IDAHO STATE POLICE FORENSIC SERVICES
LATENT PRINT SECTION
ANALYTICAL METHOD
HISTORY PAGE

The original version of the Latent Fingerprint Section SOP Manual is dated August 30, 2000.
Revision 1, revised from revision 0 was effective July 13, 2001.
Revision 2, revised from revision 1 was effective December 27, 2001.
Revision 3, the entire manual was reviewed and revised from revision 2. Revision 3 is effective January 12, 2007.
Revision 4: Section 11 "Digital Imaging Procedure" was reviewed and revised from revision 3. Revision 4 is effective May 15, 2007.
Revision 5: Section 5.6 "Retained Evidence" clarified retained latent evidence procedure 5.6.1, added section 5.6.1.1 addresses the issue of retained evidence from crime scenes, Appendix C "Latent Section Abbreviations" removed from Analytical Method. Revision 5 is effective September 12, 2007.
Revision 6: Section 10.1 "Amido Black" 10.1.5 Procedure, removed the presumptive blood testing requirement. (renumbered accordingly)
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Revision 7: Section 8.1.1 Remove wording on ALS use. 11.4 Modify documentation for new equipment. 12.4.3.2.1 and 12.4.3.2.2 and "reasonable". 14.2.3.4 add "and date verified". 14.3 update suggested wording for case reports. Appendix A change checks of balances to annually from monthly, addition of CA chamber to equipment list. Remove Appendix B "Latent Section Consumables".
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IDAHO STATE POLICE FORENSIC SERVICES
LATENT SECTION ANALYTICAL METHOD

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1 BACKGROUND/SCOPE

1.1 The discipline of Latent Print Analysis is the process of determining whether a particular area of friction ridge skin produced a particular latent print.

1.2 It is a discipline based on the development and comparison of multiple levels of detail such as pattern type, ridge characteristics (also known as minutiae), ridge shapes, etc. between a latent print and a known print.

1.3 When there is agreement between the details in a latent or questioned print and those in the known print, without any unexplainable dissimilarities, an identification can be declared.

1.4 The principles behind latent print evidence are: Friction Ridge Skin (FRS) is permanent, in that it does not change naturally throughout one's life and Friction Ridge Skin is unique and individual, no two areas of FRS have been found to possess identical ridge characteristics.

1.5 This Analytical Method defines both technical procedures for processing the majority of evidence encountered by the Latent Print Discipline and comparison methodology.

- 1.5.1 These methods will describe procedures and techniques that are routinely used in the examination of evidence.
- 1.5.2 These methods cannot be expected to address each and every situation or type of evidence encountered.
- 1.5.3 The individual analyst must exercise sound judgment in selecting the methods at their discretion which will best suit the requirements of the evidence submitted in a specific case; therefore, the procedures are designed to accommodate the majority of evidence encountered.

2 GENERAL REFERENCES

Idaho State Police Forensic Services – Quality Manual Section 2.0 NORMATIVE REFERENCES

The Scientific Working Group on Friction Ridge Analysis, Study and Technology (SWGFAST) - *SWGFAST documents are officially published in the Journal of Forensic Identification*, 2006. And the SWGFAST official website http://www.swgfast.org/

*Additional references are listed per individual procedures.

3 DEFINITIONS

ACE-V - Comparison methodology consisting of Analysis, Comparison, Evaluation, and Verification.

AFIS - Automated Fingerprint Identification System. The generic term for a fingerprint matching, storage, and retrieval system.

AFIS Databases - These are various databases available to ISP Forensic Services for searching latents. These databases include Idaho, WIN, WA, CAL-DOJ , IAFIS, as well as other local databases.

ALGORITHMS- S =Standard

ALTERNATE LIGHT SOURCE (ALS)/FORENSIC LIGHT SOURCE - Any light source, other than a laser, used to excite luminescence of latent prints, body fluids, etc.

ANALYSIS - The methodical examination of friction skin impressions; separation into parts so as to determine the nature of the whole.

ANATOMICAL SOURCE - An area of friction ridge skin from an individual from which an impression originated.

ARCH – PLAIN - A fingerprint pattern in which the ridges enter on one side of the impression, and flow, or tend to flow, out the other with a rise or wave in the center.

ARCH –TENTED - A type of fingerprint pattern that possesses either an angle, an up-thrust, or two of the three basic characteristics of the loop.

ARTIFACT- 1. Any distortion or alteration not in the original friction ridge impression, produced by an external agent or action.
2. Any information not present in the original object/image, inadvertently introduced by image capture, processing, compressions, transmission, display or printing.

BIAS- See cognitive bias, confirmation bias, and contextual bias.

BIFURCATION - The point at which one friction ridge divides into two friction ridges.

BLIND VERIFICATION - The 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.

Candidate - An individual's fingerprint record under consideration for comparison to the latent fingerprint.

CHARACTERISTICS/MINUTIAE - Features of the friction ridges. Commonly referred to as minutiae(e), Galton detail, point, feature, ridge formation, or ridge morphology (dot, bifurcation, and ending ridge).

CLARITY - Visual quality of a friction ridge impression.

CLASS CHARACTERISTICS - Characteristics used to put things into groups or classes (e.g., arches, loops, and whorls).

CLASSIFICATION - Alpha/numeric formula of finger and palm print patterns used as a guide for filing and searching.

COGNITIVE BIAS - The effect of perceptual or mental processes on the reliability and validity of one's observations and conclusions.

COMPARISON - The second step of the ACE-V method. The observation of two or more impressions to determine the existence of discrepancies, dissimilarities, or similarities.

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

COMPLEX EXAMINATIONS - The encountering of uncommon circumstances during an examination (e.g. the existence of high distortion, low quality or quantity, simultaneous impressions, or conflicts among examiners).

CONFIRMATION BIAS - The tendency to search for data or interpret information in a manner that supports one's preconceptions.

CONFLICT – A difference of conclusions that becomes apparent during, or at the end of an examination.

CONSULTATION - a significant interaction (i.e. guidance or exchange of information) between examiners regarding one or more impressions in question.

CONTEXTUAL BIAS - The effect of information or outside influences on the evaluation and interpretation of data.

CORE - The approximate center of a pattern.

CREASE - A line or linear depression; grooves at the joints of the phalanges, at the junction of the digits and across the palmar and plantar surfaces that accommodate flexion.

DELTA - That point on a 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.

DERMIS - The layer of skin beneath the epidermis.

DESTINATION - The database (ie., Idaho, WIN, IAFIS) or database section searched [ie.,LI/LR single (S) Idaho (ID)].

DEVIATION – 1. A change in ridge path. 2. An alteration or departure from a documented policy or method.

DISCREPANCY - The presence of friction ridge detail in one impression that does not exist in the corresponding area of another impression. See also Dissimilarity.

DISSIMILARITY – A difference in appearance between two friction ridge impressions. See also Discrepancy.

DISSOCIATED RIDGES – Disrupted rather than continuous, friction ridges. An area of friction ridge units that did not form into friction ridges, generally due to a genetic abnormality.

DISTORTION - Variances in the reproduction of friction skin caused by pressure, movement, force, contact surface, etc. Distortion is not a discrepancy and is not a basis for exclusion.

DOT - An isolated ridge unit whose length approximates its width in size.

EDGEOSCOPY- Study of the morphological characteristics of friction ridges; contour or shape of the edges of friction ridges.

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 access to the item examined for latent prints.

ENDING RIDGE - A single friction ridge that terminates within the friction ridge structure.

EPIDERMIS - The outer layer of the skin.

ERRONEOUS EXCLUSION - The incorrect determination that two areas of friction ridge impressions did not originate from the same source.

ERRONEOUS IDENTIFICATION - The incorrect determination that two areas of friction ridge impressions originated from the same source.

EVALUATION - The third step of the ACE-V method wherein an examiner assesses the value of the details observed during the analysis and the comparison steps and reaches a conclusion.

EXCLUSION - The determination that there is sufficient quality and quantity of detail in disagreement to conclude that two areas of friction ridge impressions did not originate from the same source (non-identification).

EXEMPLARS- The prints of an individual, associated with a known or claimed identity, and deliberately recorded electronically, by ink, or by another medium (also known as known prints).

FALSE NEGATIVE RATE - The proportion of the comparisons between mated prints that result in an erroneous exclusion conclusion.

FALSE POSITIVE RATE - The proportion of the comparisons between non-mated prints that result in an erroneous individualization conclusion.

FEATURES – Distinctive details of the friction ridges, including Level 1, 2, and 3 details.

FINGERPRINT - An impression of the friction ridges of all or any part of the finger.

FOCAL POINTS - In classification, the core and delta(s) of a fingerprint. Another term for target group.

FRICTION RIDGE - A raised portion of the epidermis on the palmar or plantar skin, consisting of one or more connected ridge units of friction ridge skin.

FRICTION RIDGE DETAIL (MORPHOLOGY) - An area comprised of the combination of ridge flow, ridge characteristics, and ridge structure.

FRICTION RIDGE UNIT - Single section of friction ridge containing one pore.

FURROWS - Valleys or depressions between the friction ridges.

GALTON DETAILS - Term referring to friction ridge characteristics attributed to the research of English fingerprint pioneer, Sir Francis Galton.

HENRY CLASSIFICATION – An alpha-numeric system of fingerprint classification named for Sir Edward Richard Henry.

IAFIS - Integrated Automated Fingerprint Identification System. The FBI's national AFIS.

IDENTIFICATION/INDIVIDUALIZATION - The determination by a qualified examiner that there is sufficient quality and quantity of detail in agreement to conclude that two friction ridge impressions originated from the same source.

INCIPIENT RIDGE - A friction ridge not fully developed which may appear shorter and thinner in appearance than fully developed friction ridges (interstitial, nascent).

INCONCLUSIVE - The inability to either individualize or exclude an area of friction ridge detail.

INTERVENING RIDGES - The number of friction ridges between two characteristics.

JOINT - The hinged area that separates segments of the finger.

KNOWN PRINT (FINGER, PALM, FOOT)/EXEMPLAR - A recording of an individual's friction ridges with black ink, electronic imaging, photography, or other medium on a contrasting background.

LATENT PRINT - Transferred impression of friction ridge detail not readily visible; generic term used for questioned friction ridge detail.

LEVEL 1 DETAIL - Friction ridge flow and general morphological information.

LEVEL 2 DETAIL - Individual friction ridge paths and friction ridge events (e.g., bifurcations, ending ridges, and dots).

LEVEL 3 DETAIL - Friction ridge dimensional attributes , e.g., width, edge shapes, and pores.

LIFT - An adhesive or other medium used to transfer a friction ridge impression from a substrate and on which recovered friction ridge detail is preserved.

LIVE-SCAN - Electronic recording of friction ridges (fingers and/or palms).

LI/LR - Latent Inquiry/Latent Register

L/RI - Latent Re-Inquiry

LOOP – ULNAR - A type of pattern in which one or more ridges enter upon either side, re-curve, touch or pass an imaginary line between delta and core and pass out, or tend to pass out, on the same side the ridges entered. The flow of the pattern runs in the direction of the ulna bone of the forearm (toward the little finger).

LOOP – RADIAL - A type of pattern in which one or more ridges enter upon either side, re-curve, touch or pass an imaginary line between delta and core and pass out, or tend to pass out, on the same side the ridges entered. The flow of the pattern runs in the direction of the radius bone of the forearm (toward the thumb).

LR - Latent registration in the Unsolved Latent Database (ULD) single search - a Latent Inquiry (L/I) and a Latent Re-Inquiry (L/RI) of a single latent constitute a single search.

MAJOR CASE PRINTS/COMPLETE FRICTION RIDGE EXEMPLARS - A systematic recording of all of the 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. Under special circumstances complete friction ridge exemplars may also need to be taken from the plantar portion of the feet.

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

MINUTIAE - Events along a ridge path, including bifurcations, ending ridges, and dots (also known as Galton details).

MISSED IDENTIFICATION - The failure to make an identification when, in fact, both friction ridge impressions are from the same source.

NCIC CLASSIFICATION - An alpha/numeric system of fingerprint classification.

NGI – The acronym for Next Generation Identification, the updated version of IAFIS.

NON-COMPLEX - The encountering of common circumstances during an examination (e.g., low distortion, high quality or quantity, or no conflicts among examiners).

NON-POROUS - Non-absorbent.

ORIGINAL IMAGE – Primary image; with respect to digital images, an accurate replica of the primary image.

PALM PRINT – An impression of the friction ridge of all or any part of the palmar surface of the hand.

PATENT PRINT - Friction ridge impression of unknown origin, visible without development.

PATTERN TYPE – Fundamental pattern of the ridge flow: arch, loop, whorl. Arches are subdivided into plain and tented arches; loops are subdivided into radial and ulnar loops; whorls are subdivided into plain whorls, double loops, central pocket loops, and accidental whorls.

PLASTIC PRINT - Friction ridge impression of unknown origin that is impressed in a soft substrate to create a three-dimensional impression.

PORES - Small openings in the skin through which perspiration is released.

POROSCOPY - A study of the size, shape, and arrangement of pores.

POROUS - Absorbent.

PRIMARY IMAGE – The first recording of an image onto media.

PRESERVED - Casting, photography, lifting, or other method used to capture latent impressions for further examination.

PROFICIENCY - The ongoing demonstration of competency.

QUALIFIED ANALYST - Is an individual who has completed the internal training program, passed competency testing, and been approved to perform case work.

QUALITY - The clarity of information contained within a friction ridge impression.

QUANTITY- The amount of information contained within a friction ridge impression.

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

RELATIVE POSITION - Proximity of characteristics to each other.

RIDGE FLOW - The direction of one or more friction ridges. A component of Level 1 detail.

RIDGE PATH - The directional flow of a single friction ridge. A component of Level 2 detail.

RIDGEOLOGY - The study of the uniqueness of friction ridge skin and its use for personal identification.

SEQUENTIAL PROCESSING - Use of a series of development methods in a specific order to maximize development of friction ridge detail.

SIMULTANEOUS IMPRESSION- Two or more friction ridge impressions from the same hand or foot deposited concurrently.

SOURCE- An area of friction ridge skin from an individual from which an impression originated.

STOCK SOLUTION - Concentrated solution diluted to prepare a working solution.

SUBSTRATE - Surface upon which a friction ridge impression is deposited.

SUFFICIENT - The analyst's determination that adequate unique details of the friction skin source exist in the impression to support the conclusion.

SUITABLE - The determination that there is sufficiency in an impression to be of value for further analysis or comparison.

TARGET GROUP - A distinctive group of ridge features (and their relationships) that can be recognized.

TECHNICAL REVIEW – Review of notes, documents, and other data that forms the basis for a scientific conclusion.

TEN PRINT
1. A generic reference to examinations performed on intentionally recorded friction ridge impressions.
2. A controlled recording of an individual's available fingers using ink, electronic imaging, or other medium.

TOLERANCE - The amount of variation in appearance of friction ridge features to be allowed during a comparison, should a corresponding print be made available.

VERIFICATION - The independent confirmation of the ACE process as utilized by a subsequent qualified examiner to either support or refute the conclusions of the original examiner.

WHORL – ACCIDENTAL - A fingerprint pattern consisting of two different types of patterns, with the exception of the plain arch, with two or more deltas; or a pattern which possesses some of the requirements for two or more different types; or a pattern which conforms to none of the definitions.

