgrounds that ~~should~~ must be preserved photographically.

15.7.11 References

- Chesapeake Bay Division: https://www.cbdiai.org/mrm-10.html
- Kent, Terry, ed. Fingerprint Development Techniques. Derbyshire, England: Heanor Gate Publisher; 1993.
- Lennard, Christopher J. and Pierre A. Margot. “Sequencing of Reagents for the Improved Visualization of Latent Fingerprints,” Journal of Forensic Identification, September/October 1988; 38(5):197-210.
- Processing Guide for Developing Latent Prints, U.S. Department of Justice, pgs. 54-55, 2000.

- Vachori, G. and J. Sorel. “New Fingerprint Development Process,” in Proceedings of the International Forensic Symposium on Latent Prints, U.S. Department of Justice, U.S. Government Printing Office; 1987.

15.8 Powders and Particulates

15.8.1 Introduction

Fingerprint powders are very fine particles with an affinity for moisture throughout a wide range of viscosity. Palmar sweat, grease, oils, and most contaminants that coat the surface of friction ridge skin possess sufficient moisture and viscosity to attract and bind the fine particles together. Contact between friction ridge skin and a non-porous surface will sometimes result in a transfer of the skin coating to that surface. The non-absorbency of the surface prevents penetration by the deposited moisture. All fingerprint powders are indiscriminate in adhesion to moisture. Surfaces coated with residue in addition to suspected prints would attract powders throughout the surface.

Dependent upon the composition of the residue, the deposited moisture will range from a most apparent appearance to the barely perceptible or invisible, even under oblique lighting. Powder application is the effort to produce or improve the appearance for preservation.

Carbon is the most effective agent in terms of adherence to moisture, non-adherence to dry surfaces, particle size, shape, uniformity, and intensity of color. Carbon is black, and as a result, black powders consistently produce the best results. Other colored powders may be required due to the substrate encountered, but should be restricted to absolute necessity.

Magnetic powders are powder-coated, fine iron filings subject to magnetic attraction. These adhere to moisture to a lesser degree than carbon powders, but can be applied with less destructive force to the surface. Magnetic powders cannot be effectively used on ferrous metal surfaces.

Most commercial black fingerprint powders have a high carbon base. According to the manufacturer's particular formula and production methods, the carbon base may be from a variety of sources, including lamp black, bone, or wood charcoal. Commercial powders contain milled carbon of highly uniform size and shape, along with additional ingredients to preserve the milled condition and retard air moisture absorption.

15.8.2 Reagent Applicability

Nonporous surfaces
Pre/Post-cyanoacrylate

15.8.3 Safety Considerations

Commercially Prepared Powders

This procedure involves hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. Consult the appropriate SDS for each chemical prior to use.

Traditionally, fingerprint powders have been used with little regard for safety. Many commercial powders do pose a potential health risk and vary in their overall effectiveness. Some powders have been found to contain fluoranthene and pyrene, which are polynuclear aromatic hydrocarbons known to be carcinogens. Lead, manganese, nickel, aluminum, iron and actinium have all been found in commercial preparations. The effects of these chemicals range from carcinogenic and/or toxic to the central nervous system to being radioactive. Powders applied in a laboratory environment or in the field require appropriate safety precautions. Ventilation systems filter masks, or respirators are essential. The scientist should contact the manufacturer for the MSDS or chemical makeup of the specific powder they are using and take the appropriate safety precautions when using that powder.

15.8.4 Equipment

Powder, fiberglass brush, clearing brush, clear tape, appropriate contrast backing or acetate for lifts.

15.8.5 Storage and Shelf Life

Powder containers must be stored in a dry area. Shelf life, if properly stored, is indefinite.

15.8.6 Standards and Controls

Powders work by adhering and causing discoloration to latent print residues. Due to their inherent ability to adhere and discolor these materials, there is no need for test impressions to be done prior to evidence application. Powders must not be exposed to high humidity or moisture. Powders may clump if exposed to excessive moisture or contaminants. Keeping the stock container closed as much as possible and using containers with small amounts of powder to work from may minimize moisture content and contaminants. Powder may also be kept in desiccators designed to reduce the atmospheric moisture within the enclosed desiccators' unit.

See Appendix I – Standards and Controls.

15.8.7 Procedure

15.8.7.1 Standard Powders

Powders may be applied by various means, but the preferred procedure for most items is the use of a brush. Fiberglass brushes are the easiest to use and maintain, while permitting application over a wider area. Powders are more effective if applied in very small amounts. While some scientists prefer pouring a supply of powder into a secondary container or a piece of paper, direct contact between brush and powder container is acceptable. Only the ends of the brush bristles will be coated with the powder, and the brush should be gently tapped several times to remove all but a minimum amount.

With the brush handle in a nearly vertical position to the surface, the bristle ends are lightly and delicately moved over the surface. Discoloration of the latent print residue will usually appear immediately. With a fiberglass brush and a proper amount of powder, the impression will develop in density with each light pass until no further development can be observed. Even slightly excessive amounts of powder will cause a fill to occur between ridges. This fill should be removed with continued brush strokes until the impression is as free of extraneous powder as possible. Except on highly polished surfaces, excessive brushing is rare with a fiberglass brush. However, at the first indication that the impression is being removed, all further brushing should cease.

Extraneous residue on the surface may cause a general painting effect that obscures friction ridge detail. A lift made of the area can sometimes remove the extraneous material and permit a second application of powder. This second application may offer better contrast between latent print deposit and the background.

15.8.7.2 Magnetic Powders

Magnetic powder must be applied with a magnetic application device. Wands that contain a movable magnet attract the powder when the magnet is depressed and release the powder when it is raised. Contact between powder and surface is completed without bristles and is lighter and more delicate than the fiberglass brush. However, the particle size, larger than standard powder, has a tendency to paint some surfaces. Excessive powder can sometimes be removed by passing the magnetic wand without powder near the surface. Since the magnetic attraction holding the iron particles is relatively weak, the supply can be depleted quickly. Surface areas examined generally must be processed more slowly with magnetic powders, and great care must be exercised to prevent actual contact between the end of the wand and the surface.

15.8.7.3 Fluorescent Powders

A number of fluorescent powders are available. Strongly fluorescent, these powders can be detected with a low power ultraviolet lamp. They are useful on occasions when the surface is rough and/or multi-colored preventing photography by conventional methods. Fluorescent powders are available in both magnetic and non-magnetic forms.

15.8.8 Interpretation of Results

Powder latent impressions should be properly preserved. Experiments have revealed that the developed latent impressions have a weaker adhesion to the surface than undeveloped and, as a result, are more susceptible to damage from accidental contact. Two methods of preservation are normally afforded the powder-developed latent: photography and lifting. Both should be used at every opportunity.

Photographic preservation of the developed impressions on the item affords the best procedure in terms of minimal damage and complete documentation. Lifting is also an approved procedure but caution will be taken when lifting to ensure that the lift will be successful. If the lift cannot be made with confidence, then the developed friction ridge detail must be photographed prior to lifting.

15.8.9 References

- Cowger, James F. Friction Ridge Skin Comparison and Identification of Fingerprints. Boca Raton, FL: CRC Press; 1993.
- Lee, Henry C. and R.E. Gaensslen, eds. Advances in Fingerprint Technology. New York, NY: Elsevier Science Publishers; 1991.Olson, Robert. Scott's Fingerprint Mechanics. Springfield, IL: Charles C. Thomas Publisher;1978.
- Processing Guide to Developing Latent Prints, U.S. Department of Justice, pgs.26-27, 2000.
- Technical Notes, Lightning Powder Co. Inc., Salem, OR, 2000.
- Waldoch, Terry L. "The Flame Method of Soot Deposition For The Development of Latent Prints On Non-Porous Surfaces," Journal of Forensic Identification, 1993; 43 (5):463-465.

15.9 RAM

15.9.1 Introduction

Fluorescent dye staining was developed as a means of enhancing cyanoacrylate ester. The dye staining process can be used before and after the use of powders. Fluorescent dye stains are used to increase contrast of the superglue developed print and possibly make a weak print suitable for identification purposes through florescence examination. Caution must be used to avoid over processing with cyanoacrylate fumes. Excessive cyanoacrylate ester application may result in a loss of fine ridge detail resulting in excessive fluorescence. Often when a surface is textured, the application of fluorescent dye and use of photography can eliminate the background allowing only the fluorescent latent print to photograph.

RAM is used to chemically dye cyanoacrylate developed friction ridge detail. These prints are then visualized by the use of an ALS or UV light source. This method is effective on all colors of non-porous surfaces, except surfaces that luminance. It should be noted that the use of the combination of components, rather than the use of the individual components, results in the saving of time.

15.9.2 Reagent Applicability

Fluorescent technique
Nonporous surfaces
Post-cyanoacrylate

15.9.3 Safety Considerations

Ardrox P133D
Rhodamine 6G
Methanol
Petroleum ether
Acetone
Isopropyl alcohol
Acetonitrile
MBD (7-P-methoxybenzylamino-4-nitrobenz-2-oxa-1-3-diazole)

This procedure involves hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. Consult the appropriate SDS for each chemical prior to use.

WARNING!
FLAMMABLE!
Propanol, Petroleum Ether, Acetone vapors can ignite at room temperature.
Consider a **SEVERE HAZARD!**

15.9.4 Equipment

Scales, weigh boats, beakers, graduated cylinder, squirt bottle, glass tray, magnetic stirrer, stirring bar or other stirring device, and dark glass or plastic storage bottles

15.9.5 Preparation

Two stock solutions must be mixed prior to formulating the RAM dye.

Stock Solution 1 (Rhodamine 6G)

RHODAMINE 6G	1g
METHANOL	1000 ml

Combine ingredients and place on a stirring device until all the Rhodamine 6G is thoroughly dissolved. Store in a sealed dark bottle.

Stock Solution 2 (MBD)

MBD	1 g
ACETONE	1000 ml

Combine ingredients and place on a stirring device until all the MBD is thoroughly dissolved. MBD must be stored in a sealed dark bottle.

Ardrox
The ardrox solution does not have to be dissolved in any type of carrier as it is used full strength from its container.