WHORL - CENTRAL POCKET LOOP - A type of fingerprint pattern which has two deltas and at least one ridge which makes, or tends to make, one complete circuit, which may be spiral, oval, circular, or any variant of a circle. An imaginary line drawn between the two deltas must not touch or cross any re-curving ridges within the inner pattern area.

WHORL - DOUBLE LOOP - A type of fingerprint pattern that consists of two separate loop formations with two separate and distinct sets of shoulders and two deltas.

WHORL – PLAIN - A type of fingerprint pattern which consists of one or more ridges which make, or tend to make, a complete circuit, with two deltas, between which, when an imaginary line is drawn, at least one re-curving ridge within the inner pattern area is cut or touched.

WORKING SOLUTION - Solution at the proper dilution for processing.

4 RESPONSIBILITIES

4.1 The Latent Program Supervisor is responsible for ensuring that personnel adhere to established analytical methods, safety practices, and laboratory policies and procedures.

4.2 The Latent Program Supervisor shall ensure that analyst's training records are on file in the latent section.

4.3 Individual analysts are responsible for adherence to established analytical methods, safety guidelines, and laboratory polices and procedures.

4.4 Latent print analyst duties include, but are not limited to:

- 4.4.1 Development of friction ridge impressions;
- 4.4.2 Documentation of visible or developed friction ridge impressions;
- 4.4.3 Analysis, comparison, and evaluation of friction ridge impressions;
- 4.4.4 Verification of compared friction ridge impressions;
- 4.4.5 Issuing reports of examination activities;
- 4.4.6 Performing technical and administrative casework reviews;
- 4.4.7 Obtaining known exemplars from living and deceased subjects;
- 4.4.8 Responding to crime scenes to the extent to which they are trained;
- 4.4.9 Satisfactorily completing annual proficiency tests;
- 4.4.10 Presenting expert testimony in court.

5 EVIDENCE HANDLING PROCEDURES

5.1 Evidence handling will be in accordance to ISPFS Quality/Procedure Manual Section 5.8 HANDLING ITEMS OF EVIDENCE.

5.2 In order to ensure a correct count, money shall be counted by the analyst and witnessed by one other person when first opened (if possible) and again when it is resealed. If the dollar amount is less than $20.00 a count witness is not required.

5.3 Evidence that contains a measurable amount of a controlled substance may be handled and processed in the latent Section.

5.3.1 The preferred practice is for the submitting agency to separate the suspected controlled substance from the packaging material.

5.3.2 If a recoverable amount of substance is received, the Latent Section will separate the substance from the packaging, re-package the substance in a secondary container and return the substance to the original container.

5.3.2.1 The Latent Section shall not measure any suspected controlled substance.

5.4 Submission of hands, fingers, or feet of deceased persons to the Latent Section shall only occur when normal printing procedures have failed or cannot be applied due to decomposition.

5.4.1 Hands, fingers, or feet should only be removed by the attending medical examiner/coroner or under their authority and supervision.

5.4.2 When possible, it is desirable to have the hands severed at the wrist, and forwarded in their entirety. This eliminates the possibility of getting fingers mixed up or incorrectly labeled. If it is not possible to send the hands, the fingers may be submitted. Fingers should be severed at the palm, placed in individual containers, and immediately labeled as to which finger it is.

5.4.3 It is requested that hands, fingers, etc. be submitted as soon as possible in the same condition as found. If the hands were immersed in water, transport in water. If found dried out, place in an airtight container and transport without using any preservative.

5.4.4 Tissue should be refrigerated if possible.

5.4.5 **Do not use a formaldehyde solution** to preserve the tissue as it causes it to become brittle and hard, making the task of obtaining identifiable prints very difficult.

5.4.6 Body parts received by the lab shall be sealed and placed in an evidence refrigerator or freezer.

5.4.7 Biological evidence shall be promptly returned to the submitting agency after being processed.

5.5 Latent print processing has the potential to irreparably damage items of evidence.

5.5.1 If an item is suspected to have great value (monetary or sentimental), the analyst should contact the submitting agency to explain potential damage and gain verbal approval prior to processing.

5.6 RETAINED EVIDENCE

5.6.1 Evidence generated by the latent section may be retained for future reference with the approval from the Discipline Leader.

5.6.2 Latent section will return evidence and sub items of evidence (latent lifts) to the submitting agency. (See ISPFS Quality Manual section 15.8.2.4.1)

6 GENERAL LATENT PROCESSING

6.1 Latent print evidence is processed according to the nature of the substrate (surface) to be processed.

6.1.1 Substrate types include porous, semi-porous, and non-porous.

6.1.2 Processing is generally carried out in a sequential manner employing methods appropriate to the substrate type.

6.1.3 ISP Forensic Services Latent Section reserves the right to process evidence items as a whole when submitted evidence items are not listed individually on the evidence submittal form (e.g. bag of miscellaneous items).

6.2 Latent print evidence is also processed with regards to what the latent print matrix may consist of. For example a latent print may be composed of perspiration, blood, or a combination of both.

6.2.1 Eccrine sweat glands are most concentrated on the palmar portion of the hands and plantar portion of the feet. Secretions from these glands consist of 99.0 to 99.5 percent water and 0.5 to 1.0 percent solids (organic substances and inorganic salts).

6.2.2 Latent prints may also consist of fats and oils (sebum) secreted by the sebaceous glands. These glands are most concentrated on the nose, ear, and groin areas. They are not located on the palmar portion of the hands and plantar portion of the feet, but sebum may be transferred to them via contact with other portions of the body.

6.2.3 Fats, oils, and other contaminants may also be transferred to friction ridge skin by contact with sources external to the body.

6.3 For the purpose of this manual, latent print methods are divided into three categories; light based methods, physical methods, and chemical methods.

6.3.1 LIGHT BASED METHODS

6.3.1.1 Latent prints may be visualized through the use of various angles and wavelengths of light.

6.3.1.2 Visualization of latent prints through the use of forensic lighting methods is non-destructive and should be attempted prior to other processing methods.

6.3.2 PHYSICAL METHODS

6.3.2.1 The development of latent prints through the use of physical methods does not involve a chemical reaction between the impression and the method used.

6.3.2.2 Physical methods encompass dusting and other discoloration methods often relying on the adhesive quality of certain latent prints.

6.3.2.3 The taking of known exemplars from a living or deceased person shall be considered a physical method for the purposes of this manual.

6.3.3 CHEMICAL METHODS

6.3.3.1 The development of latent prints through the use of chemical methods occurs because of a chemical reaction between the latent print residue components and the reagent.

6.3.3.2 Reagents shall be tested after they are prepared and prior to use. If the same lot of working solution is used multiple times in the same day, only the initial control tests must be noted on the "ISP FS Latent Section Control Test Log". Subsequent use of the reagent use on the same day shall revert to the prior tests. Control test results shall also be recorded in the case documentation.

7 QUICK REFERENCE SEQUENTIAL PROCESSING GUIDE

(Processing steps indicated by bold typeface are a base requirement that shall be conducted when processing a specific evidence type. If the base requirement is not performed the analyst shall contact the discipline leader and request a deviation from the processing guide prior to beginning processing documentation is required in the case notes.)

7.1 GENERAL EVIDENCE:

7.1.1 POROUS:

1. **Visual**: White light/Alternate Light Source (ALS)
2. Iodine Fuming
3. Visual: White light
4. 1,8 Diazafluorenone-9-one (DFO)
5. Visual: ALS
6. **Ninhydrin or 1,2 Indanedione**
7. Visual: White light
8. Physical Developer
9. Visual: White light

7.1.2 NON-POROUS:

1. **Visual**: White light/ALS
2. **Cyanoacrylate Fuming**
3. Visual: White light/ALS
4. **Dye Stain**
5. **Visual: ALS** or Ultraviolet light (UV) as required
6. Powders: Luminescent or non-luminescent
7. Visual: White light/ALS

7.2 BLOOD EVIDENCE:

7.2.1 POROUS:

1. **Visual**: White light/UV (fabric-background luminescence)
2. **Amido Black or Ninhydrin or LCV**
3. Visual: White light

7.2.2 NON-POROUS:

1. **Visual**: White light
2. **Cyanoacrylate Fuming**
3. Visual: White light
4. **Amido Black or Ninhydrin or LCV**
5. Visual: White light/ALS
6. De-stain/Rinse solution
7. Visual: ALS
8. Powders: Luminescent or non-luminescent
9. Visual: White light/ALS

7.3 CARTRIDGE CASES:

1. **Visual:** White light
2. **Cyanoacrylate Fuming**
3. Visual: White light/ALS
4. Dye Stain
5. Visual: ALS
6. Powders: Luminescent or non-luminescent

7.4 GLOSSY PAPER/GLOSSY CARDBOARD:

1. **Visual**: White light
2. Iodine
3. **Cyanoacrylate Fuming**
4. Visual: White light/ALS
5. **Powders:** Luminescent or non-luminescent
6. Visual: White light/ALS
7. Ninhydrin
8. Visual: White light
9. Physical Developer
10. Visual: White light

7.5 HUMAN SKIN:

7.5.1 Decomposing and/or Macerated Friction Ridge Skin (water soaked)

1. Ink and/or powder lift method (if possible)
2. Photography

7.5.2 Mummified Friction Ridge Skin (dried)

1. Ink and/or powder lift method (if possible)
2. Photography
3. Casting
4. Attempt to re-hydrate

7.5.3 Burned Friction Ridge Skin

1. Photograph
2. Ink

7.6 LEATHER:

1. **Visual**: White light/ALS
2. **Cyanoacrylate Fuming**
3. Visual: White light/ALS
4. **Powders**: Luminescent or non-luminescent
5. Visual: White light/ALS

7.7 PAINTED SURFACES:

1. Latex Paint: process as for porous evidence
2. Semi-gloss/enamel paint: process as for non-porous evidence

7.8 PHOTOGRAPHIC PAPER:

7.8.1 Glossy side (process first):

1. **Visual**: White light
2. **Cyanoacrylate fuming**
3. Visual: White light/ALS
4. **Powders**: luminescent or non-luminescent
5. Visual: White light/ALS

7.8.2 Reverse side (if paper) - process as for porous evidence

7.9 RUBBER/SYNTHETIC GLOVES:

1. **Visual**: White light/ALS
2. Iodine
3. **Cyanoacrylate fuming**
4. Visual: White light/ALS
5. Ninhydrin
6. **Dye Stain**
7. **Visual: ALS**
8. Powders: Luminescent or non-luminescent
9. Visual: White light/ALS

7.10 TAPE:

7.10.1 Non-adhesive side of all tapes:

1. **Visual**: White light
2. **Cyanoacrylate Fuming**
3. Visual: White light/ALS
4. **Dye Stain**
5. **Visual: ALS**
6. Powders: Luminescent or non-luminescent
7. Visual: White light/ALS

7.10.2 Adhesive side of tape (select method that contrasts with the color of the tape):

1. **Visual:** White light/ALS
2. **Gentian Violet or Small Particle Reagent or Sticky Side Powder**
3. Visual: White light

OR

1. **Visual:** White light/ALS
2. **Cyanoacrylate Fuming**
3. Visual: White light/ALS
4. **Dye Stain**
5. Visual: ALS

7.11 VARNISHED WOOD:

1. **Visual**: White light/ALS
2. **Cyanoacrylate fuming**
3. Visual: White light/ALS
4. **Dye Stain (water solution)**
5. Visual: ALS
6. Powders: Luminescent or non-luminescent
7. Visual: White light/ALS

7.12 WET SURFACES:

7.12.1 POROUS:

1. **Visual**: White light/ALS
2. Dry to room temperature
3. Visual: White light/ALS
4. **Physical developer**

7.12.2 NON-POROUS:

1. **Visual**: White light/ALS
2. **Small Particle Reagent (SPR)**
3. Visual: White light/ALS
4. Tape lift

8 LIGHT BASED METHODS

8.1 ALTERNATE LIGHT SOURCE

8.1.1 BACKGROUND:

Alternate light sources (ALS) are portable, multi-waveband, and tunable light sources that are used to enhance or visualize potential items of evidence. Latent impressions may be composed of various substances such as blood, perspiration, chemicals or other organic substances that react differently to different wavelengths of light. When a luminescent deposit is excited with a particular wavelength of light, the deposit absorbs the light and re-emits it at a different wavelength. The short-lived light being re-emitted is termed fluorescence. There are several alternate light sources available to analysts that adequately meet the needs described in this manual.

8.1.2 SCOPE:

8.1.2.1 The ALS is used to attempt to create contrast between an impression and the substrate it is on.

8.1.2.2 Fluorescence may occur due to a naturally occurring substance within the latent print residue itself (inherent luminescence), may be transferred to the friction ridge skin via contamination and re-deposited, or may be chemically induced in latent print residue with certain dyes and powders known to exhibit fluorescent properties. Fluorescence of the substrate may also occur.

8.1.3 EQUIPMENT AND MATERIALS:

Alternate light source
Filtered goggles

8.1.4 REAGENTS:

Not applicable

8.1.5 PROCEDURE:

8.1.5.1 Turn on ALS. Make sure the ALS comes to full operating speed.

8.1.5.2 Turn on the lamp The lamp function will vary slightly in different models.

8.1.5.3 Choose the band-width you wish to use. Some models have a variable power dial that may need to be adjusted.

8.1.5.4 Observe evidence with the appropriate wavelength/goggle combination:

< 400nm	yellow or clear UV safe
400-450nm	yellow
450-540nm	orange
540->700nm	red

8.1.5.5 Turn off the ALS lamp and cool ALS completely before powering off ALS.

8.1.6 ADDITIONAL INFORMATION:

8.1.6.1 Maintenance shall consist of cleaning the exterior of the ALS with a soft cloth dampened with a mild detergent solution and using a cotton swab moistened with glass cleaner to clean the optical filters. Bulbs should be replaced as needed.

8.1.6.2 If an ALS malfunctions, it will be taken out of service until it can be repaired. The ALS shall be tagged indicating that it is out of service. Maintenance, service, etc. will be recorded in the maintenance log.

8.1.6.3 No calibration is required of these units.

8.1.6.4 The manufacturer's operator manuals shall be read prior to using the equipment.

8.1.7 CONTROLS:

Not applicable

8.1.8 SAFETY:

8.1.8.1 As with other electrical appliances, guard against electrical shock. This can be accomplished by ensuring that all connections are proper and that no loose, damaged, or frayed wires exist. Make sure the ALS is unplugged before attempting any maintenance and do not use outdoors if wet conditions exist.

8.1.8.2 The eyes are generally more vulnerable than the skin, and appropriate eye protection must be used to protect them. Permanent eye damage can occur from reflected, refracted, or direct illumination to the eye. Most of the light emitted by an ALS is not absorbed, but is reflected and scattered off the surface being examined. Extreme care should be taken around highly reflective surfaces. Never look directly into the light or allow beams to bounce off the surface into your eyes or the eyes of another person in the vicinity. Filtered goggles or shields shall be utilized when using this equipment as they provide protection from potentially harmful rays and provide additional enhancement for viewing latent prints.

8.1.8.3 The nature and extent of all potential hazards are not yet known because in-depth assessments have not been made on most of the high intensity light sources used in forensic identification work.