Ram Working Solution

STOCK SOLUTION 1	3 ml
ARDROX	2 ml
STOCK SOLUTION 2	7 ml
METHANOL	20 ml
ISOPROPYL ALCOHOL	10 ml
ACETONITRILE	8 ml
PETROLEUM ETHER	950 ml

Combine and mix ingredients. Do **not** use a magnetic stirrer.

15.9.6 Storage and Shelf Life

Keep all solutions in sealed, dark bottles. Shelf life is indefinite for stock solutions. The RAM working solution is stable for approximately thirty days. At thirty days, and any time the working solution is to be used thereafter, it must be checked for separation. If the solution has separated, shake the container vigorously, and the solution should return to suspension. If this does not occur, discard the solution.

All the ingredients for the RAM working solution, with the exception of the petroleum ether, may be mixed and stored. When it is time to mix the RAM working solution, the appropriate amount of petroleum ether can be added. Once the petroleum ether has been combined with the other ingredients, the thirty day shelf life begins.

15.9.7 Instrumentation

Alternate Light Source
High Intensity Ultra Violet Light Source
Laser

15.9.8 Standards and Controls

Fluorescent stains work by discoloring latent impressions developed with cyanoacrylate ester. The Standards and Controls for RAM consist of placing test impressions on a non-porous, non-evidentiary item and treating it with cyanoacrylate ester. Apply the RAM to the item and view with the proper ALS wavelength. If the print is visualized, the RAM is working properly. This testing must be performed for each working solution at the time of preparation and prior to use on evidence. Documentation of this testing will appear in the reagent prep log and in the case examination notes.

See Appendix I – Standards and Controls.

15.9.9 Procedure

After an item has been processed with cyanoacrylate, RAM can be applied by wash bottle, aerosol or pump, spraying, or dipping followed by examination under an ALS, laser or ultra-violet lamp.

15.9.10 Interpretation of Results

If the impressions are faint, repeated applications of the RAM solution may be attempted.

15.9.11 References

- Chesapeake Bay Division: https://www.cbdiai.org/ram.html
- Cummings, Harless, Mitch Hollars and Tim Trozzi. “Getting the Most from Cyanoacrylate Dyes,” Journal of Forensic Identification, 1993; 43 (1): 37-43.

- Lennard, Christopher J. and Pierre A. Margot. “Sequencing of Reagents for the Improved Visualization of Latent Fingerprints,” Journal of Forensic Identification, September/October 1988; 38(5):197-210.
- Menzel, E. Roland, Fingerprint Detection with Lasers. New York, NY: Marcel Dekker; 1980.
- Menzel, E. Roland, “A Guide to Laser Latent Fingerprint Development Procedures,” Identification News, September; 1983.
- Menzel, E. Roland, “Detection Of Latent Fingerprints By Laser-excited Luminescence,” Analytical Chemistry, 1989; 61 (8):557-561.
- Processing Guide to Developing Latent Prints, U.S. Department of Justice, pgs.19-20, 2000.

15.10 Rhodamine 6G

15.10.1 Introduction

Fluorescent dye staining was developed as a means of enhancing cyanoacrylate ester. The dye staining process can be used before and after the use of powders. Fluorescent dye stains are used to increase contrast of the superglue developed print and possibly make a weak print suitable for identification purposes through florescence examination. Caution must be used to avoid over processing with cyanoacrylate fumes. Excessive cyanoacrylate ester application may result in a loss of fine ridge detail resulting in excessive fluorescence. Often when a surface is textured, the application of fluorescent dye and use of photography can eliminate the background allowing only the fluorescent print to photograph.

Rhodamine 6G, like ardrox and zinc chloride, is a supplemental processing procedure designed to enhance faint or indistinct impressions developed by another technique. Rhodamine 6G is used after cyanoacrylate ester fuming. Rhodamine 6G has an affinity for adhesion to polymerized latent impressions even at levels below visual observation.

15.10.2 Reagent Applicability

Fluorescent technique
Nonporous surfaces
Post-cyanoacrylate

15.10.3 Safety Considerations

Isopropanol
Methanol
Rhodamine 6G
Synperonic N

This procedure involves hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. Consult the appropriate SDS for each chemical prior to use.

WARNING!
FLAMMABLE!
Isopropanol vapors can ignite readily at room temperatures.
Consider an **EXTREME HAZARD!**

Rhodamine 6G is classified as "an animal positive experimental carcinogen." Nancy Masters indicated, in her review of Rhodamine 6G that for latent print usage this chemical has not been considered a human carcinogen and, is in fact, used in cosmetics, soaps and perfumes. This chemical is toxic, however, and shall be handled using appropriate laboratory safety equipment. Since this chemical is soluble in water, absorption can occur through ingestion or inhalation. Inhalation levels have not been established but are to be avoided in any amounts.

15.10.4 Equipment

Scales, weigh boats, beakers, graduated cylinder, magnetic stirrer and stirring bar or other stirring device, and dark storage bottles.

15.10.5 Preparation

The scientist can choose from two preparations of Rhodamine 6G solutions. The preparation chosen is primarily dependent on the reaction of the substrate to the solvent used. A 0.01% to 0.001% rhodamine 6G in methanol or isopropanol, weight to volume, is productive for most surfaces with methanol being the preferred solvent. Working solutions of Rhodamine 6G should be prepared in small amounts. Weaker solutions are recommended from the viewpoint of health risk and degree of background fluorescence. Aerosol spraying or fuming with Rhodamine 6G has been attempted with no consistent improvement in results, and due to increased health risk, are not recommended. Aqueous Rhodamine 6G solutions will be used when methanol or other organic solvents will be destructive to the surface being treated.

<u>Methanol Formula</u>

Stock Solution

RHODAMINE 6G ---------- 1 g
METHANOL ---------- 1000 ml

Mix until dissolved.

Working Solution

Dilute with additional Methanol to preference. Add one (1) liter Methanol for a strong solution which must be rinsed. Add three (3) liters of methanol for a one-step no-rinse formula.

<u>Petroleum Ether Formula</u>

Stock Solution

RHODAMINE 6G ---------- 1 g
METHANOL ---------- 1000 ml

Working Solution:

RHODAMINE 6G STOCK SOLUTION	3 ml
ACETONE	15 ml
ACETONITRILE	10 ml
METHANOL	15 ml
ISOPROPANOL	32 ml
PETROLEUM ETHER	925 ml

Combine in the order listed

Aqueous Formula

RHODAMINE 6G	1g
DISTILLED WATER	1000 ml
SYNPERONIC N	3-6 drops

The Synperonic N is a surfactant which allows for more even covering of the item with the working solution.

15.10.6 Storage and Shelf Life

Solution is stored in sealed, dark glass or plastic bottles. Shelf life for the stock solutions and the aqueous formula is indefinite. Shelf life for the petroleum ether working solution is six (6) months.

15.10.7 Instrumentation

Alternate Light Source
High Intensity Ultra Violet Light Source
See Appendix III-General Instrumentation.

15.10.8 Standards and Controls

Fluorescent stains work by discoloring latent impressions developed with cyanoacrylate ester. The Standards and Controls for Rhodamine 6G consist of placing a test impressions on a non-porous, non-evidentiary item and treating it with cyanoacrylate ester. Apply the Rhodamine 6G to the item and view with the proper ALS wavelength. If the print is visualized, the Rhodamine 6G is working properly. This testing must be performed for each working solution at the time of preparation and prior to use on evidence. Documentation of this testing will appear in the reagent prep log and in the case examination notes.

See Appendix I – Standards and Controls.

15.10.9 Procedure

All applications should be completed in a fume hood.

1. Apply the solution to the item to be processed by immersion or squirt bottle.
2. Rinse the item with methanol and allow it to dry.
3. Examine the item with a laser or alternate light source at 495 nm to 540 nm.
4. Photograph any impressions observed using an orange or bandpass 550(BP35) barrier filter.

15.10.10 Interpretation of Results

If the impressions are faint repeated applications of the Rhodamine 6G solution may be attempted. If repeated applications of the dye solution fail to improve the fluorescence, the Rhodamine 6G concentration may be increased. Photographic preservation incorporating orange filters, as used in evidence examination, prove quite successful with even faint fluorescence.

15.10.11 References

- Chesapeake Bay Division: https://www.cbdiai.org/rhodamine-6g.html
- Cummings, Harless, Mitch Hollars and Tim Trozzi. “Getting the Most from Cyanoacrylate Dyes,” Journal of Forensic Identification, 1993; 43 (1): 37-43.
- Kent, Terry, ed. Fingerprint Development Techniques. Derbyshire, England: Heanor Gate Publisher; 1993.
- Lennard, Christopher J. and Pierre A. Margot. “Sequencing of Reagents for the Improved Visualization of Latent Fingerprints,” Journal of Forensic Identification, September/October 1988; 38(5):197-210.
- Mazzella, William D. and Christopher J. Lennard. “An Additional Study of Cyanoacrylate Stains,” Journal of Forensic Identification, 1995; 45(1): 5-18.
- Masters, Nancy E. “Rhodamine 6G: Taming the Beast,” Journal of Forensic Identification, September/October 1990; 40(5):265-270.
- Menzel, E. Roland. Fingerprint Detection with Lasers. New York, NY: Marcel Dekker; 1980.
- Menzel, E. Roland. “A Guide to Laser Latent Fingerprint Development Procedures,” Identification News, September; 1983.
- Menzel, E. Roland. “Detection Of Latent Fingerprints By Laser-excited Luminescence,” Analytical Chemistry, 1989; 61 (8): 557-561.
- Processing Guide for Developing Latent Prints, U.S. Department of Justice, pgs. 57-58, 2000.
- Technical Notes, Lightning Powder Co. Inc., Salem, OR, 2000.

15.11 Small Particle Reagent

15.11.1 Introduction

Small particle reagent (SPR) was devised and refined by the British Home Office as an effective procedure for processing wet surfaces. Surfaces, both porous and nonporous, which are wet at the time of latent print deposit or become wet after deposit, seldom retain sufficient water-soluble material for conventional processing methods. Nonporous items which have been allowed to dry offer some potential if the deposit contains non-water soluble oily matter, but the drying process lessens the possibility of adequate adhesion for powders or particulates.

Molybdenum disulfide is a lipid-sensitive reagent. Initial efforts to create a suspension of molybdenum disulfide in water used Photo-Flo as a means of reducing surface tension. These met with limited success. Introduction of Photo-Flo to the mixture requires a critical measurement as too much Photo-Flo prevents complete adhesion of the molybdenum disulfide particles to the lipids. Organic solvents can not be used because these solvents may remove the lipid material.

Refinements in the surfactant solution have not only improved the uniformity of suspension but have increased the application of SPR to other surfaces. SPR is very effective in the secondary treatment of cyanoacrylate ester developed impressions by adhering to faint impressions generally better than powders and particulates. Molybdenum disulfide is produced in various particle sizes with smaller particle size being more effective. Lightning Powder Company provides a product with the proper particle size.

15.11.2 Reagent Applicability

Nonporous surfaces
Post-cyanoacrylate
Wet surfaces

15.11.3 Safety Considerations

Molybdenum disulfide
Photo-Flo 200
Tergitol 7 (liquid form)

This procedure involves hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid

exposure to dangerous chemicals. Consult the appropriate SDS for each chemical prior to use.

15.11.4 Equipment

Scales, beakers, graduated cylinder, magnetic stirrer and stirring bar or other stirring device, storage bottle.

Preparation

Formula 1

TERGITOL 7	0.4 ml
MOLYBDENUM DISULFIDE	5 g
DISTILLED WATER	50 ml

Combine into a suspension. Reagent can also be purchased commercially prepared.

Formula 2

MOLYBDENUM DISULFIDE	30g
DISTILLED WATER	1000ml
PHOTO-FLO 200	2 DROPS

Reagent can also be purchased commercially prepared.

15.11.5 Storage and Shelf Life

Reagent must be stored in a sealed, dark glass or plastic bottles. Shelf life is indefinite.

15.11.6 Standards and Controls

Molybdenum disulfide works by adhering and causing discoloration to latent print residues. The Standards and Controls for Small Particle Reagent consist of placing test impressions on a non-porous, non-evidentiary item. Apply the Small Particle Reagent to the item and if the print is visualized, the Small Particle Reagent is working properly. This testing must be performed prior to use on evidence. Documentation of this testing will appear in the case examination notes.

See Appendix I – Standards and Controls

15.11.7 Procedure

15.11.7.1 Immersion Technique

1. Shake the working solution well and place in a shallow tray. Fill the tray until the item to be processed is covered.
2. Keep stationary for one (1) minute.
3. Rinse excess reagent in a gentle flow of tap water for approximately fifteen (15) seconds.

4. Allow item to air dry.
5. All impressions should be photographed and can subsequently be lifted.

15.11.7.2 Wash Bottle Application

1. Spray a flow of SPR over the surface of the item for approximately one (1) minute.
2. Wash the surface with a light to moderate flow of clear tap water.
3. Allow item to air dry.
4. All impressions should be photographed and can subsequently be lifted.
5. Larger items may be processed using a wash bottle to spray a flow of SPR over the surface. For outdoor application of very large items, such as a wet automobile, a garden sprayer can be used. Generally light to moderate flows of rinse water will not dislodge the molybdenum disulfide particles.

15.11.8 Interpretation of Results

SPR lifts easily from dried, processed, nonporous surfaces, but all developed impressions should be photographed prior to lifting. Faint impressions may benefit from a reprocessing of the item. The intense black color generally facilitates photographic preservation. When SPR is used as a secondary technique after cyanoacrylate ester fuming, the results are sometimes superior to powders in both adhesion and clarity of detail. Commercial kits are available, which can develop ridge detail in black, white, or ultraviolet.

15.11.9 References

- Chesapeake Bay Division: https://www.cbdiai.org/small-particle-reagent.html
- Onstwedder, John III and Thomas E. Gamboe, “Small Particle Reagent: Developing Latent Prints on Water-Soaked Firearms and Effect on Firearms Analysis,” Journal of Forensic Sciences, 1989; 34 (2): 321-327.
- Technical Notes, Lightning Powder Co. Inc., Salem, OR, 2000.

15.12 Sudan Black

15.12.1 Introduction

Sudan Black is used for developing friction ridge detail on smooth or rough, nonporous surfaces contaminated with greasy or sticky substances. It works best on glass, metal, or plastic materials. It can be used on waxy surfaces, such as candles or wax-paper milk cartons. Sudan Black is a dye which stains the fatty components of sebaceous secretions. Besides being sensitive to grease, oils, and sticky substances, it will also enhance cyanoacrylate ester-developed prints.

Success has been reported using this process on the inside of latex gloves. The gloves shall first be treated with cyanoacrylate ester fuming, heavier than normal. The gloves are then dipped in the Sudan Black solution for about ten seconds and then rinsed in water. Continue dipping for ten seconds and rinse until the prints appear. Often, prints will have better contrast after the surface dries.

Do not use this on porous or absorbent items as the entire item will be stained a dark color. This process may run inks, interfere with blood and body fluid examinations.

15.12.2 Reagent Applicability

Nonporous surfaces
Post-cyanoacrylate
Residue contaminated items
Water soaked items

15.12.3 Safety Considerations

Sudan Black B
Ethanol

This procedure involves hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the uses of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. Consult the appropriate SDS for each chemical prior to use.

WARNING!
FLAMMABLE!
Ethanol vapors can ignite at room temperature.
Consider a **SEVERE HAZARD!**

15.12.4 Equipment

Scales, weigh boats, beakers, graduated cylinder, and stirring bar or other stirring device, and glass storage bottles.

15.12.5 Preparation

SUDAN BLACK B---------- 15 g
ETHANOL (DENATURED) ---------- 1000 ml
DISTILLED WATER ---------- 500 ml

Combine the Sudan Black B and the denatured ethanol in a 2 liter glass beaker. Stir with a plastic stirring rod. Add the distilled water and stir with stirring rod. A black working solution will result. Some of the Sudan Black B will not dissolve and will remain as a particulate matter floating in the solution or will appear as sediment.

15.12.6 Storage and Shelf Life

Keep the solution in sealed, clean, glass bottle. The working solution has an indefinite shelf life.

15.12.7 Standards and Controls

Dye stains, such as sudan black, work by discoloring latent impressions composed of sebaceous secretions. The Standards and Controls for sudan black consist of placing test impressions on a non-porous, non-evidentiary item. Apply the sudan black to the item and if a dark, black-blue impression is observed, the sudan black is working properly. This testing must be performed for each working solution at the time of preparation and prior to use on evidence. Documentation of this testing will appear in the reagent prep log and in the case examination notes.

See Appendix I – Standards and Controls.

15.12.8 Procedure

1. Shake the container of Sudan Black before use.
2. Pour a sufficient amount of the solution into a tray large enough to contain the evidence.
3. Soak the item for 2 to 3 minutes.
4. Rinse the article in cool, running tap water.

Rinse with cool, running tap water. Allow the item to dry at room temperature. Applying heat is not recommended. Evaluate the prints only after they have completely dried. Faintly developed ridge detail can sometimes be enhanced by reprocessing.

15.12.9 Interpretation of Results

Friction ridge detail developed with Sudan Black must be photographed. While it is possible to lift the prints with tape, the tape frequently does not lift the print sufficiently. Therefore, it is strongly recommended that the prints be photographed prior to lifting.

15.12.10 References

- Chesapeake Bay Division: https://www.cbdiai.org/sudan-black.html
- Manual of Fingerprint Development Techniques 2nd ed., Home Office-Police Scientific Development Branch, White Crescent Press, Ltd., Luton, England, 2001.
- Processing Guide for Developing Latent Prints, U.S. Department of Justice, pg. 40, 2000.
- Stone, R.S. & Metzger, R.A., "Comparison of Development Techniques for Water Soaked Porous Items-Sudan Black Solution/Magna Powder," Identification News, Jan 1981, pp.13.
- Technical Notes, Lightning Powder Co. Inc., Salem., OR, 2001.

16 Procedure: Porous Surfaces

16.1 DFO

16.1.1 Introduction

DFO, or 1,8-diaza-9-fluorenone, is used to develop friction ridge detail on porous surfaces prior to processing with ninhydrin. DFO reacts to the amino acids present in perspiration. When this reaction takes place, the prints turn a pale purple color that is lighter than those developed by ninhydrin.

16.1.2 Reagent Applicability

Fluorescent technique
Porous surfaces
Raw wood surfaces

16.1.3 Safety Considerations

DFO (1, 8 Diazafluoren-9-one)
Methanol
Ethyl acetate
Glacial acetic acid
Petroleum ether

This procedure involves hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. Consult the appropriate SDS for each chemical prior to use.

WARNING!
EXTREMELY FLAMMABLE!
Petroleum Ether can vaporize quickly. Readily forms flammable mixtures in air. Consider an **EXTREME HAZARD!**

WARNING!
FLAMMABLE! Methanol, Ethyl Acetate vapors can ignite at room temperatures. Consider a **SEVERE HAZARD!**

16.1.4 Equipment

Scale, weigh boats, beakers, graduated cylinder, magnetic stirrer and stirring bar, dark plastic storage bottles, squirt bottle or spray device, and an oven or household iron.

16.1.5 Preparation

DFO is mixed in two solutions: stock and working. Care must be taken to not allow any water into the mixture, as it will destroy the fluorescent capability of the solution.

Stock Solution

DFO	1 g
METHANOL	200 ml
ETHYL ACETATE	200 ml
GLACIAL ACETIC ACID	40 ml

Combine and stir with a magnetic stirrer for approximately twenty (20) minutes or until all the ingredients are dissolved.

Working Solution

PETROLEUM ETHER	2000 ml

Dilute the stock solution with petroleum ether. This solution will be clear.

Alternate Stock Solution

DFO	0.25 g
METHANOL	40 ml
ACETIC ACID	20 ml
HFE-7100	940 ml

16.1.6 Storage and Shelf Life

Store both the stock and working solutions in sealed, dark plastic bottles. The solutions have a shelf life in excess of six (6) months.