8.1.9 REFERENCES:

Advances In Fingerprint Technology, Henry Lee and R. E. Gaensslen, pages 90, 115-118.

An Introduction to Lasers, Forensic Lights, and Fluorescent Fingerprint Detection Techniques, E. Roland Menzel, (1991).

Friction Ridge Skin, James F. Cowger, (1983), pages 106-107.

Omnichrome Evidence Detection with Forensic Laser Technology, (1989).

Omniprint 1000A Operating Instructions, Omnichrome.

Mini-CrimeScope Tunable Forensic Light Source Model MCS-400W Operation and Maintenance Instructions (2003).

Rofin Polilight PL400 Forensic Light source, Polilight PL400 Instruction Manual, Version 1 11/2001

8.2 KRIMESITE IMAGER

8.2.1 BACKGROUND:
The KRIMESITE IMAGER (KSI) is an image-intensifying device that locates untreated latent prints and other evidence of forensic interest on non-porous surfaces by utilizing Reflective Ultra-Violet Imaging System technology (RUVIS). Ultra-violet (UV) light will reflect off of a fingerprint at a different wavelength or speed than it will off the substrate. This creates contrast that you are able to visualize because the KSI system takes UV light and converts it to visible light.

8.2.2 SCOPE:
8.2.2.1 No treatment with powders or chemicals is necessary, however, use of the imager may greatly enhance results obtained by cyanoacrylate fuming.
8.2.2.2 The KSI is most effective on non-porous surfaces, but can detect recently deposited prints on some porous surfaces.
8.2.2.3 The KSI is not affected by ambient light, which means it can be used in daylight or total darkness, indoors or outdoors.
8.2.2.4 The most appropriate method to preserve KSI-located impressions is through photography.
8.2.2.5 The KSI system may be used in the laboratory or when providing technical field assistance.

8.2.3 EQUIPMENT AND MATERIALS:
Short wave 254 nm ultraviolet light source
Camera
Reflective Ultraviolet Imaging System

Tripod
Eye protection

8.2.4 PROCEDURE:

8.2.4.1 Attach the KSI to a tripod or use it as a hand held device.

8.2.4.2 Position the sliding filter system assembly to the UV position window (mirror facing away from analyst and the catalogue number facing the analyst).

8.2.4.3 Turn the KSI unit on and verify the red light is lit.

8.2.4.4 Turn on the ultraviolet light source. If using both 6-watt bulbs on the UV source, turn one bulb on at a time or both bulbs of the unit will only illuminate at half-power.

8.2.4.5 For best results, direct the UV light at a 15° to 45° angle from the surface of interest. Point the KSI perpendicular to the surface.

8.2.4.6 Set the aperture to the f/3.5 position (completely open).

8.2.4.7 Focus the 60mm lens.

8.2.4.8 Focus the eyepiece until you have the clearest largest picture.

8.2.4.9 When scanning an item or area for possible latent evidence the most effective distance for viewing is 0 –5 ft with the 12 watt UV light source and 5-10 ft with the 30 watt UV light source. The operator of the lamp and all others present should remain behind the light source when it is turned on.

8.2.4.10 If a latent impression is located, mark the location using the marking devices supplied or an adhesive scale. Always use a UV scale to insure proper sizing when photographing images with the KSI.

8.2.4.11 Use the Canon Power Shot G3 or other appropriate digital camera to capture KSI images.

8.2.4.12 After locating a latent print, attach the KSI unit to the copy stand or a tripod.

8.2.4.13 Focus using the short-wave UV light. Make sure that the KSI aperture is all the way open (f/3.5) and leave the KSI eyepiece in.

8.2.4.14 Attach the digital camera using the adapter.

8.2.4.15 Turn the camera on, ensure it is set to auto, turn on the MACRO setting, turn off the flash, and set to highest resolution possible.

8.2.4.16 Press the shutter button half way to activate the auto focus.

8.2.4.17 Use the zoom function to fill the viewing field with the latent image.

8.2.4.18 Capture the image by fully pressing the shutter button. It is preferable to use the remote to avoid shaking the camera.

8.2.4.19 Once the examination is complete, turn all equipment off, and store appropriately.

8.2.5 ADDITIONAL INFORMATION:

8.2.5.1 Refer to the digital camera manufacture's operator manual for full camera operation.

8.2.5.2 General maintenance consists of periodic laser pointer battery replacement, cleaning the surface of the KSI band pass filer with a lens cleaning solution and tissue, and cleaning the short-wave UV lamps and KSI UV lens with an alcohol moistened soft cloth. General maintenance shall be performed as needed.

8.2.5.3 UV lamps should be replaced as needed, taking care to dispose of lamps in a proper environmental manner as they contain mercury.

8.2.5.4 If the KSI malfunctions, it will be taken out of service until it can be repaired. The KSI shall be tagged indicating that it is out of service. Maintenance, service, etc. will be recorded in the maintenance log.

8.2.5.5 No calibration is required of this unit.

8.2.5.6 The manufacturer's operator manuals for this equipment shall be read prior to using the equipment.

8.2.6 CONTROLS:

8.2.6.1 Testing of the KSI is performed prior to each use.

8.2.6.2 This test involves the making of a quality latent print on a non-porous surface similar to the evidence being examined, if possible.

8.2.6.3 The test print is viewed with the KSI as outlined in the procedure.

8.2.6.4 An analyst shall not proceed with the processing of the evidence until a control test bearing positive results (visualization of a green colored print) has been carried out and documented in the laboratory case notes.

8.2.6.5 The area surrounding the intentionally deposited latent print shall serve as a negative control.

8.2.7 SAFETY:

8.2.7.1 Serious eye and skin injury along with allergic reactions may result if personnel are inadequately protected from the lamp or other improper use of the equipment occurs.

8.2.7.2 Exposure to UV-C and UV-B present great risk to the cornea. The short-wave UV-C light used with the KSI operates at 254 nm. Short-term injury may include keratoconjunctivitis (snow blindness or welder’s flash, a condition where the corneal epithelial cells are damaged or destroyed) and severe sunburn-like symptoms. Chronic (repeated) exposure is known to cause premature aging of the skin and skin cancers.

8.2.7.3 Never operate the UV lamps without wearing protective eyewear. Failure to do so may result in severe burns, long-term injury to the eyes, or blindness. Avoid needless exposure. UV light, although invisible, reflects in a manner similar to visible light. Turn lamps off when not in use.

8.2.7.4 All persons present should utilize protective measures including, UV absorbing face shields or glasses, long sleeved shirts, and gloves when the lamps are in use. These measures may not eliminate all UV radiation, but they will lessen the risk of severe exposure.

8.2.7.5 Some individuals are abnormally sensitive to UV radiation. If you believe yourself to be particularly sensitive to sunlight, do not work in an area where short-wave UV light is in use. Certain common medications and cosmetics may greatly increase your sensitivity to UV radiation. Consult your physician concerning any medication you may be taking.

8.2.7.6 Use extra caution when new lamps are installed as radiation levels may be markedly higher.

8.2.8 REFERENCES:

"Detecting and Enhancing Latent Fingerprints with Short Wave UV Reflection Photography," Wang Gui Qiang. Proceedings of the International Symposium on Fingerprint Detection and Identification, Israel National Police, 1991 pgs. 37-49.

"Evaluation of a Reflected Ultraviolet Imaging System for Fingerprint Detection," Richard Saferstein, and Susan L. Graf. *Journal of Forensic Identification*, 51 (4), 2001 pgs. 385-393.

Krimesite Imager User's Manual, Sirchie Finger Print Laboratories, Inc.

"Krimesite Training Notes," Instructor: Chris Harris, Sales and Training Representative, Sirchie Fingerprint Laboratories, Inc.

"Reflected Ultraviolet Imaging System Applications," Edward R. German. Proceedings of the International Symposium on Fingerprint Detection and Identification, Israel National Police, 1996 pgs. 115-118.

"UV Detection of Untreated Latent Fingerprints," Hadrian Fraval, Alex Bennett, and Eliot Springer. Proceedings of the International Symposium on Fingerprint Detection and Identification, Israel National Police, 1996 pgs. 51-58.

9 PHYSICAL METHODS

9.1 IODINE FUMING

9.1.1 BACKGROUND:

Iodine fuming is one of the oldest latent print methods currently employed in the examination processes for the visualization of latent prints. Iodine vapors are physically absorbed by fats and oils of a latent print deposit and turn the latent print a yellow/brown color.

9.1.2 SCOPE:

9.1.2.1 Use when attempting to develop prints that are thought to be recently deposited and/or composed of fatty or oily residue. Iodine reacts to recently deposited prints better than old ones because the fats tend to become less receptive to this process with time.

9.1.2.2 Other latent print methods such as DFO or ninhydrin tend to dissolve the fats that the iodine reacts with. Therefore, if iodine fuming is to be used, it must be used prior to other latent print development processes.

9.1.2.3 Iodine is not suitable for metals or dark surfaces.

9.1.3 EQUIPMENT AND MATERIALS:

Fume hood

Chamber or a heavy-duty sealable plastic bag

9.1.4 REAGENT:

Iodine crystals

9.1.5 PROCEDURE 1 - CHAMBER METHOD:

9.1.5.1 In a fume hood, break open a glass ampoule of iodine crystals to reveal the iodine crystals.

9.1.5.2 Place the crystals in an airtight chamber (ex. sealable heavy plastic bag, commercial fuming chamber, etc.).

9.1.5.3 Apply heat if necessary. The application of heat may be accomplished in various ways including transfer of body heat, contained hot water, or an electric heater. Iodine crystals will start to sublimate, go from a solid to a gas, resulting in purplish fumes with the application of heat (approximately 100° F).

9.1.5.4 Place the control test and the questioned surface in the chamber and proceed with fuming.

9.1.5.5 The control test and evidence are monitored by viewing through the chamber to determine when processing is complete.

9.1.5.5.1 Latent prints, if developed, will turn a yellow-brown color.

9.1.5.5.2 The process needs to be carefully monitored so that over-development does not occur.

9.1.5.6 Developed prints are evaluated to determine their suitability for comparison.

9.1.5.7 Prints deemed to be of value are marked and photographed as soon as possible, and notes are taken.

9.1.6 ADDITIONAL INFORMATION:

9.1.6.1 The resulting yellow-brown latent prints can vanish and must be preserved.

9.1.6.2 It is suggested that the camera be set up prior to iodine processing.

9.1.6.3 Iodine prints that have faded, or are completely gone, can sometimes be redeveloped by reprocessing. Iodine reprocessing cannot be done if other methods have been used or if too long of a time span has elapsed.

9.1.6.4 Shelf life of sealed iodine is indefinite.

9.1.6.5 Iodine crystals originating from glass ampoules shall be disposed of in the hazardous waste containers located in the fume hoods.

9.1.7 CONTROLS:

9.1.7.1 Testing of iodine crystals is performed prior to each use.

9.1.7.2 This test involves the making of a quality latent print (oil based) on a test surface similar to the evidence being examined.

9.1.7.3 The test print is exposed to the fumes in the same manner as the questioned surface would be.

9.1.7.4 When using the chamber method, testing of the iodine crystals and processing may be conducted at the same time.

9.1.7.5 The area surrounding the intentionally deposited latent print shall serve as a negative control.

9.1.8 SAFETY:

9.1.8.1 Safety is a serious concern when using the iodine fuming method. *Iodine is toxic in any form. ALWAYS AVOID INHALING IODINE FUMES.*

9.1.8.2 Iodine fumes may irritate the skin and damage the respiratory tract. Headaches that can last for several days may result from exposure to iodine. Long-term effects to the thyroid gland may result from exposure.

9.1.8.3 Adequate ventilation when using the method is mandatory as the fumes are corrosive to metals and may discolor other surfaces that they come in contact with.

9.1.8.4 Iodine shall be purchased in glass ampoules. The ampoules shall stay sealed until use.

9.1.9 REFERENCES:

Friction Ridge Skin, James F. Cowger, (1983), pages 93-96.

Fingerprint Techniques, Andre A. Moenssens, (1971), pages 114-120.

Scott's Fingerprint Mechanics, Robert D. Olsen, (1978), pages 247-256.

Manual of Fingerprint Development Techniques, British Home Office, (1998), Chapter 4. Peavey Product Guide, (1999).

9.2 LIFTING METHODS

9.2.1 BACKGROUND:

Lifting methods are effective for the preservation of latent print impressions because the adhesive on the lifting medium is stickier than the surface on which the latent print deposit resides. It is a good idea to have a variety of lifting mediums as they vary in clarity, adhesion, and flexibility.

9.2.2 SCOPE:

9.2.2.1 Lifting methods are applicable to prints that have first been developed utilizing other methods such as powders, SPR, and occasionally prints deposited in dust.

9.2.2.2 Lifts are inexpensive, easy, and a quick method of preserving developed latent images for future comparison.

9.2.2.3 Latent print lifting is one of the most common and effective methods of preserving latent print images at a crime scene.

9.2.2.4 Lifting may not be the most effective method of preserving a particular latent print.

9.2.3 EQUIPMENTAND MATERIALS:

Powder station exhaust vent or hood
Various sizes and types of standard lifting tapes
Hinge lifts
Elastic tapes
Gel lifters
Casting compounds

9.2.4 PROCEDURE 1 - HINGE LIFTS, TAPES, AND GEL LIFTERS:

9.2.4.1 Ensure that the surface has been prepared for lifting by removing excess powder.

9.2.4.2 Lifting mediums should be removed from their backing in a smooth, continuous motion without hesitation to avoid lines in the adhesive.

9.2.4.3 The lifting medium is then applied to the latent bearing surface in a smooth continuous motion taking care to avoid air pockets and

creases. It may be necessary to firmly rub the lifting medium onto the surface using a fair amount of pressure.

9.2.4.4 Removal of the lifting medium from the latent bearing surface should also be performed in a smooth continuous motion and reapplied to the glossy side of the latent lift card in the same manner as noted above.

9.2.4.5 Latent lift cards shall be filled out as completely as possible and shall include the following:
Unique case identifier;
Date and initials;
Impression source (description or source identifier);
Significant information about the orientation and/or position of the latent print on the object through description and/or diagram(s). One should be able to pinpoint the area and orientation of a latent print on the object.

9.2.4.6 Lifts from multiple areas (different latents) shall be placed on individual cards.

9.2.4.7 Multiple lifts of the same latent may be placed on the same card.

9.2.5 PROCEDURE 2 - CASTING COMPOUNDS:

9.2.5.1 Ensure that the surface has been prepared for lifting by removing excess powder.

9.2.5.2 Casting material is mixed either by hand or though the use of an extruder gun.

9.2.5.3 Casting material is applied to the latent bearing surface in a manner that precludes air pockets. It may be necessary to place the casting material to the side of the latent and then smooth it across the surface.

9.2.5.4 The casting material is left in place until solidified.

9.2.5.5 It then is removed from the surface and attached to a latent lift card. The appropriate documentation is noted as detailed in 9.2.4.5.

9.2.6 ADDITIONAL INFORMATION:

9.2.6.1 Caution should be exercised in using general-purpose tapes (those not developed for lifting latents) as they may cause migration of some latent print ridge detail or may have striations or other imperfections making it hard to do comparisons.

9.2.6.2 Lifting should be performed after any necessary photography. The analyst's training and experience will determine the use and/or sequence of the lifting and photographic processes.

9.2.6.3 Store lifting mediums and casting compounds in a cool dry place.

9.2.6.4 Dispose of lifting mediums and casting compounds in the trash.

9.2.7 CONTROLS:
Not applicable

9.2.8 SAFETY:
There are no known health hazards associated with the use of lifting mediums or casting compounds.

9.2.9 REFERENCES:
Scott's Fingerprint Mechanics, Robert D. Olsen, (1978). Pages 369-387.

Fingerprint Techniques, Andre, A. Moenssens, (1971). Pages 109-112.

Friction Ridge Skin, James F. Cowger, (1983). Pages 85-88.

Manual of Fingerprint Development Techniques Home Office Police Scientific Development Branch (1998).

9.3 POWDER DETECTION METHODS

9.3.1 BACKGROUND:
Many commercially produced latent print powders are available and no powder is universally applicable to all types of non-porous surfaces. Most analysts stock a variety of different types and colors of powders as well as a variety of brushes for specialized applications. Powder particles physically adhere to latent print residue allowing the latent print to be visualized. This coloring of the friction ridge residue occurs because the residue has greater adhesion properties than the substrate.

9.3.2 SCOPE:
9.3.2.1 Latent print powders are used to develop invisible ridge detail, improve contrast of visible ridge detail, and to facilitate lifting and preservation of fingerprint evidence from non-porous surfaces.
9.3.2.2 The type of powder that is selected is dependent upon:
9.3.2.2.1 Whether resulting latents will be photographed. If so, a powder color that contrasts with the surface is often desirable.
9.3.2.2.2 The nature of the surface to be processed. Traditional powders are often most effective on non-textured surfaces while magnetic powders are often most effective on plastics and textured surfaces. The use of magnetic powders and wands should generally be avoided on substrates that contain iron. Fluorescent powders tend to have limited use. They are useful on multicolored surfaces or surfaces with a light texture that doesn't accept magnetic powder well.
9.3.2.3 The type of applicator selected is dependent upon:

9.3.2.3.1 The size of area to be dusted. Larger brushes are ordinarily used for large areas and smaller brushes on concentrated work or individual latent prints. Fiberglass brushes are often used for both instances.

9.3.2.3.2 The type of powder to be used. Magnetic wands are used in conjunction with magnetic powders while traditional powders are used with a variety of brushes. Traditional fluorescent powders are applied with a feather brush and their application requires the use of an ALS.

9.3.2.4 The prior use of cyanoacrylate esters often increases the adhesion of powders to latent print residue.

9.3.2.5 Powder processing is not suitable for surfaces that are wet, tacky, or exceptionally rough and is generally the last step in the latent print processing sequence.

9.3.3 EQUIPMENTAND MATERIALS:

Hood/exhaust vents/particulate filters
Traditional, magnetic, and fluorescent powders
Magnetic wand, feather brush, fiberglass brush, animal hair, etc.
Alternate light source
Filtered goggles

9.3.4 PROCEDURE 1 - TRADITIONAL POWDERS:

9.3.4.1 A variety of brushes or applicators may be utilized with the exception of magnetic wands.

9.3.4.2 Apply a small amount of powder to the brush and remove excess powder.

9.3.4.3 Powder should generally be applied to the surface in a smooth circular motion with only the tips of the brush touching the surface. Once the direction of ridge flow can be established, powdering should proceed by following the ridge flow until optimal development is achieved.

9.3.4.4 The adherence of powder to a latent print may be enhanced by utilizing the "huffing technique." Gently breathing on the surface while dusting for latent prints sometimes adds moisture to the latent print residue, thus enabling the powder to adhere more effectively. All visible moisture should be evaporated prior to powder application.

9.3.4.5 If too much powder has been applied, it may be possible to remove excess powder by tapping the object, blowing air over the surface, or by brushing it out.

9.3.4.6 Developed prints are evaluated to determine their suitability for comparison.

9.3.5.7 Prints deemed to be of value are marked and may be photographed or lifted.

9.3.5 PROCEDURE 2 - MAGNETIC POWDERS:

9.3.5.1 Magnetic powders generally utilize a magnetic wand in their application.

9.3.5.2 The wand is dipped into the magnetic powder where the powder is picked up by the tip of the wand. The powder actually forms a bristle-less brush that is then applied directly to the surface. The actual wand should not come in contact with the surface.

9.3.5.3 The application of magnetic powders is similar to the dusting method described in 9.4.4.3 & 9.4.4.4.

9.3.5.4 The plunger located at the end of the brush is pulled to its fully extended position to release the powder from the tip of the brush.

9.3.5.5 Excess powder may be removed by passing a wand over the surface without making contact.

9.3.5.6 Developed prints are evaluated to determine their suitability for comparison.

9.3.5.7 Prints deemed to be of value are marked and may be photographed or lifted.

9.3.6 PROCEDURE 3 - FLUORESCENT POWDERS:

9.3.6.1 A variety of brushes or applicators may be utilized.

9.3.6.2 Lightly dip the brush into the powder. Remove excess powder. A very small amount of fluorescent powder goes a long way.

9.3.6.3 If possible, it is best to use an ALS while applying the powder. This will prevent over powdering and loss of ridge detail. The application of fluorescent powders is similar to the dusting methods described in 9.4.4.3 & 9.4.4.4.

9.3.6.4 Developed prints are evaluated to determine their suitability for comparison.

9.3.6.5 Prints deemed to be of value are marked and may be photographed or lifted. When photographing latents developed with fluorescent powders, it is necessary to use an ALS and a camera filter that corresponds to the color of viewing goggle utilized with the ALS. It is necessary to use black latent lift cards with fluorescent powders.

9.3.7 ADDITIONAL INFORMATION:

9.3.7.1 Occasionally, latent quality may be enhanced by repeated powdering and lifting of the same area.

9.3.7.2 An ample number of appropriate brushes will help preclude cross-contamination of powders and brushes.

9.3.7.3 When powder-processing evidence known to be biologically contaminated, every effort shall be made to avoid cross contamination by utilizing previously unused brushes and powder. Brushes and powder will be discarded after use on contaminated items. Magnetic wands will be disinfected.

9.3.7.4 Powders stored in a cool dry place have an indefinite shelf life.
9.3.7.5 Dispose of powders in the trash.

9.3.8 CONTROLS:
Test impressions are generally not applicable. However, when there is doubt as to the suitability of a powder for processing a particular surface a test impression should be made on a similar surface if available. If a similar surface is not available, then an area of the suspected surface may be explored "blindly" (i.e. wiped clean and used for testing). This test impression shall be destroyed immediately after it has served its purpose.

9.3.9 SAFETY:
9.3.9.1 Safety concerns when using commercial fingerprint powders are minimal.
9.3.9.2 Analysts are required to use the hoods or exhaust vents positioned at each workstation when performing powdering and lifting in the laboratory.
9.3.9.3 When fingerprint powders are to be used for an extended period of time, a dust mask or half face respirator with dust filters should be worn to minimize the inhalation of the powder particles.
9.3.9.4 Persons using fingerprint powders should monitor reactions (if any) to the fingerprint powders.

9.3.10 REFERENCES:
Scott's Fingerprint Mechanics, Robert D. Olsen, (1978), pages 209-235.

Fingerprint Techniques, Andre A. Moenssens, (1971), pages 106-109 and 112-114.

Friction Ridge Skin, James F. Cowger, (1983), pages 85-88.

Manual of Fingerprint Development Techniques Home Office Police Scientific Development Branch (1998).

9.4 SMALL PARTICLE REAGENT

9.4.1 BACKGROUND:
Two types of small particle reagents (SPR) are available for use, traditional SPR which consists of a suspension of fine molybdenum disulfide (MoS_2) particles in a detergent solution and commercially available white SPR. These solutions works like a liquid fingerprint powder by adhering to the fatty portion of the latent print residue resulting in a gray or white colored latent.

9.4.2 SCOPE:

9.4.2.1 Small particle reagent is used to develop latent prints from a variety of surfaces including adhesives and non-porous items that are or have been wet.

9.4.2.2 The color of SPR should be chosen to contrast with the background.

9.4.2.3 SPR may be used by dipping or spraying. Dipping is the preferred method as spraying is less sensitive. It is, however, difficult to prevent damage to fingerprints located on the lower side of an article in a dish and spraying is a valid alternative when processing large items, vehicles, or responding to crime scenes.

9.4.2.4 Surfaces that need other forensic examinations such as biology, questioned document, or trace examinations should be carefully evaluated prior to processing to determine if the SPR procedure will have an impact on subsequent examinations.

9.4.3 EQUIPMENT AND MATERIALS:

Beaker
Balance
Magnetic stirrer/stirring bar
Spray bottles
Processing tray

9.4.4 REAGENTS:

Commercially available white SPR
Molybdenum Disulfide (MoS_2)
Photo Flo 200
Distilled water

Small Particle Reagent Working Solution:

1. Place a 1500 ml beaker on magnetic stirrer base.
2. Add 1000 ml of distilled water to the beaker.
3. Place a magnetic stirring bar in the beaker.
4. Dissolve 30g of MoS_2 in the water (MoS_2 comes in 30g bottles).
5. Add three to four drops of Photo Flo 200 to the solution.

9.4.5 PROCEDURE 1 - DIPPING METHOD:

9.4.5.1 Shake or stir the SPR thoroughly and pour the solution into a tray.

9.4.5.2 Add the item to be processed to the solution. The item should be submerged.

9.4.5.3 Agitate the solution in the tray for 2-3 minutes, remove the item from the SPR and gently rinse with tap water.

9.4.5.4 Allow the surface to dry (if feasible).

9.4.5.5 Developed prints are evaluated to determine their suitability for comparison.

9.4.5.6 Prints deemed to be of value are marked and may be photographed or lifted. Depending on the circumstances, the item may or may not be dried prior to lifting.

9.4.6 PROCEDURE 2 - SPRAY METHOD:

9.4.6.1 Place the SPR into a spray bottle and shake thoroughly. The bottle should be shaken often to keep the MoS_2 in suspension.

9.4.6.2 Spray the SPR onto the item being examined. If the location of the latent print is known, spray the area above the prints and allow the SPR to flow over the prints. Otherwise, spray the area to be examined starting at the top and working downwards.

9.4.6.3 Gently rinse the processed area with tap water and allow it to dry (if feasible).

9.4.6.4 Developed prints are evaluated to determine their suitability for comparison.

9.4.6.5 Prints deemed to be of value are marked and may be photographed or lifted. Depending on the circumstances, the item may or may not be dried prior to lifting.

9.4.7 ADDITIONAL INFORMATION:

9.4.7.1 Pre-mixed molybdenum has an indefinite shelf life. The shelf life the SPR working solutions is at least six months, but shall be tested prior to each use.

9.4.7.2 Excess reagent shall be collected and placed in the hazardous waste container located in the fume hood.

9.4.8 CONTROLS:

9.4.8.1 Testing of SPR is performed each day prior to use.

9.4.8.2 This test involves the making of quality latent prints on a test surface similar to the one being examined.

9.4.8.3 The test print is exposed to the SPR in the same manner as the questioned surface.

9.4.8.4 An analyst shall not proceed with the processing of the evidence until a control test bearing positive results (development of a gray colored latent with traditional SPR or a white colored latent with white SPR) has been carried out and documented in the laboratory case notes and on the control tests work sheet.

9.4.8.5 The area surrounding the intentionally deposited latent print shall serve as a negative control.

9.4.9 SAFETY:

There does not appear to be any health hazards associated with small particle reagent, but the process should be monitored to see if there are any allergies. Lab coats, gloves, and safety glasses should be worn.

9.4.10 REFERENCES:

Manual of Fingerprint Development Techniques, British Home Office, (1998), chapter 4.

Advances in Fingerprint Technology, Henry C. Lee and R.E. Gaensslen, (1991), pages 82-83.

Technical Notes #1-2757, Lightning Powder Co.

9.5 STICKY-SIDE POWDER

9.5.1 BACKGROUND:

Processing adhesives on the sticky sides of tape and other items, such as labels, presents problems in processing. Traditional powders will not work (unless modified) because the adhesive properties cause the powder to obscure latent print deposits. Sticky-side powder is a liquid fingerprint detection method that produces gray-black developed latent prints when applied to adhesive surfaces. Sticky-side powder detects the fatty/oily and/or epithelial cells often left when handling adhesive surfaces.

9.5.2 SCOPE:

9.5.2.1 Sticky-side powder is used to process adhesives. Due to the color of the resulting latent print, sticky-side powder may be more appropriate for certain types of tapes than for others (ex. masking tape vs. electrical tape).

9.5.2.2 When the item to be processed contains both an adhesive side and a non-porous side, the non-porous side should be processed prior to the application of sticky-side powder.

9.5.2.3 Sticky-side powder can be used in two ways, the powder solution can be painted on, or the surface can be immersed in an aqueous solution containing the powder solution.

9.5.2.4 Surfaces that require other forensic examinations, such as trace or biology, should be carefully evaluated prior to processing to determine if this procedure will have an impact on subsequent examinations.

9.5.3 EQUIPMENT AND MATERIALS:

Small glass beaker
Stir rod
Soft brush (animal hair, paint brush, etc.)
Glass tray

9.5.4 REAGENTS:

Sticky-Side powder

Photo-Flo
Black Powder
Liqui-Nox detergent or equivalent
Tap or distilled water

Sticky-Side Powder Working Solution:
1. Mix a solution of water and Photo-Flo in a glass beaker in a 1:1 ratio.
2. Mix approximately equal amounts of sticky-side powder into the Photo-Flo solution to make a liquid that has the consistency of paint. Mix a volume suitable for the application at hand.

Sticky-Side Powder Equivalent Working Solution:
1. Measure out 0.5g of traditional black fingerprint powder and place in a glass beaker.
2. Add 1 ml of water.
3. Add 1 ml of Liqui-Nox or other equivalent detergent.
4. Thoroughly mix the liquid and fingerprint powder.

9.5.5 PROCEDURE:

9.5.5.1 The reagent is painted onto the adhesive surface with soft brush or the item may be submersed in the solution. When using the submersion method, ensure that the adhesive side is up as some agitation may be necessary.

9.5.5.2 Allow the reagent to remain on the surface for 10 to 20 seconds.

9.5.5.3 Rinse with water.

9.5.5.4 Examine the adhesive surface for latent prints. The surface may be reprocessed to improve contrast and/or make the latent print(s) darker.

9.5.5.5 Allow the surface to dry thoroughly.

9.5.5.6 Any suitable latent prints are marked and photographed or covered with a protective cover such as lifting tape or clear plastic.

9.5.6 ADDITIONAL INFORMATION:

9.5.6.1 Pre-mixed sticky-side powder has an indefinite shelf life. The working solution shall be mixed prior to each use.

9.5.6.2 Working solution may be rinsed down the drain or disposed of in the trash.

9.5.7 CONTROLS:

9.5.7.1 Testing of sticky-side powder is performed each day prior to use.

9.5.7.2 This test involves the making of a quality latent print on a test surface similar to the evidence being examined and following the processing procedure.

9.5.7.3 An analyst cannot proceed with the processing of the evidence until a control test bearing positive results (development of a

gray-black print) has been carried out and documented in the laboratory case notes.