16.1.7 Instrumentation

High Intensity Ultra Violet Light Source
Alternate Light Source (ALS)

16.1.8 Standards and Controls

DFO works by discoloring latent impressions that are composed of amino acid secretions. The Standards and Controls for DFO consist of placing test impressions on a porous, non-evidentiary item. Apply the DFO to the item, subject it to the proper level of heat/humidity and view with the proper ALS wavelength. If the impressions are visualized, the DFO is working properly. This testing must be performed for each working solution at the time of preparation and prior to use on evidence. Documentation of this testing will appear in the reagent prep log and in the case examination notes.

See Appendix I – Standards and Controls.

16.1.9 Procedure

All applications should be completed in a fume hood.

16.1.9.1 Dipping (the preferred method of application)

1. In a tray large enough to accommodate the evidence, pour enough working solution to cover all of the items.
2. Completely immerse each item to be processed in the working solution until the item is completely saturated, usually five seconds or less.
3. Remove and allow the item to air dry completely.
4. Process item a second time and allow to air dry completely.
5. A humidity/heat chamber or dry iron is used to accelerate the process. Use chamber according to manufacturer's instruction.
6. Check the item periodically to monitor the impression development. Care must be taken not to saturate the item with water vapor.
7. View under alternate light source at 495nm to 550 nm using red or orange barrier filters.
8. Photograph any developed impressions.

16.1.9.2 Alternate Methods of Application -- Brushing and Spraying

Larger items, which will not fit conveniently into processing trays, can be painted with the DFO solution using a soft bristle brush. Two inch to four inch nylon paint brushes are adequate. Care must be taken to apply an even and thorough amount to all surfaces. Avoid spraying methods, except for very small items involving brief exposure. The health and safety risks from the use of aerosols are unwarranted when other methods are available.

16.1.9.3 Accepted Deviations

A hair dryer or a DRY steam iron may be substituted for a baking oven, if necessary. Do not allow steam to contact the item. Strict control of the humidity is not required. Pentane (instead of Petroleum ether) can be used as the carrier solvent. View the item at 500 nm to 590 nm using red colored goggles to reduce background fluorescence, if necessary.

A post-DFO dip of 150 ml of ethanol and 850 ml of HFE 7100 can be used to remove discoloration caused by thermal papers. Dip the item in the solution for 30 seconds and let air dry. If the discoloration remains, repeat the method. This can be used prior to and after exposure to heat. It can also be used with Ninhydrin.

16.1.10 Interpretation of Results

While items processed with DFO are visible under white light, they are better visualized using an alternate light source. Photographic preservation is essential and should be

accomplished as soon as possible, as environmental humidity can decrease luminescence.

16.1.11 References

- Chesapeake Bay Division: https://www.cbdiai.org/dfo.html
- Didierjean, C., Debart, M-H, Crispino, F., "New Formulation of DFO in HFE-7100", Fingerprint Whorld, Vol. 24, No. 94, October 1998, pp.163-167.
- Hardwick, S.A., Kent, T., and V.G. Sears. Fingerprint Detection by Fluorescence Examination: A Guide to Operational Implementation. Hertfordshire, England: Home Office Police Scientific Development Branch; 1990.
- Lennard, Chris, and Pierre Margot. Fingerprint Detection Techniques. Lausanne, Switzerland: Institut de Police Scientifique et de Criminologie; 1994.
- Manual of Fingerprint Development Techniques 2nd. Ed., Home Office - Police Scientific Development Branch, White Crescent Press, Ltd., Luton, England, 2001.
- Processing Guide for Developing Latent Prints, U.S. Department of Justices, pgs. 24-25, 2000.
- Technical Notes, Lightning Powder Co. Inc., Salem, OR., 2001.

16.2 Ninhydrin

See PROCEDURE: BLOOD PROTEIN ENHANCEMENT

17 Procedure: Wet Surfaces

17.1 Small Particle Reagent

See PROCEDURE: NON-POROUS SURFACES

18 Procedure: Irregular Surfaces

18.1 Casting Materials

18.1.1 Introduction

Casting materials are used to lift latent impressions from curved, textured, or otherwise difficult surfaces where conventional tape would be unsuccessful. Casting materials give excellent rendering of small details, high contrast for examination, good releasing ability, and short setting times. These materials come in black, brown, transparent and white. Two commercially prepared casting materials are Mikrosil™ and AccuTrans®.

18.1.2 Reagent Applicability

Nonporous surfaces
Postmortem printing
Pre/Post cyanoacrylate

18.1.3 Safety Considerations

AccuTrans®
Mikrosil™

This procedure involves hazardous materials. This procedure does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use. Proper caution shall be exercised and the use of personal protective equipment shall be considered to avoid exposure to dangerous chemicals. Consult the appropriate SDS for each chemical prior to use.

18.1.4 Equipment

Mixing area, tongue depressor, and/or applicator gun with mixing tips.

18.1.5 Storage and Shelf Life

According to manufacturer's instructions.

18.1.6 Standards and Controls

See Appendix I—Standards and Controls.

18.1.7 Procedure or Analysis

Procedure differs by brand of casting material being used. Refer to manufacturer's instructions for use.

18.1.8 Interpretation of Results

Casting materials are used to lift powdered latent lifts or inked known prints from surfaces on which conventional tape is difficult to use.

18.1.9 References

- Morris, M. “Casting a Wide Net: Lifting Fingerprints from Difficult Surfaces.” Forensic Magazine August/September 2005.
- Technical Notes, Lightning Powder Co. Inc., Salem, OR., 2001.

19 Recording of Post Mortem Friction Ridge Skin

19.1 Introduction

Deceased persons are identified by various methods ranging from visual examination to dental or bone radiographs. Fingerprint identification of deceased individuals is used when accidental or deliberate damage to facial features occurs, decomposition affects appearance, mass disasters prohibit individual identity, criminal death is involved, or a visual identification is questionable. Generally, post-mortem fingerprint recording is done by investigators and the latent print may be involved only in the comparison of the post-mortem prints to previously recorded standards or latent impressions developed from personal articles associated to the suspected deceased.

Actual recording of inked prints at a morgue may be rare but each should be familiar with the procedure. More likely, requests for post-mortem recording will occur when efforts to obtain usable fingerprints have failed due to extensive damage or advanced decomposition. Rather than a scene procedure, the best results are generally achieved in the laboratory examining the hands severed from the deceased. Various methods have been designed to obtain satisfactory recorded impressions, and no one method is applicable to the possible conditions encountered. Method of death, environmental conditions, and degree of decomposition can alter the effectiveness of techniques. Those described in this section shall deal with the premise of submitted severed hands, although adaptation to a morgue visitation is easily accomplished. Individuals with a suspected identity and for which inked standards are available require only a recording of sufficient friction ridge skin area to confirm identification. Those whose identity is completely unknown, those with no fingerprints on file and those eliminated from suspected identity require a full, ten finger recording for classification and/or AFIS searching.

19.2 Safety Considerations

General laboratory safety precautions are required for this procedure. As in any situation when dealing with potential biohazard materials the scientist should follow all prescribed protocols in the Bloodborne Pathogen Plan and in the Chemical Hygiene Plan. No hazardous materials are used in this procedure.

19.3 Equipment

Black printers ink (in tube), rubber ink roller, spoon, fingerprint cards, glycerin or tissue builder, latex gloves, syringes, and silicone rubber casting material.

19.4 Standards and Controls

The standards and controls for the recording of post-mortem standards requires the inspection of each area recorded to determine if the detail present is a clear and accurate depiction of the area that is being recorded.

See Appendix I – Standards and Controls.

19.5 Procedure

19.5.1 Inked Fingerprint Recording

Fingerprint ink is applied to the finger using a direct roller application or using a detached glass plate previously coated with ink. If the glass plate is utilized, it is moved around the finger to insure even application. The recording is made by using a specially designed spatula or spoon with finger block strips or a standard fingerprint card specifically folded for post-mortem printing. The spatula device, available from most fingerprint supply firms, is a curved instrument with slot-type guides to hold a strip of white card stock in place. Once the finger is inked, the spatula is pressed up against the finger. Usually the concave surface of the spoon affords ample contact between the strip and the digit to record the area of a normal rolled print with minimum movement. An alternative method uses a folded fingerprint card that is rolled around the deceased's inked finger. The recorder uses his or her hand to support and guide the card from the back. Either method requires care and patience to produce a full legible impression from each digit. Numerous attempts may be required before a full set of acceptable prints is obtained.

19.5.2 Latent Print Processing

Standard black latent print processing powder may be used to obtain remarkably clear and legible post-mortem impressions. One method requires the application of a very light coating of glycerin to the fingers and the rolling of a folded fingerprint card around the treated digit. The card is then processed with standard black powder to develop the impression. Lifting tape is then applied to the developed impression to prevent damage. An easier method is the direct application of standard black powder to the finger. A piece of lifting material is then pressed against the powdered finger and a lift is made. Opaque lifting material reveals an impression in true position. Transparent materials produce a true position impression on the adhesive side and must be covered with another piece of transparent tape, adhesive to adhesive, for protection.

19.5.3 Silicone Rubber Casting

Silicone rubber casting material may be used to produce extremely accurate recordings of friction ridge skin areas. However, casts yield reproductions that are inverted to the skin formations, that is, the furrows appear as raised areas and the ridges as depressions. Thin casts can be flattened between glass slides and photographed using backlighting. If the casts are too thick to permit proper light transmission, the casts may

be used as molds for a second generation cast. A light spray of window cleaner, such as Windex, is applied to the cast and additional silicone rubber material poured into these molds. The resulting positive cast may be photographed using oblique lighting or inked or powdered and lifted.

19.5.4 Epidermal De-Gloving

Certain stages of decomposition will cause a separation of the epidermis and dermis to an extent that the epidermis can be slipped off intact from the underlying tissue. An incision around the middle joint area may ease the removal of the skin to produce a section similar to a portion of a glove. This skin can be placed over the de-gloved finger and inked and printed as if it were his or her own.

19.5.5 Dermal Photography

Advanced stages of decomposition which has destroyed the epidermis or destruction to the epidermis from heat or chemicals may require recording the dermal structure. Efforts to record inked impressions of the dermis are very difficult and produce a double row, broken outline of the papillae that support each ridge that appears in the epidermis. Photographic recording generally gives better results, especially with oblique lighting.