9.5.7.4 The area surrounding the intentionally deposited latent print shall serve as a negative control.

9.5.8 SAFETY:

When using sticky-side powder in the previously described manner, there does not appear to be a significant health hazard. When using the powder in the dry form, precautions should be taken to prevent the powder from becoming airborne and possibly inhaled. Small amounts of sticky-side powder can be safely washed down the drain, while larger amounts should be collected in a suitable container for disposal.

9.5.9 REFERENCES:

Journal of Forensic Sciences, Vol. 44, No. 2, "Sticky-Side Powder: The Japanese Solution", Darren S. Burns, pages 133-138.

"Sticky-Side Powder", Technical Note, Lightning Powder Co., (April, 1994).

9.6 TAKING KNOWN EXEMPLARS (REFERENCE STANDARDS)

9.6.1 BACKGROUND:

Known exemplars (reference standards) is a term used to describe friction ridge impressions that are purposely made. These impressions may be made using a number of techniques, including, but not limited to, traditional ink, live scan, and powder/adhesive lift methods. The goal of the process is to produce legible impressions that are suitable for classification and/or comparison.

9.6.2 SCOPE:

9.6.2.1 The following techniques are used when analysts are called upon to take fingerprints of living and/or deceased persons. It is up to the analyst's discretion to determine the appropriate methods for the given circumstances.

9.6.2.2 The section on post-mortem fingerprinting does not signify that the procedures be mandated to the extent that it precludes the use of variations of the procedures or different procedures for recording impressions. Each case is unique as to its requirements and it is up to the analyst to determine the procedure appropriate for the given circumstances. The printer's task is to obtain usable prints; any reasonable technique that accomplishes this is acceptable.

9.6.3 EQUIPMENT AND MATERIALS:

Black printers ink
Brayer & inking plate
Porelon pad
Black fingerprint powder
Fiberglass brush
Identification cards
Adhesive lifts
Needle and syringe
Fingerprinting spoon
Protective apparel

9.6.4 REAGENTS:
Post-mortem injection solution (tissue builder, water, air etc.)

9.6.5 PROCEDURE 1 - KNOWN EXEMPLARS:
9.6.5.1 Insure that the area to be printed is dry and free of debris.
9.6.5.2 Inked Fingerprints
9.6.5.2.1 Place the fingerprint card in the cardholder.
9.6.5.2.2 Beginning with the right thumb, roll the thumb from nail-bed to nail-bed on an inking plate or Porelon pad. Roll the thumb in the same manor on the fingerprint card in the space marked "1. R. Thumb." Roll the thumb with even pressure to avoid smearing.
9.6.5.2.3 Continue this procedure for each finger ensuring the prints are placed in the corresponding box on the fingerprint card.
9.6.5.2.4 If a mistake is made, the analyst may affix an adhesive tab over the error and roll a new print or destroy the card.
9.6.5.2.5 Ink the right and left thumbs and place a plain impression in the corresponding box at the bottom of the fingerprint card. Repeat the procedure with the right and left four fingers simultaneously placing plain impressions in the corresponding boxes at the bottom of the fingerprint card.
9.6.5.2.6 If an amputation, deformity, or injury makes it impossible to print a finger, make a notation to that effect in the individual finger block.
9.6.5.3 Inked Palm Prints
9.6.5.3.1 Place a piece of white paper or palm print card around a cylindrical object (piece of pipe, cardboard tube etc.).
9.6.5.3.2 Using a brayer, apply a thin coat of ink to the palmer friction ridges from the wrist to the tips of the fingers.
9.6.5.3.3 Place the wrist of the inked palm on the paper and roll the cylinder back toward the subject while applying pressure to the palm. This method will produce quality

ridge detail for the entire palmar surface, even hard to capture areas such as the medial and proximal phalanges and the center portion of the palm.

9.6.5.3.4 Individually ink and roll the thenar and hypothenar portions of the palm using the inking plate. The sides of the hand are placed on the inking plate at an approximate 45° angle and partially rolled to ink the correct portion of the palm. The same motion is then repeated to transfer the ink to the palm print sheet. These impressions may be placed on the same sheet if there is adequate room.

9.6.5.3.5 Repeat the above procedure for the other hand.

9.6.5.4 Complete Friction Ridge Exemplars.

9.6.5.4.1 Complete friction ridge exemplars are often referred to as major case prints. They consist of recordings of all friction ridge skin on the palmer surface of the hands and on occasion, the plantar portion of the feet. A complete set of palmar major case prints includes a set of rolled fingerprints, palm prints, sides of palms, sides of fingers (full length), and finger tips.

9.6.5.4.2 These prints may be obtained through traditional inking methods or by using the black powder/adhesive lift method.

9.6.5.5 Black Powder/Adhesive Lift Method

9.6.5.5.1 Lightly powder the portion of friction ridge skin to be printed using a fiberglass brush and black powder.

9.6.5.5.2 Choose an adhesive lift of appropriate size and remove the backing.

9.6.5.5.3 Place the powder-processed skin onto the adhesive lift and ensure that it makes good contact.

9.6.5.5.4 Carefully remove the adhesive from the skin and smooth an acetate cover over the lift avoiding creases and air pockets.

9.6.5.6 All exemplars should be marked with the date, analyst's name, case number (if known) and subject's name (if known).

9.6.6 PROCEDURE 2 – POST-MORTEM EXEMPLARS:

9.6.6.1 Prints may be recovered from the deceased in the same manner as stated above. However, due to injury, decomposition or other circumstances, traditional methods may not yield satisfactory results.

9.6.6.2 Examine the remains to determine the appropriate method.

9.6.6.3 Clean the remains with a soft brush or cloth and warm water.

9.6.6.4 Dry the friction ridge areas to be printed.

9.6.6.5 Choose an appropriate post-mortem method. It is up to the analyst to determine the appropriate procedure for the given circumstances. The following are recommendations only:

9.6.6.5.1 Printing the Recently Deceased

9.6.6.5.1.1 If the body has been refrigerated, it is helpful to allow it to warm near room temperature prior to printing. This will reduce condensation that may interfere with the printing process.

9.6.6.5.1.2 If rigor mortis has set in, attempt to "break the rigor" by forcefully bending the joints back and forth.

9.6.6.5.1.3 If the fingers have begun to wrinkle due to decomposition or exposure, an attempt should be made to pull the skin tight while taking the impression.

9.6.6.5.1.4 If complete impressions still cannot be obtained, this condition may be corrected through the use of a post mortem injection solution.

9.6.6.5.1.4.1 Fill a syringe with a post mortem injection solution.

9.6.6.5.1.4.2 Insert the needle just below the skin at the distal joint of the finger and into the distal phalanx area. Inject the solution until the pattern is rounded out. Care should be taken to prevent the needle from puncturing the skin after the initial insertion. If necessary, a string may be tied just above the site to prevent the solution from leaking out.

9.6.6.5.1.5 Print the finger as outlined in one of the above methods.

9.6.6.5.2 Printing Badly Decomposed or Macerated Remains

9.6.6.5.2.1 In cases of advanced decomposition or extended periods of water immersion, it is common for the epidermal layer of skin to separate from the dermis.

9.6.6.5.2.2 Wash and dry the friction ridge skin.

9.6.6.5.2.3 Attempt to photograph and/or record with ink or powder methods.

9.6.6.5.2.4 If the separated friction ridge skin is too fragile to work with, it may be cleansed,

flattened under a piece of glass, and photographed.

9.6.6.5.2.5 Occasionally, a large portion of the epidermis separates in the form of an "epidermal glove." If this occurs, the skin may be placed on the analyst's gloved hand and the impressions recorded in a traditional fashion. It may be necessary to excise the skin from the underlying tissue if it is still partially attached.

9.6.6.5.2.6 If the epidermal layer is no longer available, it may still be possible to obtain usable prints by photographing the dermis and/or using the black powder lift method.

9.6.6.5.3 Printing Mummified Remains

9.6.6.5.3.1 As the drying process occurs, friction ridge areas may become shrunken, hard, dry, and deeply creased making fingerprinting via traditional means impossible.

9.6.6.5.3.2 Depending on the circumstances, an analyst may attempt traditional ink and/or powder lift methods, photography**,** casting, or re-hydration techniques.

9.6.6.5.3.2.1 See literature for re-hydration solutions.

9.6.6.5.3.2.2 If re-hydration is successful the tissue may be printed as outlined in one of the above methods.

9.6.6.5.4 Printing Burned Remains

9.6.6.5.4.1 Remove hardened and partially loosened skin by gently twisting.

9.6.6.5.4.2 Examine the underside of the skin for friction ridges.

9.6.6.5.4.3 Gently clean the skin using a soft brush and warm water.

9.6.6.5.4.4 Allow the skin to dry.

9.6.6.5.4.5 Photograph and/or attempt to ink, powder and lift, or cast.

9.6.6.6 Examine impressions as soon as they are obtained to ensure that adequate clear impressions have been obtained.

9.6.7 CONTROLS:
Not applicable

9.6.8 SAFETY:

All human tissue shall be treated as if infectious.

9.6.8.2 Gloves, eye protection, lab coat, and/or a protective disposable apron shall be worn at all times when working with any body parts.

9.6.8.3 Utensils shall be disposed of or cleaned and disinfected after use and surfaces will be disinfected.

9.6.9 REFERENCES:

Friction Ridge Skin, Comparison and Identification of Fingerprints, James F. Cowger, (1993) Chapter 2 *Taking Inked Prints*, pages 9-33,

The Science of Fingerprints, U.S. Department of Justice, F.B.I. Laboratory Division, (1984), pages 111-157.

Scotts Fingerprint Mechanics, Robert D. Olsen, SR (1977), pages 55-92.

10 CHEMICAL METHODS

10.1 AMIDO BLACK BLOOD PRINT PROCESSING

10.1.1 BACKGROUND:

Amido Black is also known as Amido Black 10B, Amido Black 12B, Napthol Blue Black, or Napthalene Black. Amido black is a dye that stains the protein portion of blood a blue-black color.

10.1.2 SCOPE:

10.1.2.1 Blood contaminated prints may be processed with amido black to detect faint deposits of friction ridge skin impressions. It is generally used on dried blood stains on non-porous surfaces, but has been successful in developing prints on some semi-porous and porous surfaces as well.

10.1.2.2 Amido black will not detect the normal constituents of latent prints and therefore must be used in the proper sequence with other latent processing methods.

10.1.2.3 The amido black process utilizes a working solution, a rinse solution, and a wash solution (distilled water). Blood must be fixed prior to the application of amido black (unless using methanol in the amido black working solution as a fixing agent) to prevent the liquid solutions used in the process from washing away some or all of the blood deposits.

10.1.2.4 Bloodstains must be carefully examined and evaluated to preclude destruction of potentially valuable evidence. Any samples to be used for the biological examination of blood deposits or trace analysis should be collected prior to enhancement. It is often necessary to coordinate with investigators and/or other laboratory sections (biology for example) to determine which procedures may provide the most valuable findings.

10.1.3 EQUIPMENT AND MATERIALS:

Balance, magnetic stirrer/stirring bar
Pipettes
Beakers
Graduated cylinder
Appropriately sized storage bottles
Squirt bottles

10.1.4 REAGENTS:

Amido Black
Glacial acetic acid
Methanol
Distilled water

Amido Black Working Solution:

1. Weigh out 3-5 grams of amido black and place in a clean, dry beaker.
2. Measure out 100 ml of acetic acid and add to the amido black.
3. Measure out 900 ml of methanol and add to the beaker containing the amido black and acetic acid.
4. Stir the solution with a magnetic stirrer for thirty minutes and transfer the solution to a clean storage bottle.

Amido Black Rinse Solution (de-stain):

1. Measure out 100 ml of acetic acid and pour into a clean, dry glass beaker.
2. Measure the 900 ml of methanol and add it to the beaker.
3. Stir the solution for two to three minutes and transfer the solution to a clean, dry storage bottle.

10.1.5 PROCEDURE:

10.1.5.1 Determine if samples for biology should be taken prior to processing.

10.1.5.2 Conduct control tests.

10.1.5.3 "Fix" impressions using heat, methanol, or super-glue. Blood can be fixed to an object by heating in a 100° centigrade oven for thirty minutes (restricted to non-heat sensitive objects). Methanol may be sprayed or pipetted over the item. The first amido black rinse that contains methanol will suffice for this "fixing" rinse. Super-glue is an effective method for non-porous evidence as it will fix all possible latent prints not just those contaminated with blood.

10.1.5.4 Immerse the item in the amido black working solution for two to three minutes. Alternatively, the item may be sprayed or irrigated with the amido black working solution.

10.1.5.5 Immerse or irrigate the item with the de-stain rinse solution to remove the excess dye.

10.1.5.6 Resulting latent prints are a dark blue-black. The above process may be repeated to improve contrast.

10.1.5.7 Immerse or irrigate the surface with the distilled water wash (optional).

10.1.5.8 Allow the item to dry thoroughly.

10.1.5.9 Developed prints are evaluated to determine their suitability for comparison.

10.1.5.10 Prints deemed to be of value are marked and photographed.

10.1.6 ADDITIONAL INFORMATION:

10.1.6.1 Shelf life of the pre-mixed amido black, working solution, and de-stain is indefinite.

10.1.6.2 Excess reagent shall be collected, when possible, and placed in the hazardous waste container located in the fume hood.

10.1.7 CONTROLS:

10.1.7.1 Testing of amido black is performed each day prior to use.

10.1.7.2 Control tests are performed by the application of the reagent to a slide prepared with known blood. For safety reasons, analysts *will not* prepare friction ridge impressions made with blood. A smear will be applied to the slide instead.

10.1.7.3 An analyst shall not proceed with the processing of the evidence until a control test bearing positive results (known blood staining a blue-black color) has been carried out and documented in the laboratory case notes and on the control tests work sheet.

10.1.7.4 The area surrounding the intentionally deposited blood smear shall serve as a negative control.

10.1.8 SAFETY:

10.1.8.1 Gloves, lab coats, goggles, and respirators, (if there is a chance of the reagents becoming airborne) are worn when mixing or using Amido Black.

10.1.8.2 Glacial acetic acid is corrosive and extremely irritating to the eyes and respiratory system. Avoid breathing the vapors and use in a fume hood, with a respirator, or with adequate ventilation. Glacial Acetic Acid will cause burns if it comes in contact with skin.

10.1.8.3 Methanol is *flammable*. It needs to be handled carefully and non-permeable gloves worn during the mixing and use of Amido Black. Methanol is toxic in quantities as small as 30 ml and should not be allowed to come in contact with the skin, eyes, or mouth. It is possible for methanol to be absorbed through the skin. If methanol comes into contact with the eyes or mouth, the area should be flushed with generous amounts of water and a doctor may be consulted. Inhalation of methanol vapors should be kept at a minimum and the solution should be used in a well-ventilated area.

10.1.8.4 In addition, analysts must be aware of the biological hazards associated with blood and other body fluids and take extra precautions to protect themselves.

10.1.9 REFERENCES:

Manual of Fingerprint Development Techniques, British Home Office, (1998).

Journal of Forensic Identification, Vol. 45, No. 5 Sept/Oct 1995, "Superglue of Latent Shoe Prints in Blood Prior to Processing", pages 498-50.

Proceedings of the International Forensic Symposium on Latent Prints, "Enhance Latent Prints in Blood With New Staining Techniques", Paul Norkus and Kevin Noppinger, page 147.