If photography of the dermis attached to the digit is unsuccessful, the dermis may be removed with careful incisions, gently scraped on the underneath side to clear away as much attached flesh as possible, placed between glass slides and photographed with transmitted lighting.

19.5.6 Special Skin Conditions

Water soaked skin often wrinkles to the extent that any of the above methods will fail to produce adequate recording of the friction ridge skin areas needed for classification. Lesser amounts of wrinkling may be corrected merely by pulling the skin tight over the pattern areas while recording the finger. If this is unsatisfactory, the finger may be inflated using fluid provided the skin appears unlikely to rupture or tear. Hot water, glycerin, air, or a commercially available tissue builder may be used, although hot water is more difficult to use properly. A hypodermic syringe is used to inject the fluid or air by inserting the needle tip below the skin into an area in the proximal joint. The fluid or air is slowly injected until the finger bulb inflates sufficiently to eliminate most wrinkles. Hot water tends to seep out quickly once the needle is removed although a string tightly secured above the injection point may retard or reduce the seepage. Tissue builder tends to thicken once injected. Badly wrinkled fingers may require multiple injections before the area can be adequately recorded, but too much fluid can produce a rupture, especially if decomposition has begun.

Dehydrated or mummified fingers often result in skin too hard and inflexible for complete recording. Restoration of near normal pliancy can be accomplished by soaking

the skin in a 3% potassium hydroxide in warm water solution. The skin is checked periodically until soft enough for recording purposes, then rinsed in distilled water and dried. Another less destructive technique is to use a dishwashing liquid or fabric softener to re-hydrate and soften the skin. The hands or fingers are soaked in the dish washing liquid until they become pliable. A high lanolin content hand lotion worked into the skin and removed immediately before recording also may be beneficial. The less destructive Palmolive technique should be attempted prior to the potassium hydroxide procedure.

19.6 Interpretation of Results

The wide possibility of conditions affecting post-mortem recording precludes predictable results of any method, but with care and patience, adequate friction ridge detail is usually obtainable. Laboratory examination with access to materials and equipment, including proper photography, generally produces satisfactory results when attempts at the morgue are not successful.

19.7 References

- Federal Bureau of Investigation. "The Science of Fingerprints," Washington, D.C.: U.S. Government Printing Office; 1984.
- Olson, Robert. Scott's Fingerprint Mechanics. Springfield, IL: Charles C. Thomas Publisher; 1978.

Appendix I: Standards and Controls

Chemical Processes

Standards

- Reagents will be prepared according to the guidelines established in the Latent Prints Method Manual. The forensic scientist preparing the reagent will make an entry into the reagent preparation log according to the standards set forth in the Quality Manual. Standardized preparation logs are stored in PowerDMS.
- Minimum standards and controls for specific chemical preparations are in the Latent Prints Method Manual with each formula.

Controls

- Exact chemical concentrations are critical to analyses in some forensic sciences, however, in latent print examinations, the chemicals used merely visualize ridge detail for comparison purposes. They do not alter the types of ridge characteristics present or change their relative positions. A slightly weaker or stronger solution than usually employed may differ slightly from the norm in ridge contrast produced, but as long as ridge detail is discernible, an identification may be effected.
- Test impressions are prepared on non-porous and porous surfaces. Amino acid and sebaceous oil reference pads are provided to create test impressions. However, it is acceptable to touch the forehead or skin to produce a test impression.
- Upon reagent preparation, stock and working solutions will be tested against a surface bearing a known impression. Amino acid and sebaceous oil reference pad are provided to create test impressions. Documentation of this testing and the results of the test will appear in the reagent prep log.
- Upon reagent use, working solutions will be tested against a surface bearing a known impression. This type of testing will occur for each reagent used only once during the defined work day for each scientist. Documentation of this testing will appear in the case examination notes. An expired reagent may be used if it passes the acceptable criteria during performance check prior to use in casework.

Appendix II: General Instrumentation

Latent print examination equipment utilizes a large array of items which include those specifically designed for residue detection and those modified or adapted for the specialized needs of evidence processing. There are many chemical formulas and ways to perform the same process successfully. Available powders, applicators, and lifting medium vary little between sources. Manufacturers of films and chemicals adhere to such competitive quality standards that individual preference has no real influence on the results of the followed procedures. Choosing an individual product over another will not significantly affect the quality of the work performed.

Materials such as powders, applicators, and lifting devices are far more varied and include items which have no practical value for evidence processing. Equipment and supplies within the scope of the latent print discipline are the tools of procedures. Such tools are dependent on the skill and purpose of the scientist using them. Individual preference which has selected an inferior tool used skillfully may have yielded results assessed as satisfactory; better tools applied with equal skill will add to the harvest of productivity.

Appendix III: Notes Abbreviations- Packaging and Processing

Packaging	Processing	
Brn = Brown Bx = Box Cello = Cellophane cdbd= cardboard Ck, cks = Checks Cl = Clear Cont = Containing Contr = Container Env = Envelope Evid= evidence HS = Heat Sealed Kn = Knotted Man = Manila Mkd =Marked O = Opened Pap = Paper PB = Paper Bag Pkg = Package Pkt = Packet Pl = Plastic Rec'd = Received S, Sld = Sealed Sub = Submitted Un-sld = Unsealed Wht = White	AB = Amido Black AT =Accutrans ADAMS = Authenticated Digital Asset Management System Adh= Adhesive A, AE, AFQ, AQ = AFIS entry/quality ALS = alternate light source Ar, Ard = Ardrox P133D AY = Acid Yellow Blk = black BP = black powder BMP= black magnetic powder BPLL = black powder latent lift BY = Basic Yellow BWW = black Wet-Wop CA, SG = Cyanoacrylate ester fuming DI = digital image(s) DC = digital camera *DCS5 = Digital Capture System* FL = fluorescent FLGV = Fluorescent Gentian Violet FLP = fluorescent powder FLPLL = fluorescent powder latent lift GV = Gentian Violet I = Iodine LCV = Leucocrystal violet LD = Liqui-Drox LN = Liqui-Nox Mag = magnetic Mik = mikrosil MH = More Hits MP = magnetic powder MPLL = magnetic powder latent lift NIN = ninhydrin NIN-M= ninhydrin methanol NIN-PE = ninhydrin petroleum ether NGI= Next Generation Identification P, Proc = process PD = Physical Developer Pow = powder R6G = Rhodamine 6-G	Redwop = fluorescent red powder SB = Sudan Black Sil = silver SL = silicone lift SP = silver powder SPLL = silver powder latent lift SPR = Small Particle Reagent SSP = Sticky Side powder TPW= Thermal Paper Wash Unk= Unknown V = visual WL = white light WP = white powder WMP= white magnetic powder WPLL = white powder latent lift WW = Wet-Wop WWW = white Wet-Wop ZP= Zar-Pro

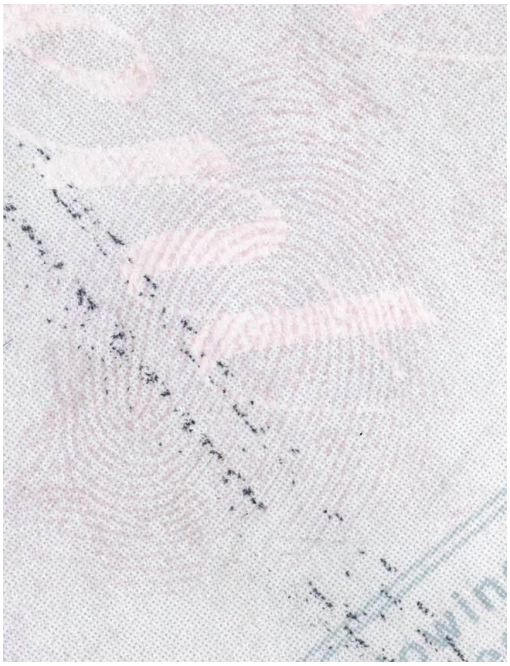
Appendix IV: Notes Abbreviations- Examination

Examination	
Avail = Available	PD= pressure distortion
AD= apparent duplicate	PILP = partial inked latent print
BD= Borderline	PIFP = partial inked fingerprint
C=core	PIPP = partial inked palm print
Chem = Chemistry Section	PLP = partial latent print
Comp = comparison	PLFP = partial latent fingerprint
Concl= conclusion	PLPP = partial latent palm print
Cont'd = continued	PCOP = possible collecting officers prints
CD= continuity disruption	pp = palm print(s)
△=delta	PPC = palm print card
Dept = department	PQ = poor quality
DG = drag	Purp = purposes
DNA = DNA Section	QD = Questioned Documents section
DO = date opened	R = results
DR=diffused ridges	RC= ridge count
DS = date sealed	Ret'd = returned
DT= double tap	Rev = revealed
Ea = each	RD = ridge detail
Elim = elimination	RI = Right Index finger
Ext= Exterior	RL = Right Little finger
Exam'd= examined	RM = Right Middle finger
Exemp= exemplar	RP, R.Palm = Right Palm
FA = Firearms Section	RR = Right Ring finger
FB = Forensic Biology Section	RS= Right slant
fp = fingerprint(s)	RT = Right Thumb
FPC = fingerprint card	Suf, Suff, SRD = sufficient ridge detail
FR = friction ridge	S=searched
FRAG= fragmented ridges	SS= slippage
FRD = friction ridge detail	SR=superimposed ridges
∅ = identification	SD= substrate distortion
ICP= Incomplete	SDS= Support for Different Source
Int= Interior	SSS= Support for Same Source
IM= impression	ST= second touch
INC= inconclusive	SWP= swipe
Insuf, Insuff, ins = insufficient	SMR= smear
L1= level one	T= tip
L2= level two	TR=tonal reversal
L3= level three	TW= twisting
LI = Left Index finger	ULDB = Unsolved Latent Print Database
LJ= Lower Joint	VI = Verifier's initials
LL = Left Little finger	VC=voids/creases
LM = Left Middle finger	W/ = with
LP, L.Palm = Left Palm	W/O = without
lp = latent print(s)	X/exc,= Exclusion
LR = Left Ring finger	
LS= Left slant	
LT = Left Thumb	
MD= matrix distortion	
MR= misaligned ridges	
NC= not compared	
Neg = negative	
NE= Not examined	
NM = no match	
NV = no value	
NS= not searched	
OR=obscured region	
Pc = piece	
PCT= poor contrast	