10.2 CYANOACRYLATE ESTER

10.2.1 BACKGROUND:

Cyanoacrylate ester (CAE) also referred to as "superglue," is sold as a number of brands and in a number of viscosities. Items that are to be processed with CAE need to be exposed to an atmosphere rich in CAE fumes. This may be accomplished through the use of a fuming chamber, superglue-fuming wand, or vacuum chamber.

10.2.2 SCOPE:

10.2.2.1 Fuming with cyanoacrylate esters (super-glue) is a process that is used to visualize latent print deposits on non-porous and some semi-porous objects. CAE processing also prepares the surface for the acceptance of powders and dye-stains that may enable further visualization of the latent prints.

10.2.2.2 When superglue vapors contact moisture and other components of friction ridge residue the cyanoacrylate ester polymerizes fixing the latents to the surface. This makes them more stable and less easily damaged.

10.2.2.3 The process is temperature, humidity, and pressure sensitive.

10.2.2.4 Objects that need additional forensic examinations such as trace or questioned document examinations should be carefully evaluated prior to processing to determine if this procedure will have an impact on subsequent examinations.

10.2.3 EQUIPMENT AND MATERIALS:

Fuming chamber (computerized)
Relatively airtight container such as a tank or sealed plastic bag
Vacuum chamber
Superglue fuming wand
Cups/warm water (optional)
Low temperature heating element (optional)

10.2.4 REAGENTS:

Cyanoacrylate gel or liquid
One shot fuming kit or equivalent
Superglue cartridges

10.2.5 PROCEDURE 1 - TRADTIONAL FUMING CHAMBER:

10.2.5.1 Select the appropriately sized fuming chamber.

10.2.5.2 Place the surface to be processed in the chamber (suspend if possible).

10.2.5.3 Add control test.

10.2.5.4 Add humidity to the chamber via cups of hot water (larger chambers will require more cups, smaller chambers fewer).

10.2.5.5 Allow the chamber to warm (if necessary) and humidity to build (80 degrees Fahrenheit and 80 % humidity is optimal but satisfactory results may be obtained at varying temperatures and humidity levels).

10.2.5.6 Add the CAE source.

10.2.5.6.1 Hot Plate Method - plug in the hot plate and place in the chamber. Add an approximately 2-3 cm in diameter pool of liquid superglue to a disposable aluminum dish and place on the hot plate.

10.2.5.6.2 Gel Packet Method - open and add one or more foil CAE gel packets (dependent on size of chamber, fuming rate, and analyst's preference) to the chamber. Once the gel is exposed to the air, the CAE will begin to vaporize at a controlled rate.

10.2.5.6.3 "ONE-SHOT" fuming kits - place the "activator solution" in the jar provided. Add the "activator canister" to the solution. Empty the CAE on to the top of the "activator canister." This method is generally reserved for crime scene response.

10.2.5.7 Secure the door to the chamber.

10.2.5.8 Fuming times will vary by the size of the chamber, the properties of the cyanoacrylate being used, the amount of heat and humidity, and the properties of the evidence being fumed. Control test should be carefully monitored by the analyst to prevent over or under fuming. Proper development is achieved when ridge characteristics on the control turn slightly white in color and begin to show good contrast. In the event of under fuming, the item may be re-fumed.

10.2.5.9 When development is complete evacuate the CAE fumes and remove the CAE source from the chamber.

10.2.5.10 Remove the item from the chamber and examine for comparable ridge detail.

10.2.5.11 Prints may be marked and photographed at this point, but are more commonly further enhanced with powders or dyes prior to preservation.

10.2.6 PROCEDURE 2 – SUPER GLUE FUMING WAND METHOD

10.2.6.1 In a fume hood or other well ventilated area, place a superglue cartridge over the end of the fuming wand. Select cartridge size dependent upon amount and size of evidence.

10.2.6.2 Set control level to high and ignite the fuming wand. Fumes should be visible once the wand is hot, approximately 1-2 minutes.

10.2.6.3 Lower the heat level if desired.
10.2.6.4 Conduct a control test.
10.2.6.5 Fume the item by holding the fuming wand approximately 4-8 inches away. Fumes from the wand will rise so it is best to direct the fumes below your item if possible or deflect the fumes toward your item. Do not hold the wand too close or in the same area too long as damage and/or over development may occur.
10.2.6.6 Turn the fuming wand off and allow the unit to cool completely prior to removing cartridges or repackaging.
10.2.6.7 Examine item for comparable ridge detail.
10.2.6.8 Prints may be marked and photographed at this point, but are more commonly further enhanced with powders or dyes prior to preservation.

10.2.7 PROCEDURE 3 - VACUUM CHAMBER METHOD
10.2.7.1 Place items of evidence and controls into the vacuum chamber. It is not necessary to unfold garbage bags or leave large amounts of space between the items. *Do not place pressurize items such as sealed cans, bottles etc. in the chamber as they may explode.*
10.2.7.2 Add the CAE source. Foil CAE gel packs are recommended (number is dependent on chamber size and space), but a small dish with liquid CAE may also be used.
10.2.7.3 Place the lid on the vacuum chamber and close the release valve.
10.2.7.4 Turn on the vacuum pump.
10.2.7.5 Open the Gas Ballast Valve about one half turn.
10.2.7.6 Open the Isolation Valve (up position). If necessary, press on the lid until the chamber begins to evacuate.
10.2.7.7 Close the Gas Ballast Valve.
10.2.7.8 Evacuate the chamber to approximately 25 inches of mercury as shown on the chamber gauge.
10.2.7.9 Close the Isolation Valve.
10.2.7.10 Open the Gas Ballast Valve, wait 2-3 seconds and turn off the pump.
10.2.7.11 Close the Gas Ballast Valve.
10.2.7.12 Leave the items under vacuum for at least 20 minutes. There is no danger of over fuming.
10.2.7.13 Evacuate the chamber by slowly opening the release valve.
10.2.7.14 Remove glue and evidence. Examine item for comparable ridge detail.
10.2.7.15 Prints may be marked and photographed at this point, but are more commonly further enhanced with powders or dyes prior to preservation.

10.2.8 PROCEDURE 4 – CYANOACRYLATE FUMING CHAMBER:

10.2.8.1 Turn on power

10.2.8.2 The menu screens are designed to prompt the use of action to be taken to complete a full cycle. Screen is touch operated. Do not tap on screen with any object that could damage it.

10.2.8.3 Upon start-up the unit will load software and self calibrate.

10.2.8.4 Once running, the unit will prompt the user for each activity.

10.2.8.5 Set the desired humidity level and fuming time. The unit default is 80% RH for 15 minutes.

10.2.9 ADDITIONAL INFORMATION:

10.2.9.1 In the event of over-fuming, it may be possible to use an adhesive lifting technique (tape, gel lifter etc.) to lift away heavy upper deposits, revealing underlying ridge detail.

10.2.9.2 The “foil packets" may be stored at room temperature and have a shelf life of six months to a year. Liquid CAE and cartridges may be stored at room temperature with an indefinite shelf life.

10.2.9.3 CAE may be disposed of in the trash.

10.2.9.4 Analysts shall read the manufactures operating instructions for the super glue fuming wand and vacuum chambers prior to operating this equipment.

10.2.10 CONTROLS:

10.2.10.1 Testing of CAE and processing are performed at the same time.

10.2.10.2 A quality test print is applied to a non-porous surface and put into the tank in an easily-monitored position with the questioned surface. Placing one’s own fingerprints on a black latent lift card works well for this purpose.

10.2.10.3 When the development of the control test is complete, the questioned surface is also finished. Positive results are indicated by development of a white print.

10.2.10.4 The area surrounding the intentionally deposited latent print shall serve as a negative control.

10.2.10.5 Results of control tests shall be documented in the laboratory case notes.

10.2.11 SAFETY:

10.2.11.1 Super glue fuming should only be conducted in well-ventilated areas. Precautions should be taken to avoid inhaling or allowing the vapors to contact the eyes, as the vapors can be irritating to the eyes, nose, and throat. Persons wearing contact lenses should not open CAE chambers without taking proper precautions. Non-vented goggles should be worn.

10.2.11.2 Precautions include using relatively sealed CAE chambers and evacuating the fumes from the chambers prior to removal of the questioned and test surfaces.

10.2.11.3 Gloves should be worn to prevent the cyanoacrylate from contacting the skin. If liquid glue is allowed to contact the skin, adhesion may result. If the skin sticks together, immerse affected areas in warm water. This will loosen the skin so that it can be gently pulled apart.

10.2.12 REFERENCES:

"Methods of Latent Print Development", Henry C. Lee and R. E. Gaensslen, 1987 Proceedings of the International Symposium on Latent Prints, pages 15-23.

Advances in Fingerprint Technology, Henry C. Lee and R. E. Gaensslen, (1991).

Journal of Forensic Identification, Vol.46, No. 4 July/August, 1996; Vol. 46, No. 1 January/February, 1996.

Coleman Vacu-Print Instructions and Notes, Lightning Powder, (1995).

Manual of Fingerprint Development Techniques, British Home Office, Chapter 4, (1998).

Air Science, Operating Manual: SAFEFUME Cyanoacrylate Fuming Chamber, Rev 2 July-11-2008.

10.3 1,8 Diazfluoren-9-one (DFO)

10.3.1 BACKGROUND:

1,8 Diazfluoren-9-one is an analogue of the ninhydrin molecule. DFO develops latent prints containing amino acids. Resulting prints must be excited with an alternate light source in order to be visualized.

10.3.2 SCOPE:

10.3.2.1 DFO is used to develop prints on porous surfaces such as paper and cardboard.

10.3.2.2 DFO will detect latent prints on porous surfaces that ninhydrin will not and the reverse is also true. It does not replace ninhydrin but is used addition to it.

10.3.2.3 DFO should be used after iodine and prior to ninhydrin or physical developer.

10.3.2.4 Surfaces that need other forensic examinations such as trace or questioned document examinations should be carefully evaluated prior to processing to determine if this procedure will have an impact on subsequent examinations.

10.3.3 EQUIPMENT AND MATERIALS:
Fume hood
Balance
Magnetic stirrer/stirring bar
Alternate light source/filtered goggles
Lab oven
Beaker
Graduated cylinder

10.3.4 REAGENTS:
DFO
Methanol
Ethyl acetate
Acetic acid
Petroleum ether

DFO Stock Solution:
1. In a fume hood, dissolve 0.5 gram of DFO powder in 100 ml of methanol. This may be facilitated by use of a magnetic stirrer.
2. Add 100 ml of ethyl acetate and mix thoroughly.
3. Add 20 ml of acetic acid.
4. Store stock solution in a dark brown glass or polypropylene bottle.

DFO Working Solution:
1. Add 220 ml of stock solution to 780 ml of petroleum ether.
2. Mix thoroughly.

If less working solution is desired, halve or quarter the stock solution and petroleum ether accordingly.

10.3.5 PROCEDURE:
10.3.5.1 Conduct control tests.
10.3.5.2 Pour a sufficient amount of the working solution into a glass tray.
10.3.5.3 Dip the evidence into the solution for ten seconds (DFO may also be painted on). Although it is possible to spray this solution, it is *not recommended* due to the health hazards involved and its inability to soak the specimen adequately.
10.3.5.4 Allow to dry for approximately three minutes.
10.3.5.5 Repeat 10.3.5.3 and 10.3.5.4.
10.3.5.6 Apply dry heat.

10.3.5.6.1 When using a heat/humidity chamber, the specimen should be heated for ten minutes at 100° C (212° F) with a dry heat.

10.3.5.6.2 A hair dryer or dry iron will work as an alternative to an oven. Place a thick towel or other protective material on the counter, followed by the evidence, and then a few paper towels. Apply dry heat to the surface for several minutes. A dry iron can be placed directly on top of the paper towels and used the same as when ironing clothes. One advantage to this method is that it is possible to stop heating and check the progress with an alternate light source. If the latent prints are not very bright, continue to heat. Added heating time may improve resulting print development.

10.3.5.7 DFO-developed latent prints may or may not be visible to the naked eye and should be viewed under an alternate light source. DFO fluoresces when illuminated with monochromatic light in the 485 nm to 510 nm range.

10.3.5.8 Developed prints are evaluated to determine their suitability for comparison.

10.3.5.9 Prints deemed to be of value are marked and photographed using the ALS and a filter on the camera (orange or red).

10.3.5.10 Faint latent prints may be made to fluoresce brighter with a second or third application of DFO. The second and third applications of DFO (if necessary) are performed in the same manner as the first.

10.3.6 ADDITIONAL INFORMATION:

10.3.6.1 Shelf life of pre-mixed DFO is indefinite. The shelf life of the DFO stock solution and working solution is six months.

10.3.6.2 Excess reagent shall be collected and placed in the hazardous waste container located in the fume hood.

10.3.7 CONTROLS:

10.3.7.1 Testing of DFO is performed each day prior to use.

10.3.7.2 This test involves the making of a quality latent print on a test surface similar to the evidence being examined and following the processing procedure.

10.3.7.3 The test is illuminated with an alternate light source as outlined in 8.1.

10.3.7.4 An analyst shall not proceed with the processing of the evidence until a control test bearing positive results (yellow-green fluorescence) has been carried out and documented in the laboratory case notes and on the control tests work sheet.

10.3.7.5 The area surrounding the intentionally deposited latent print shall serve as a negative control.

10.3.8 SAFETY:

10.3.8.1 DFO has not been fully investigated for potential health hazards but is thought to be similar to ninhydrin, which may act as an irritant. Gloves, lab coats, and safety glasses should be worn when mixing and using DFO. The application of the DFO working solution should be performed in a fume hood, well-ventilated area, or while wearing an air-purifying respirator equipped with an organic vapor cartridge.

10.3.8.2 Glacial acetic acid is *corrosive* and extremely irritating to the eyes and respiratory system. Avoid breathing the vapors and use in a fume hood or with adequate ventilation. Glacial acetic acid will cause burns if it comes in contact with skin.

10.3.8.3 Methanol needs to be handled carefully and non-permeable gloves worn during mixing and use. Methanol is toxic in quantities as small as 30 ml and should not be allowed to come in contact with the skin, eyes, or mouth. It is possible for methanol to be absorbed through the skin. If methanol comes into contact with the eyes or mouth, the area should be flushed with generous amounts of water and a doctor may be consulted. Inhalation of methanol vapors should be kept at a minimum and the DFO should be used in a well-ventilated area.

10.3.9 REFERENCES:

Manual of Fingerprint Development Techniques, British Home Office, Chapter 4, (1998).

Technical Notes #1-0038, Lightning Powder Co., 1,8-Diazafluoren-9-One (DFO)

10.4 GENTIAN VIOLET

10.4.1 BACKGROUND:

Gentian Violet or Crystal Violet, is a biological stain used to dye epithelial cells and fatty components of latent print residues an intense purple color. Due to the toxic nature of this reagent, it should only be used in small quantities with the appropriate safety precautions observed.

10.4.2 SCOPE:

10.4.2.1 Gentian violet is a dye stain used in the laboratory to visualize latent print deposits on many types of adhesive surfaces.

10.4.2.2 Gentian violet may also be used on small non-porous surfaces contaminated with grease and oils. It is not suitable for water-soluble adhesives or porous surfaces.

10.4.2.3 Surfaces that need other forensic examinations such as biology or trace should be carefully evaluated prior to processing to determine if this procedure will have an impact on subsequent examinations.

10.4.3 EQUIPMENT AND MATERIALS:

Balance
Magnetic stirrer/stirring bar
Graduated cylinder
Glass beaker
Glass tray
Storage bottles

10.4.4 REAGENTS:

Gentian Violet or crystal violet
Distilled water

Gentian Violet Working Solution:

1. Weigh out 1 gram gentian violet.
2. Measure 1000 ml of distilled water and pour into glass beaker.
3. Slowly add the gentian violet.
4. Stir for approximately twenty-five minutes or until completely dissolved.

10.4.5 PROCEDURE:

10.4.5.1 Pour a sufficient quantity of working solution into a glass tray.

10.4.5.2 Conduct control tests.

10.4.5.3 Immerse the adhesive substrate into the working solution for 1-2 minutes.

10.4.5.4 Rinse with cool tap water. Developed latents will appear purple in color.

10.4.5.5 The above process may be repeated until optimal development of latents is achieved.

10.4.5.6 Developed prints are evaluated to determine their suitability for comparison.

10.4.5.7 Prints deemed to be of value are marked and may be photographed or lifted.

10.4.6 ADDITIONAL INFORMATION:

10.4.6.1 Shelf life of pre-mixed gentian violet and working solution are indefinite.

10.4.6.2 Excess reagent shall be collected and placed in the hazardous waste container located in the fume hood.

10.4.7 CONTROLS:

10.4.7.1 Testing of gentian violet is performed each day prior to use.

10.4.7.2 This test involves the making of a quality latent print on a test surface similar to the evidence being examined and following the processing procedure.

10.4.7.3 An analyst cannot proceed with the processing of the evidence until a control test bearing positive results (development of a purple print) has been carried out and documented in the laboratory case notes.

10.4.7.4 The area surrounding the intentionally deposited latent print shall serve as a negative control.

10.4.8 SAFETY:

10.4.8.1 Gentian violet/crystal violet is a suspected human carcinogen. It is known to effect the kidney, ureter, bladder, and thyroid of animals. It can be harmful if inhaled, and is irritating to the eyes and skin.

10.4.8.2 Gentian violet should not be used in large amounts.

10.4.8.3 A respirator should be used when working with the dry form. Gentian violet should be prepared and used in a fume hood or well-ventilated area. The analyst should wear a lab coat, heavy-duty (non-disposable) gloves, and safety glasses.

10.4.9 REFERENCES:

Chemical Formulas and Processing Guide for Developing Latent Prints, FBI, (1994).

Lightning Powder Technical Notes, "Crystal Violet," (2000).

Processing Guide for Developing Latent Prints, "Gentian Violet," USDJ/FBI, (2000).

10.5 1,2 INDANDIONE

10.5.1 BACKGROUND:

1,2 Indanedione is an amino acid reagent that is used to develop and visualize latent prints on porous surfaces. It produces only pale pink colored prints upon exposure to ambient light. However, the prints fluoresce strongly when examined using a forensic alternate light source (ALS) with wavelengths between 450nm and 570nm using an orange or red filter. The addition of a Zinc Chloride solution was found to enhance the fluorescence results obtained with the 1,2 Indanedione reagent.

10.5.2 SCOPE:

10.5.2.1 1,2 Indanedione is used to develop prints on porous surfaces such as paper and cardboard. It can replace Ninhydrin as the

primary processing technique used on porous materials. When replacing Ninhydrin, it should be used after Iodine processing and prior to processing with Physical Developer.

10.5.2.2 However, if used in conjunction with Ninhydrin, it should be used after processing with Iodine and Ninhydrin and prior to processing with Physical Developer.

10.5.2.3 Surfaces that need other forensic examinations such as handwriting analysis, body fluid examinations, or trace examinations should be carefully evaluated prior to processing to determine if this procedure will have an impact on subsequent examinations.

10.5.3 EQUIPMENT AND MATERIALS:

Scale
Graduated cylinders
Balance
Magnetic stir bar
Spatula
Beaker
Forensic Alternate Light Source (ALS)
Laboratory oven and/or Clothing Iron

10.5.4 REAGENTS:

1,2 Indanedione
Zinc Chloride
Methylene Chloride (Dichloromethane)
Ethyl Acetate
Glacial Acetic Acid
Absolute Ethanol
Petroleum Ether

10.5.5 Mixing Procedure

10.5.5.1 Working Solution 1:

1,2 Indanedione .	1 gram
Methylene Chloride	30 mL
Ethyl Acetate	60 mL
Glacial Acetic Acid	10 mL
Petroleum Ether	900 mL

10.5.5.1.1 Dissolve 1 gram of 1,2 Indanedione into 30 mL of Methylene Chloride. Next add 60 mL of Ethyl Acetate and stir. Next, add 10 mL of Glacial Acetic Acid followed by 900 mL of Petroleum Ether and stir.

10.5.5.2 Working Solution 2:

Zinc Chloride	0.4 grams
Absolute Ethanol	10 mL
Ethyl Acetate	1 mL
Petroleum Ether	190 mL

10.5.5.2.1 Dissolve 0.4 grams of Zinc Chloride into 10 mL of Absolute Ethanol. Next add 1 mL of Ethyl Acetate followed by 190 mL of Petroleum Ether and stir.

10.5.5.3 Final 1,2 Indanedione and Zinc Chloride Working Solution:
100 mL of Working Solution I
8 mL of Working Solution 2
10.5.5.3.1 Add 8 mL of Working Solution 2 to 100 mL of Working Solution 1 and stir. Working solutions should be stored in dark brown glass bottles in a darkened area. Shelf life is approximately 3 months. Excess Reagent shall be collected and placed in the hazardous waste container located in the fume hood.

10.5.6 PROCEDURE:

10.5.6.1 Dip the evidence into the solution for five seconds (the solution may also be painted on). Although it is possible to spray this solution, it is *not recommended* due to the health hazards involved and its inability to soak the specimen adequately.

10.5.6.2 Allow the item to dry for approximately three minutes and then apply dry heat. When using a heat/humidity chamber, the specimen should be heated for fifteen minutes at 100° C (212° F) with a dry heat. A hair dryer or dry iron will work as an alternative to an oven. Place a thick towel or other protective material on the counter, followed by the evidence, and then a few paper towels. Apply dry heat to the surface for several minutes. A dry iron can be placed directly on top of the paper towels and used the same as when ironing clothes. One advantage to this method is that it is possible to stop heating and check the progress with an alternate light source.

10.5.6.3 If the latent prints are not very bright, continue to heat. Added heating time may improve resulting print development. 1,2 lndanedione developed latent prints may or may not be visible to the naked eye and should be viewed under an alternate light source. 1,2 Indanedione fluoresces when illuminated with monochromatic light in the 450 nm to 570 nm range using an orange or red barrier filter.

10.5.6.4 Prints deemed to be of value should be marked and photographed. Prints developed with 1,2 lndanedione tend to fade over time if exposed to bright light. Therefore, the prints should be photographed as soon as possible after development
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10.5.7 CONTROLS:

10.5.7.1 Testing of the 1,2 Indanedione working solution is performed each day prior to use.

10.5.7.2 This test involves the making of a quality latent print on a test surface similar to the evidence being examined and following the processing procedure.

10.5.7.3 An analyst cannot proceed with the processing of the evidence until a control test bearing positive results has been carried out and documented in the laboratory case notes.

10.5.7.4 The area surrounding the intentionally deposited latent print shall serve as a negative control.

10.5.7.5 Working solutions should be stored in dark brown glass bottles in a darkened area. Shelf life is approximately 3 months.

10.5.8 SAFETY:

10.5.8.1 Eye protection, a lab coat, and rubber gloves should be worn. All mixing and application of chemicals should be done inside a ventilated laboratory fume hood. Excess Reagent shall be collected and placed in the hazardous waste container located in the fume hood.

10.5.8.1.1 1,2 Indanedione

May be harmful by inhalation, ingestion, and skin absorption. May cause skin and eye irritation.

10.5.8.1.2 Zinc Chloride

Very hazardous in case of skin contact (irritant), eye contact (irritant), ingestion, or inhalation. Hazardous in case of skin contact (corrosive, permeator), or eye contact (corrosive). Classified as a possible human mutagen.

10.5.8.1.3 Dichloromethane (Methylene Chloride)

Very hazardous in case of eye contact (irritant), ingestion, of inhalation. Hazardous in case of skin contact (irritant, permeator). Inflammation of the eye is characterized by redness, watering, and itching. Classified as a possible human carcinogen.

10.5.8.1.4 Ethyl Acetate

Hazardous in case of ingestion or inhalation. Slightly hazardous in case of skin contact (irritant, permeator) or eye contact (irritant). The substance is toxic to mucous membranes and the upper respiratory tract. The substance may be toxic to blood, kidneys, liver, or the central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. Flammable.

10.5.8.1.5 Glacial Acetic Acid

Causes severe irritation and burns. May be harmful if swallowed. Avoid breathing vapor or dust. Corrosive! Persons with pre-existing skin, eye and respiratory conditions will be more susceptible. Acute: Severe

irritation or burns to skin, eyes, respiratory tract, GI tract. Chronic: Dermatitis, eye damage, lung damage.

10.5.8.1.6 Absolute Ethanol

Causes severe eye irritation. Flammable liquid and vapor. Causes respiratory tract irritation. This substance has caused adverse reproductive and fetal effects in humans. May cause central nervous system depression. May cause liver, kidney and heart damage. Causes moderate skin irritation.

10.5.8.1.7 Petroleum Ether

Hazardous in case of eye contact (irritant), ingestion, or inhalation. Slightly hazardous in case of skin contact (irritant, permeator). Flammable.

10.6 LEUCOCRYSTAL VIOLET

10.6.1 BACKGROUND:

Leucocrystal Violet is a biological stain used to dye the blood hemoglobin components of impression residues an intense purple color. Due to the toxic nature of this reagent, it should only be used in small quantities with the appropriate safety precautions observed.

10.6.2 SCOPE:

10.6.2.1 Leucocrystal violet is a dye stain used to visualize impression deposits in blood on many types of non-porous and semi-porous surfaces such as some papers, metal and plastic as well as adhesive surfaces.

10.6.2.2 Leucocrystal violet may also be used on small non-porous surfaces contaminated with grease and oils. It is not suitable for water-soluble adhesives or porous surfaces.

10.6.2.3 Surfaces that need other forensic examinations such as biology or trace should be carefully evaluated prior to processing to determine if this procedure will have an impact on subsequent examinations.

10.6.3 EQUIPMENT AND MATERIALS:

Balance
Magnetic stirrer/stirring bar
Graduated cylinder
Glass beaker
Glass tray
Storage bottles

10.6.4 REAGENTS:

Leucocrystal Violet
5-sulfosalicylic acid

3% hydrogen peroxide
Distilled water

10.6.4.1 Formula "A"
10.6.4.1.1 Dissolve 10g of 5-sulfosalicylic acid in 100ml distilled water.
10.6.4.1.2 Add 400ml 3% hydrogen peroxide to sulfosalicylic acid solution.
10.6.4.1.3 Immediately prior to use, add 0.75g leucocrystal violet to above. Stir the mixture vigorously.

10.6.4.2 Formula "B"
10.6.4.2.1 10g 5-sulfosalicylic acid dissolved in 500ml 3% hydrogen peroxide.
10.6.4.2.2 Add 3.7g sodium acetate and 1.0g leucocrystal violet. Sir the mixture vigorously.

10.6.5 PROCEDURE:
10.5.5.1 Determine if samples for biology should be taken prior to processing.
10.6.5.2 Conduct control tests.
10.6.5.3 Spray the impression using a fine mist sprayer. Items may also be soaked or the surface flooded with the solution.
10.6.5.4 Development of dark purple impressions should occur in 30 seconds.
10.6.5.5 Developed impressions are evaluated to determine their suitability for comparison.
10.5.5.6 Impressions deemed to be of value are marked and shall be photographed and/or lifted.

10.6.6 ADDITIONAL INFORMATION:
10.6.6.1 Shelf life of the working solution is approximately 3 months.
10.6.6.2 Excess reagent shall be collected and placed in the hazardous waste container located in the fume hood.

10.6.7 CONTROLS:
10.6.7.1 Testing of leucocrystal violet is performed prior to use.
10.6.7.2 This test involves the making of a mark in blood on a slide and following the processing procedure.
10.6.7.3 An analyst cannot proceed with the processing of the evidence until a control test bearing positive results (development of a purple mark) has been carried out and documented on the Reagent Preparation Log sheet or control tests work sheet.
10.6.7.4 The area surrounding the intentionally deposited mark shall serve as a negative control.

10.6.8 SAFETY:

10.6.8.1 Leucocrystal violet may be harmful by inhalation, ingestion, or skin absorption. May cause skin and eye irritation. May cause irritation to mucous membranes and upper respiratory tract.

10.6.8.2 Leucocrystal violet should not be used in large amounts.

10.6.8.3 A respirator should be used when working with the dry form. Leucocrystal violet should be prepared and used in a fume hood or well-ventilated area. The analyst should wear a lab coat, heavy-duty (non-disposable) gloves, and safety glasses.

10.6.8.4 In addition, analysts must be aware of the biological hazards associated with blood and other body fluids and take extra precautions to protect themselves.

10.6.9 REFERENCES:

Bodziak, William J., "Use of Leucocrystal Violet to Enhance Shoe Prints in Blood", Forensic Science International, Vol. 82, No. 1, September 1996.

Chemical Formulas and Processing Guide for Developing Latent Prints, US Department of Justice, 1994, pp 47-48.

Fisher, John F., "An Aqueous Leucocrystal Violet Enhancing Reagent for Blood Impressions", Symposium on the Forensic Aspects of Footwear and Tire Impression Evidence, FBI Academy, 1994.

10.7 NINHYDRIN

10.7.1 BACKGROUND:

Ninhydrin, triketohydrindene hydrate, reacts with the amino acids and proteins present in the latent print deposit to produce a characteristic purple color (Rhuemann's Purple). The combination of heat and humidity accelerates the reaction of the amino acids and ninhydrin.

10.7.2 SCOPE:

10.5.2.1 Ninhydrin is the most commonly used method for porous and semi-porous substrates. Excessive background discoloration may occur in substrates composed of a high plant or animal protein content (ex. leather and currency). It is it not effective on items that have been wet.

10.7.2.2 Ninhydrin processing should be performed after iodine and DFO processing and prior to physical developer.

10.7.2.3 Latent prints composed of blood can often be successfully darkened with the application of ninhydrin. This may be used on porous items as well as non-porous surfaces. To allow for

further processing, non-porous surfaces should be processed with cyanoacrylate esters prior to the application of the ninhydrin reagent.

10.7.2.4 Surfaces that need other forensic examinations such as questioned document examinations should be carefully evaluated prior to processing to determine if this procedure will have an impact on subsequent examinations.