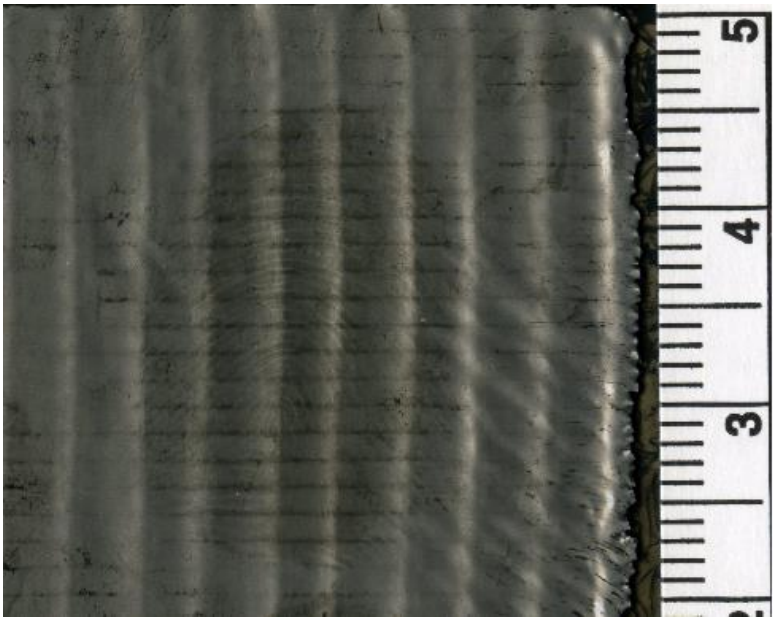
Appendix V: Examples of distortion

Substrate distortion (SD) – distortion due to the surface

Example: distortion due to substrate background noise (ninhydrin print on patterned check)

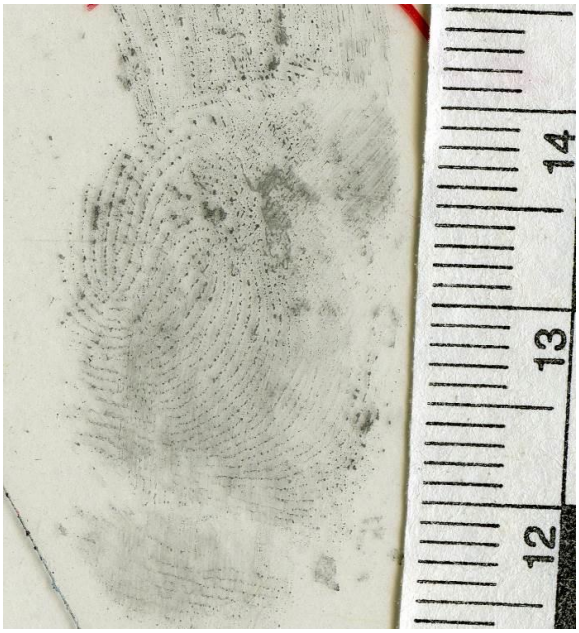


Example: distortion due to textured substrate (powdered print on ridged duct tape surface)



Matrix distortion (MD) – distortion due to the residue

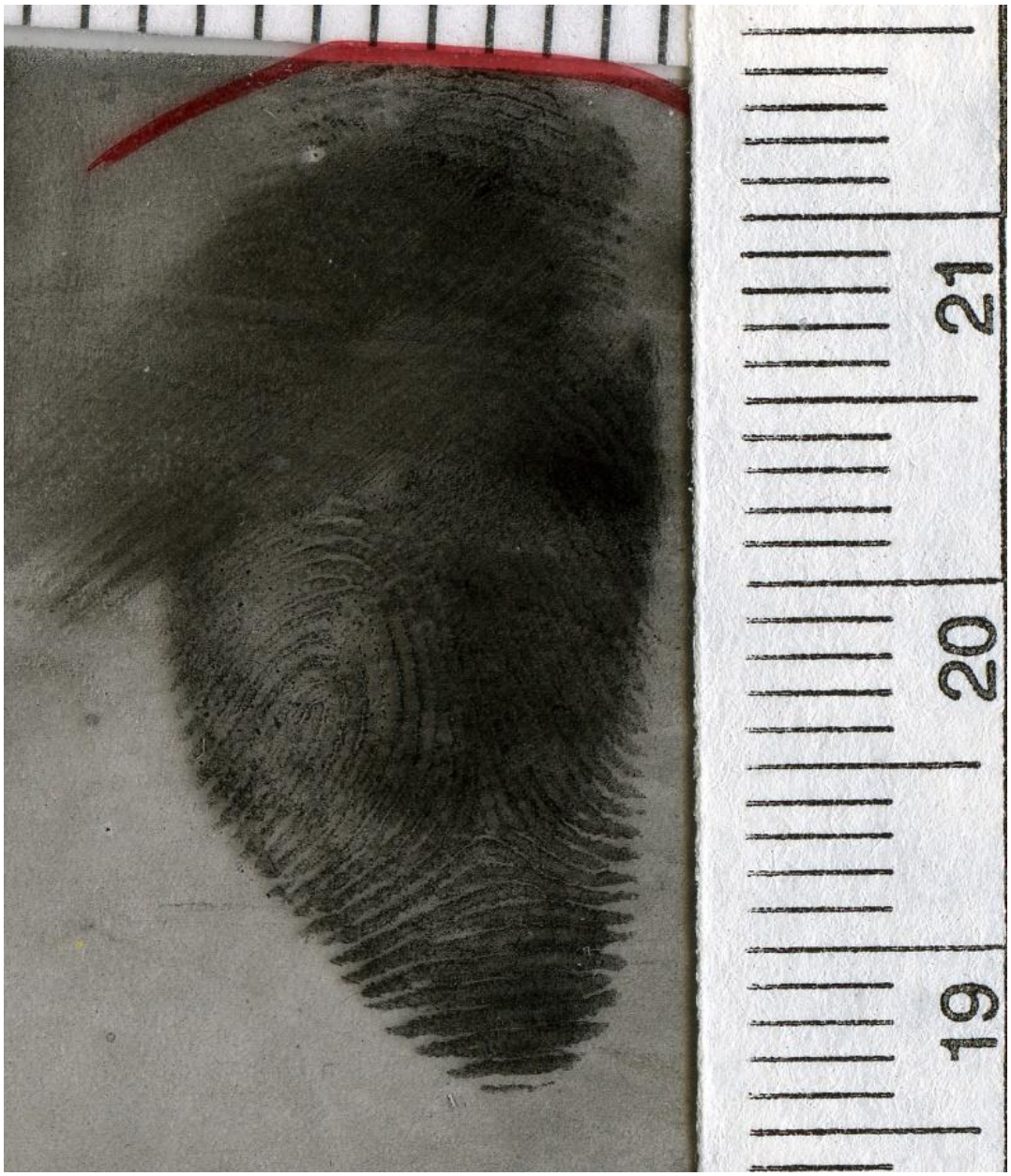
Example: Distortion due to spotty ridges from wet matrix (black powdered print)



Example: distortion due to pooling of extra matrix (white powdered print)

Pressure distortion (PD) – distortion due to deposition pressure

Example: Distortion of ridges due to heavy pressure (black powdered print)



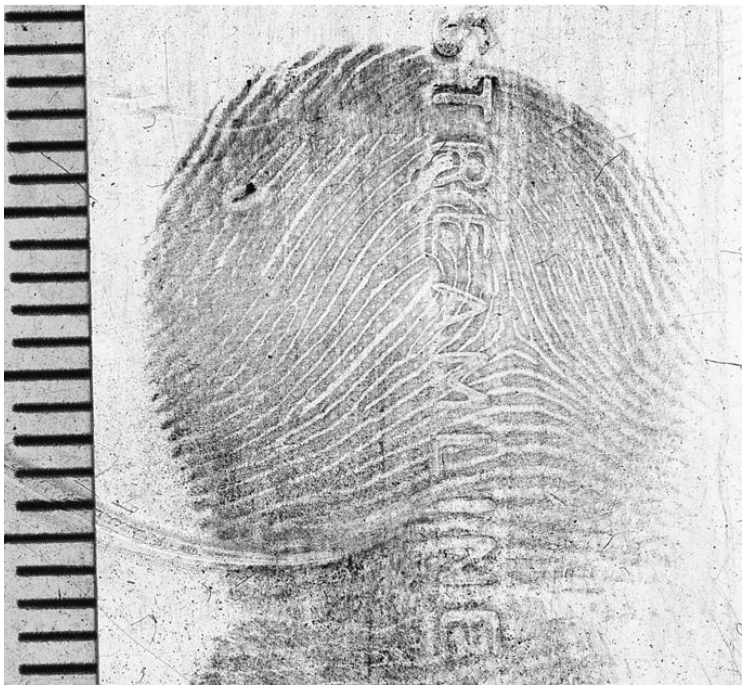
Tonal Reversal (TR) – change in appearance of color of the ridges

Example: transition from dark to light ridges due to heavy pressure distortion (black powdered print)

Continuity disruption (CD) – disconnected ridges (not caused by anatomical gap)

Example – distortion from areas of ridges disconnected by voids (black powdered AccuTrans lift)

Example: distortion from areas of ridges disconnected by voids from writing on substrate (black powdered print)

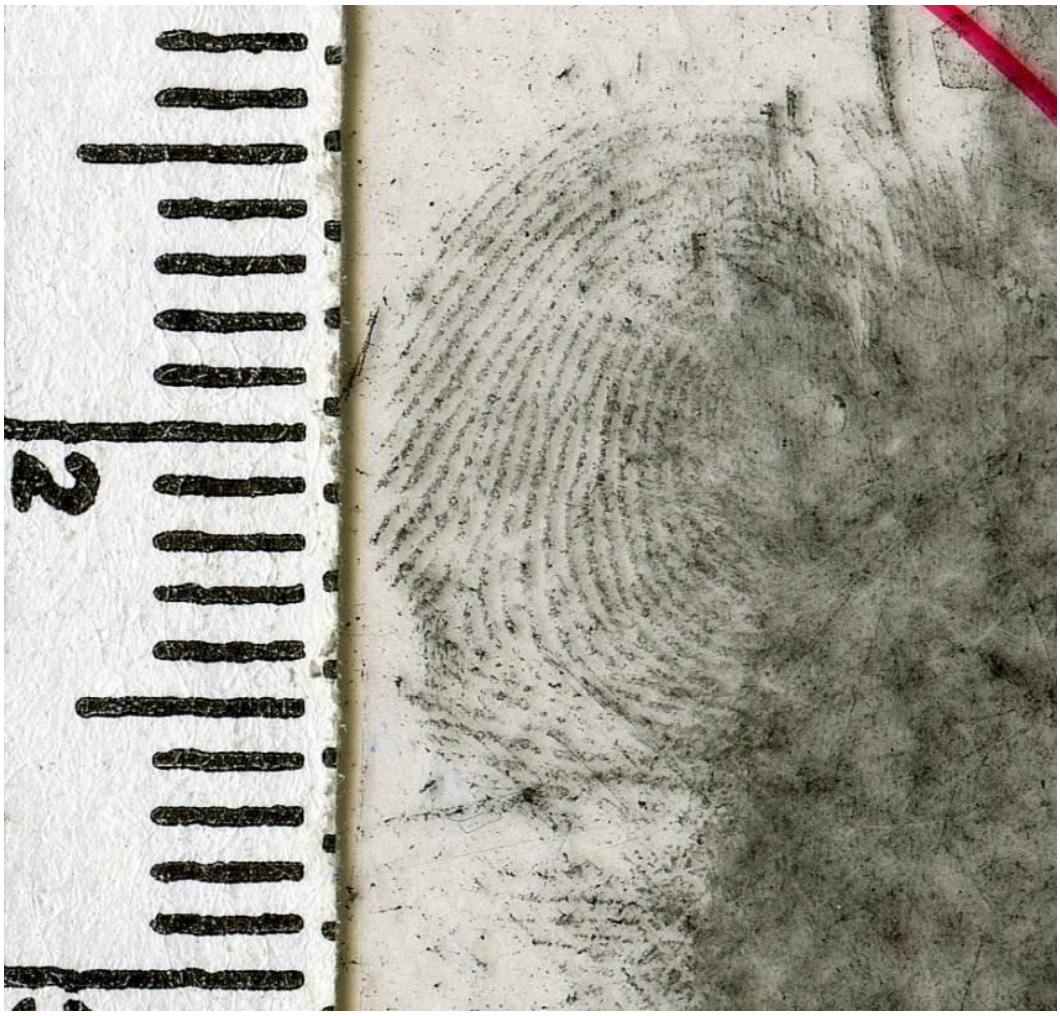


Diffused ridges (DR) – lightening/thinning of ridges (usually caused by limited residue)

Example: Distortion from ridges thinning/lightening (black powdered print)

Obscured region (OR) – unusable area

Example: Ridge detail on right side unusable/obscured (black powdered print)



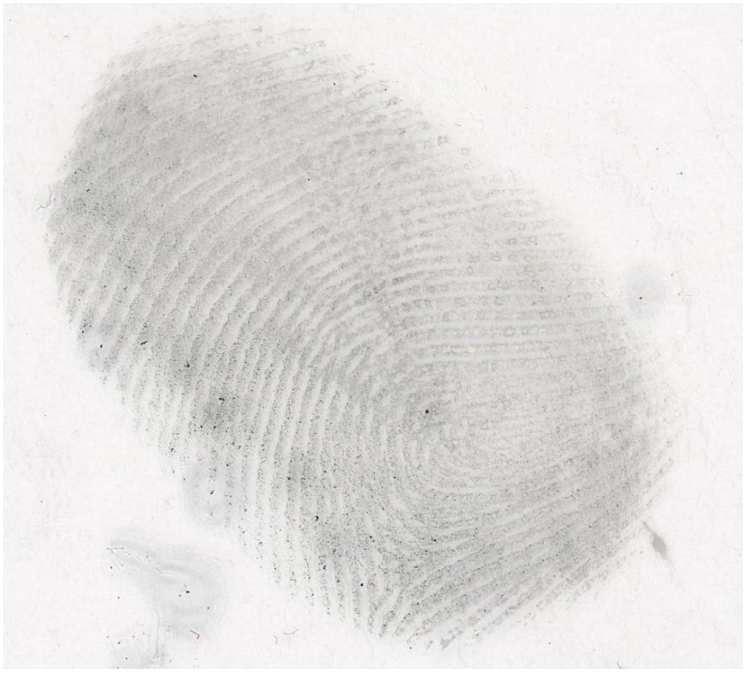
Slippage (SS) – distortion due to movement

Example: distortion from movement causing ridge detail to smear (black powdered print)

Misaligned ridges (MR) – area of ridge flow where ridges don't naturally align

Example: Distortion due to area of ridges misaligned (inked impression on check)

Example: Distortion due to unnatural ridge flow/angular formations (black powdered print)

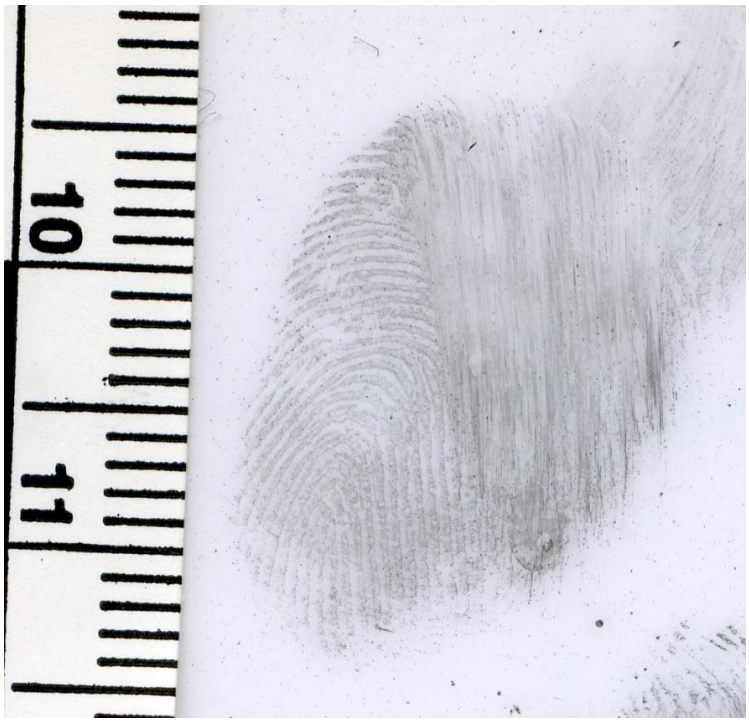


Drag (DG) – movement during contact

Example: Distortion from movement sliding upward during contact causing drag (black powdered print)

Swipe/Smear (SWP/SMR) – movement after contact

Example: Distortion from smearing of ridge detail after contact (black powdered print)



Example: Distortion from smearing of residue after contact (powdered print)

Twisting (TW) – unnatural ridge flow due to torque

Example: Distortion of ridge flow due to twisting movement (black powdered print)

Superimposed ridges (SR) – ridges from two impressions overlapping

Example: Distortion from multiple areas of overlapping ridge detail from separate impressions (black powdered print)

Double tap (DT) – subtle double impression due to partial lift off between touches/repositioning of the skin on the surface without completely leaving the surface

Example: Distortion due misaligned ridges and movement due to double tap of impression (black powdered print)

Second touch (ST) – overlapping impressions of the same ridge detail with complete lift off from surface

Example: distortion from second touch of same ridge detail overlapping original touch (black powdered print)

Voids/Creases (VC) – creases observed and areas of an impression that are void of ridges

Example: distortion due to voids present from creases/white lines present in finger (natural/anatomic voids/creases) (black powdered print)

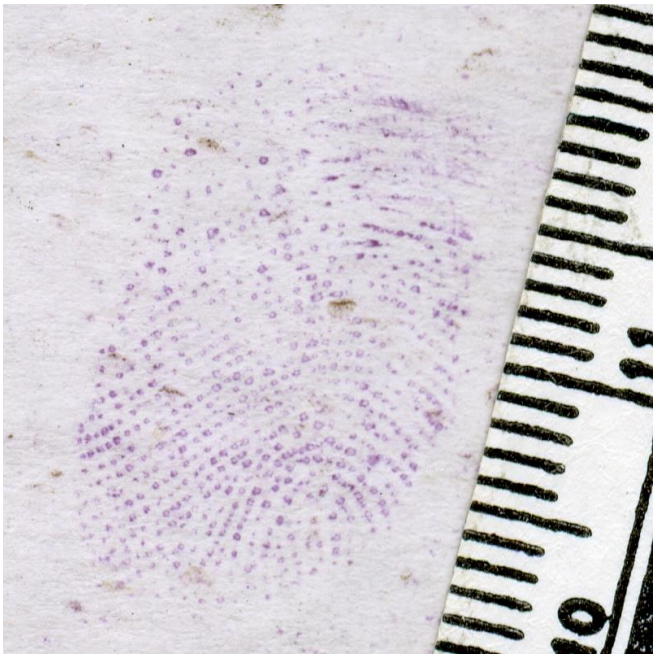
Example: distortion due to Voids present due to substrate (black powdered print)

Poor contrast (PCT) – difficulty distinguishing ridges from background

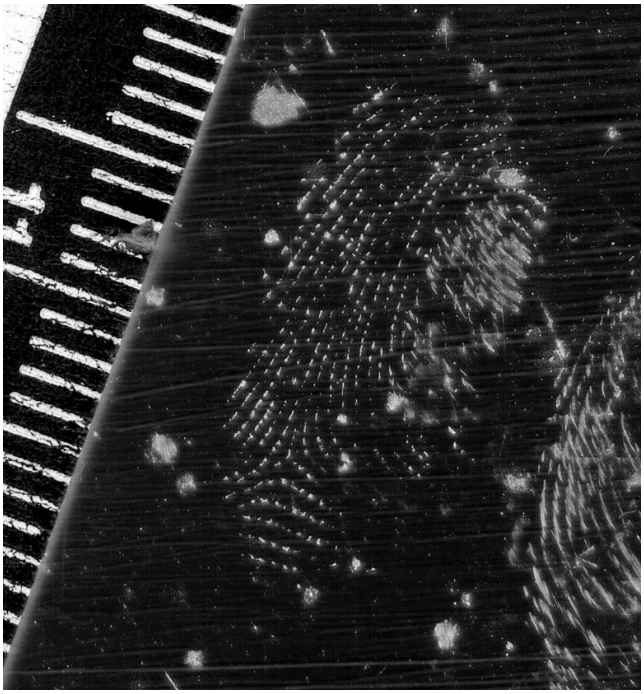
Example: distortion from low contrast between ridges and background due to color (pink metallic powdered print)

Fragmented ridges (FRAG) – spotted/broken ridges

Example: distortion from spotty ridges due to ninhydrin development method (ninhydrin developed print on paper)



Example: Distortion from fragmented ridges due to residue (powdered print)



Appendix VI: Report Examples

Ten Print to Ten Print

To:	Ohio Police Department Det. Gene Snow 1000 W 3rd St City, OH 44094	BCI Laboratory Number: Analysis Date: April 27, 2022	YY-XXXXX Issue Date: April 27, 2022
		Agency Case Number:	YY-XXXXX

Offense: Burglary
Subject(s): Charles P. Brock
Victim(s): Denise Speck

Submitted on April 27, 2022 by Det. Gene Snow:

2. One manila envelope containing exemplars from Charles Brock
   -Fingerprint card of Charles P. Brock, DOB 7/06/74

Findings:

The exemplar from item #2 was compared with the BCI Records Section exemplar bearing the name of Charles Phillip Brock, BCI #B900000. The exemplars were found to have originated from the same individual.

Remarks

The evidence is being returned to your department for retention.

Analytical Detail

Item #2 was visually examined.

Signature
examiner
Forensic Scientist
telephone
examiner@OhioAGO.gov

Ten Print Searched in AFIS

To:	Ohio Police Department Det. Bob Jones 1234 Main Street City, OH 41234	BCI Laboratory Number: Analysis Date: January 9, 2023 Agency Case Number:	YY-XXXXX Issue Date: January 9, 2023 YY-XXXXX

Offense: Possession
Subject(s): John Doe
Victim(s): State of Ohio

Submitted on January 7, 2023 by Off. Smith:

1. One manila envelope containing exemplars from John Doe
   -Exemplars bearing the name of John Robert Doe

Findings:

Ohio Automated Fingerprint Identification System (AFIS) and Next Generation Identification (NGI) system searches were performed for the above fingerprint card of John Robert Doe. John Smith was identified as a result of database searches and the exemplars were found to have originated from the same individual.

Remarks

Exemplars bearing the name of John Smith, FBI# 123456AB7, were obtained from the FBI and used for the comparison(s) detailed above.

The evidence is being returned to your department for retention.

Analytical Detail

The comparison was completed using visual examination techniques.

Signature
[examiner]
Forensic Scientist
[telephone]

[examiner]@OhioAGO.gov

Rework by New Examiner

To:	Ohio Sheriff's Office	BCI Laboratory Number:	YY-XXXXX
	Lt. Mitch Miller PO Box 555 City, OH 43764	Analysis Date: September 21, 2020	Issue Date: October 28, 2020
		Agency Case Number:	YY-XX-XXXX
		BCI Agent:	Jon Jones

Offense: Cultivation
Subject(s): Carlos May
Victim(s): Dells Mining Company

Resubmitted on September 02, 2020 by E.T. Deanna Wreck:

15. Envelope containing one acetate sheet with seven lifts, lifted by S/A Jones
  15.1. Digital images from latent lifts
16. Envelope containing two acetate sheets with two lifts, lifted by SA Bob
  16.1. Digital images from latent lifts
17. Envelope containing four acetate sheets with fingerprint lifts, lifted by SA Hank
  17.1. Digital images from latent lifts
50. Envelope containing prints taken from Carlos May

Findings:

Latent print comparisons revealed the following:

(11) Source Identifications: Carlos May

Item #	Description	Findings	Comparison Conclusions
15	Latent lift labeled 'Colgate Total tooth paste tube'	(1) Fingerprint (15-1a)	Source Identification: Carlos May
		(1) Impression (15-1b)**	--
	(3) Latent lifts	Insufficient	--
16	(2) Latent lifts labeled	(4) Fingerprints (16-6a,b,c,d)	(4) Source Identifications: Carlos May

Item #	Description	Findings	Comparison Conclusions
	'Table 1'	(5) Fingerprints (16-9a,b***,c,d,e)	(5) Source Identifications: Carlos May
	(6) Latent lifts	Insufficient	--
17	Latent lift labeled 'Can of El Pato Tomalo [sic] sauce from item #11'	(1) Latent Print (17-12a)	Incomplete: Carlos May*
	(16) Latent lifts	Insufficient	--
	(2) Latent lifts	Insufficient**	--

*New exemplars with fully rolled fingers and palms, including lower joints and extreme fingertips are needed.

** Based on current interpretation guidelines, these lifts/impressions were deemed insufficient

***Based on current interpretation guidelines, this impression was found to be sufficient

Remarks

A search of our Records Section for Carlos May, DOB 05/10/88 did not reveal any additional finger and/or palm print cards. Please submit major case print cards in order to complete this comparison.

The evidence is being returned to your department for retention. Digital images were retained at BCI and are available for future comparisons.

Impression(s) remain unidentified. If future comparisons become necessary, please submit subject and elimination major case print cards. Eliminations include victim(s), family members of victim(s), police officer(s), and other individuals who may have had contact with the submitted evidence.

Analytical Detail

All non-exemplar items listed above were visually examined for the presence of latent prints.

All impressions suitable for comparison were compared to sufficient exemplars listed above.

The remaining unidentified impression was not suitable for either an Ohio Automated Fingerprint Identification System (AFIS) or a Next Generation Identification (NGI) search.

This report replaces the original reports issued by Renee Lewis (Davis) dated September 30, 2008, January 08, 2010, January 27, 2011, and October 29, 2013, as they pertain to items 15, 16, and 17, in their entirety. ❶

Signature

examiner
Forensic Scientist
telephone
examiner@OhioAGO.gov

❶ This rework was of select items in this case over multiple reports/submissions. Earlier reports had other items processed. The name of the original examiner was also different at the time

Preliminary Exam

Ohio Police Department
Det. John Jones
123 Main Street
City, OH 43016

BCI Laboratory Number: YY-XXXXX

Analysis Date: January 05, 2023

Issue Date: January 12, 2023

Agency Case Number: YY-XX-XXX

Offense: Burglary
Subject(s): James Ray
Victim(s): Michael Smith

Submitted on December 01, 2022 by Det. John Jones:

1. Manila envelope containing latent lifts
   1.1. Digital images from latent lifts

Findings:

Latent print comparisons revealed the following:

(1) Source Identification: James Ray

Item #	Description	Findings	Comparison Conclusions
1	Latent lift labeled 'South window interior'	(1) Fingerprint	Source Identification: James Ray
		(2) Fingerprints	Not Compared ❶
	(9) Latent lifts	Preliminary Exam* ❷	--

*Additional ridge detail not analyzed at this time

Remarks

Exemplars bearing the name of James Ray, BCI# C555555, were obtained from the BCI Records Section and used for the comparison(s) detailed above.

The evidence is being returned to your department for retention. Digital images were retained at BCI and are available for future comparisons.

❶Impression(s) remain unidentified. If future comparisons become necessary, please submit a request.

--or--

❷Additional impression(s) remain available for analysis. If future examination becomes necessary, please submit a request.

Analytical Detail

All non-exemplar items listed above were visually examined for the presence of latent prints.

One (1) impression suitable for comparison was compared to sufficient exemplars listed above.

Signature
examiner
Forensic Scientist
telephone #
examiner@OhioAGO.gov

❶ For those prints where an analysis was conducted, report out what was found as "not compared". In the remarks section, note that other impressions remain.
❷ If no analysis or other sufficiency determination was done, report out findings as a "preliminary exam," adding a footnote at shown below the table. In the remarks section, clarify that additional analysis may be conducted

Appendix VII: Comparison Conclusion Scale

The following lists the conclusions a Forensic Scientist may reach when performing comparisons. In reaching a conclusion, a Forensic Scientist considers the similarities and dissimilarities and assesses the relative support of the observations under the following two propositions: the evidence originated from the same source or from a different source.

A Forensic Scientist may utilize their knowledge, training, and experience to evaluate how much support the observed similarities or dissimilarities provide for one conclusion over another. A conclusion shall not be communicated with absolute certainty. It is an interpretation of observations made by the Forensic Scientists and shall be expressed as an expert opinion.

1	Source identification	The observations provide extremely strong support for the proposition that the evidence originated from the same source and the likelihood for the proposition that the evidence arose from a different source is so remote as to be considered a practical impossibility.
2	Support for Same Source	The observations provide more support for the proposition that the evidence originated from the same source rather than different sources; however, there is insufficient support for a Source Identification. The degree of support may range from limited to strong or similar descriptors of the degree of support. Any use of this conclusion shall include a statement of the factor(s) limiting a stronger conclusion.
3	Inconclusive	The observations do not provide a sufficient degree of support for one proposition over the other. Any use of this conclusion shall include a statement of the factor(s) limiting a stronger conclusion.
4	Support for Different Source	The observations provide more support for the proposition that the evidence originated from different sources rather than the same source; however, there is insufficient support for a Source Exclusion. The degree of support may range from limited to strong or similar descriptors of the degree of support. Any use of this conclusion shall include a statement of the factor(s) limiting a stronger conclusion.
5	Source exclusion	The observations provide extremely strong support for the proposition that the evidence originated from a different source and the likelihood for the proposition that the evidence arose from the same source is so remote as to be considered a practical impossibility; or the evidence exhibits fundamentally different characteristics.