10.7.3 EQUIPMENT AND MATERIALS:

Balance
Magnetic stirrer/stirring bar
Beaker
Graduated cylinder
Glass trays
Brushes or tongs
Steam iron or heat/humidity chamber

10.7.4 REAGENTS:

N-Hexane
Acetic acid
2-propanol (isopropyl alcohol)
Ninhydrin crystals

Ninhydrin Stock Solution:

1. Place a one-liter beaker on the magnetic stirrer.
2. Add 300 ml of 2-propanol to the beaker.
3. Add 100 ml of acetic acid.
4. Place the stirring bar in the beaker and turn the stirrer on to a low level.
5. Add 50g of ninhydrin crystals to the solution. It may take up to two hours for the ninhydrin to dissolve.

Ninhydrin Working Solution:

1. Add 30ml of the ninhydrin stock solution to a one-liter beaker.
2. Fill the beaker to the 1-liter mark with N-Hexane.
3. Stir and clarify with 2-propanol as needed.
4. Upon standing in its storage container, some of the ninhydrin will "fall out of solution" causing a visible yellow layer at the bottom. Do not dip, brush, or spray items with this yellow layer.

10.7.5 PROCEDURE 1 - POROUS SUBSTRATES:

10.7.5.1 Conduct control tests.

10.7.5.2 Saturate the item with the ninhydrin working solution in a fume hood. Dipping is the preferred method, though brushing the solution on works well with large items. Spraying is the least

desirable of the application options as this allows the solution to become airborne.

10.7.5.3 Allow the item to dry.

10.7.5.4 Expose the item to a warm (approximately 80°C) and humid atmosphere (approximately 65%-wet bulb temp.70°C for heat/humidity chamber). This can be accomplished in a heat/humidity chamber or with a hand held steam iron. The moving steam iron should remain approximately 1-2 inches above the surface, never being allowed to touch, as accidental contact will result in excessive discoloration.

10.7.5.5 Developed prints are evaluated to determine their suitability for comparison.

10.7.5.6 Prints deemed to be of value are marked and photographed as they may fade with time and may not be retrievable with reprocessing. It may be possible to increase the contrast between ninhydrin-developed prints and the substrate by black and white photography utilizing a green camera filter or through digital enhancement.

10.7.5.7 It is recommended that the item be re-examined after approximately 24 hours to ensure that no additional latent prints have developed.

10.7.6 PROCEDURE 2 - BLOOD ENHANCEMENT:

10.7.6.1 Determine if samples for biology should be taken prior to processing.

10.7.6.2 Conduct control tests.

10.7.6.3 "Fix" impressions using heat or methanol.
Blood can be fixed to the object by heating in a 100° centigrade oven for one hour (restricted to non-heat sensitive objects). Heat fixing may ruin latent prints that are composed of normal latent print constituents. Methanol may be pipetted over the item and limited to the stain so that the remainder of the surface is unaffected. Three or four applications of methanol are needed to fix the stain. Failure to fix the stain does not always render a poorer quality latent print.

10.6.6.4 Apply the working solution to the stain and allow the item to remain at room temperature for approximately 48 hours. The ninhydrin will turn the protein component of the blood/serum stain a dark purple and may develop portions of the latent not previously seen.

10.7.6.5 Developed prints are evaluated to determine their suitability for comparison.

10.7.6.6 Prints deemed to be of value are marked and photographed as they may fade with time and may not be retrievable with reprocessing.

10.7.7 ADDITIONAL INFORMATION:

10.7.7.1 Shelf life of pre-mixed ninhydrin is indefinite. The shelf life of the ninhydrin stock solution and working solution is up to one year.

10.7.7.2 Excess reagent shall be collected and placed in the hazardous waste container located in the fume hood.

10.7.8 CONTROLS:

10.7.8.1 Testing of the ninhydrin working solution is performed each day prior to use.

10.7.8.2 This test involves the making of a quality latent print on a test surface similar to the evidence being examined and following the processing procedure.

10.7.8.3 An analyst cannot proceed with the processing of the evidence until a control test bearing positive results (development of a purple print) has been carried out and documented in the laboratory case notes.

10.7.8.4 The area surrounding the intentionally deposited latent print shall serve as a negative control.

10.7.9 SAFETY:

10.7.9.1 Gloves, lab coat, and eye protection shall be worn when using or mixing ninhydrin. Precautions should also be taken to avoid inhalation of the fumes.

10.7.9.2 The solvent used in the ninhydrin working solution, Hexane, is *extremely flammable* and the solution is to be used or mixed in a fume hood or in another well-ventilated area. Ensure that ninhydrin treated items are completely dry prior to exposing to the heat source.

10.7.9.3 Glacial acetic acid is *corrosive* and extremely irritating to the eyes and respiratory system. Avoid breathing the vapors and use in a fume hood or with adequate ventilation. Glacial acetic acid will cause burns if it comes in contact with skin.

10.7.9.4 2-Propanol, also known as Isopropyl Alcohol, is *flammable*. It is an irritant, and can be harmful if inhaled. Avoid breathing the vapors and use in a fume hood or with adequate ventilation.

10.7.10 REFERENCES:

Fingerprint Techniques, Andre A. Moenssens, (1971), pages 122-126.

Friction Ridge Skin, James F. Cowger, (1983), pages 96-98.

Processing Guide for Developing Latent Prints, FBI (2001).

Scott's Fingerprint Mechanics, Robert D. Olsen, (1978), pages 285-288.

10.8 PHYSICAL DEVELOPER (PD)

10.8.1 BACKGROUND:

Physical developer is a silver-based aqueous reagent that reacts with lipids, fats, oils, and waxes present in the fingerprint residue to form a silver-gray deposit.

10.8.2 SCOPE:

10.8.2.1 Physical developer is a method used for the development of latent prints on porous substrates. It is not suitable for non-porous surfaces.

10.8.2.2 This method is the final step in the sequential processing of porous items.

10.8.2.3 Physical developer is the only method to show adequate results on paper that has been wet, and has shown good results on paper currency.

10.8.2.4 Surfaces that need other forensic examinations such as body fluid, trace, or questioned document examinations should be carefully evaluated prior to processing to determine if this procedure will have an impact on subsequent examinations.

10.8.3 EQUIPMENT AND MATERIALS:

Graduated cylinder
Glass trays
Plastic tongs

10.8.4 REAGENTS:

Physical Developer Kit (parts A & B)

1. Any contamination may ruin the physical developer working solution. To avoid contamination use clean glassware rinsed with tap water, then with distilled water prior to beginning.
2. Add 5 ml of solution A (20% silver nitrate solution) to 90 ml of solution B (reductant solution) in a beaker.
3. Stir the working solution for approximately one minute with a clean glass/plastic stirring rod.
4. Do not mix the working solution until you are ready to use it as it does not have a very long shelf life once mixed.

10.8.5 PROCEDURE:

10.8.5.1 Arrange the glass trays in the stainless steel sink so that the evidence can be moved easily from one tray to another in the proper sequence.
10.8.5.2 Add the physical developer working solution to its dedicated glass tray.
10.8.5.3 Use plastic photographic tongs or plastic forceps without serrated edges to add or remove articles from PD solutions. Do not use metal tools.
10.8.5.4 Conduct control tests.
10.8.5.5 Immerse the item and gently rock the tray for approximately 5-15 minutes until friction ridge development is complete or adequate time has elapsed (analyst's discretion).
10.8.5.6 Remove the item from the physical developer working solution and place into a tray with running tap water. Rinse until the water runs clear.
10.8.5.7 Dry completely.
10.8.5.8 Developed prints are evaluated to determine their suitability for comparison.
10.8.5.9 Prints deemed to be of value are marked and photographed.

10.8.6 ADDITIONAL INFORMATION:
10.8.6.1 Cleanliness is important in the physical developer method. A good deal of the instability in the earlier solutions was a result of laboratory equipment that was not spotless. Some contaminants, especially salts, will cause the silver nitrate in the solution to come out of suspension thus spoiling the physical developer solution and perhaps ruining the item being examined. It is important to keep the glassware spotless and rinsed with distilled or de-ionized water prior to use. When washing glassware, use detergent, not abrasive cleaners.
10.8.6.2 Physical developer will cause dark stains on many surfaces. Care must be taken to avoid spills in the laboratory. Full strength chlorine bleach will usually remove any stains from counter tops and floors, but the bleach may cause damage to fabrics stained with physical developer.
10.8.6.3 Shelf life for ready to use kit (un-mixed) is six months from date of purchase. The reagent shall be mixed upon each use.
10.8.6.4 Excess reagent shall be collected and placed in the hazardous waste container located in the fume hood.

10.8.7 CONTROLS:
10.8.7.1 Testing of physical developer is performed prior to each use.
10.8.7.2 This test involves the making of a quality (oil based) latent print on a test surface similar to the evidence being examined and following the processing procedure.

10.8.7.3 An analyst shall not proceed with the processing of the evidence until a control test bearing positive results (development of a silver-gray print) has been carried out and documented in the laboratory case notes and on the control tests work sheet.

10.8.7.4 The area surrounding the intentionally deposited latent print shall serve as a negative control.

10.8.8 SAFETY:

10.8.8.1 Physical developer should only be used in well-ventilated areas, as it is irritating to the respiratory tract. Standard laboratory protocol is followed for chemical handling.

10.8.9 REFERENCES:

Manual of Fingerprint Development Techniques, British Home Office, (1999), Chapter 4.

Advances in Fingerprint Technology, Henry C. Lee, R.E. Gaensslen, (1994), pages 79, 80, 81, 95, 112.

Technical Note #1-2730, Lightning Powder Co., (1993).

10.9 RAM

10.9.1 BACKGROUND:

RAM does not actually develop the latent print. The ridge detail must have already been previously developed through the use of CAE.

10.9.2 SCOPE:

10.9.2.1 RAM is a dye-stain used to aid in the visualization of CAE developed latents on non-porous substrates.

10.9.2.2 RAM should be used after CAE and prior to powdering.

10.9.2.3 Surfaces that need other forensic examinations such as body fluid or trace examinations should be carefully evaluated prior to processing to determine if this procedure will have an impact on subsequent examinations.

10.9.3 EQUIPMENT AND MATERIALS:

Balance
Spatula
Beaker
Spray or rinse bottles
Glass tray
Alternate light source/filtered goggles
Rhodamine 6G (dye content 99%)
MBD
Ardrox P133D

Methanol
Isopropanol
Acetonitrile
Petroleum ether
Acetone

10.9.4 REAGENTS
Rhodamine 6G
Methanol
MBD
Acetone
Ardrox P133D

10.9.4.1 Mixing Procedure: The two stock solutions must be mixed prior to formulating the RAM dye.

10.9.4.1.1 Stock Solution 1 (Rhodamine 6G)
Rhodamine 6G -1 g
Methanol - 1000 mL
Combine the ingredients and place on a stirring device until all the rhodamine 6G is thoroughly dissolved.

10.9.4.1.2 Stock Solution 2 (MBD)
MBD- 1 g
Acetone- 1000 mL
Combine the ingredients and place on a stirring device until all the MBD is thoroughly dissolved.

10.9.4.1.3 Ardrox P133D
Ardrox is used undiluted directly from the container.

10.9.4.1.4 RAM Working Solution
Stock Solution 1- 3 mL
Ardrox P133D- 2 mL
Stock Solution 2- 7 mL
Methanol - 20 mL
Isopropanol - 10 mL
Acetonitrile - 8 mL
Petroleum ether - 950 mL
Combine the ingredients in the order listed. Do not place on a magnetic stirrer.

10.9.5 PROCEDURE:
10.9.5.1 After an item has been processed with cyanoacrylate CAE, RAM can be applied.
10.9.5.2 Suspend the item to be processed over a glass collection tray.
10.9.5.3 Irrigate the working solution over the item. Allow the item to dry completely.

10.9.5.4 View the item through an orange filter using an alternate light source set in the 450 - 525 nm range.

10.9.5.5 Evaluate latent prints for comparable ridge detail. Prints deemed to be of value are marked and photographed.

10.9.5.6 Photography will require the aid of an orange filter on the camera and the use of an alternate light source.

10.9.6 CONTROL TESTS:

10.9.6.1 Testing of RAM is performed each day prior to use.

10.9.6.2 This test involves placing a drop of the RAM working solution on to a surface.

10.9.6.3 The test is illuminated with an alternate light source as outlined in the procedure section.

10.9.6.4 An analyst shall not proceed with the processing of the evidence until a control test bearing positive results (visible fluorescence) has been carried out and documented in the laboratory case notes and on the control tests work sheet.

10.9.6.5 The area surrounding the intentionally deposited working solution shall serve as a negative control.

10.9.6.6 Stock solutions should be stored in dark bottles- shelf life is indefinite. The RAM working solution is stable for approximately 30 days. After 30 days it should be checked for separation. If the solution has separated, shake the container vigorously and the solution will usually return to suspension. If this does not occur, discard the solution.

10.9.7 SAFETY:

10.9.7.1 Eye protection, a lab coat and rubber gloves should be worn. All mixing and application of chemicals should be done inside a ventilated laboratory fume hood. Excess reagent shall be collected and placed in the hazardous waste container located in the fume hood.

10.9.7.2 Rhodamine 6G, Ardrox P133D and MBD are classified as suspected animal carcinogens, but sufficient evidence of human carcinogenicity has not been established. RAM is thought to be relatively safe when exposure is at low levels. It should never be inhaled or allowed to get into the eyes or mouth, as it is an irritant. If this should occur, the eyes or mouth should be flushed with a generous amount of water.

10.9.7.3 Methanol, Isopropanol and Petroleum ether are highly *flammable*. All three chemicals need to be handled carefully and non-permeable gloves worn during mixing and use of the stain. Methanol and isopropanol are toxic in quantities as small as 30 ml and should not be allowed to come in contact with the skin, eyes, or mouth. It is possible for methanol and isopropanol to be absorbed through the skin. If methanol,

isopropanol or petroleum ether comes into contact with the eyes or mouth, the area should be flushed with generous amounts of water. Inhalation of vapors from either chemical should be kept at a minimum and the stain should be used in a well-ventilated area.

10.9.7.4 Acetonitrile may be fatal if swallowed, inhaled or absorbed through skin. Affects cardiovascular system, central nervous system, liver and kidneys. Flammable liquid and vapor. May cause irritation to skin, eyes, and respiratory tract.

10.10 RHODAMINE 6G

10.10.1 BACKGROUND:

Rhodamine 6G does not actually develop the latent print. The ridge detail must have already been previously developed through the use of CAE.

10.10.2 SCOPE:

10.10.2.1 Rhodamine 6G is a dye-stain used to aid in the visualization of CAE developed latents on non-porous substrates.

10.10.2.2 Rhodamine 6G should be used after CAE and prior to powdering.

10.10.2.3 Surfaces that need other forensic examinations such as body fluid or trace examinations should be carefully evaluated prior to processing to determine if this procedure will have an impact on subsequent examinations.

10.10.3 EQUIPMENT AND MATERIALS:

Balance
Spatula
Beaker
Spray or rinse bottles
Glass tray
Alternate light source/filtered goggles

10.10.4 REAGENTS:

Rhodamine 6G powder
Methanol or distilled water

Rhodamine 6G Working Solution:

1. Measure out approximately 0.1 gram Rhodamine 6G (about the size of a BB) and add to the storage bottle.
2. Add approximately one liter of methanol OR distilled water depending on the carrier you wish to use.

3. Seal the bottle and agitate gently to mix.
4. Label the bottle with the type of carrier used (distilled water or methanol).

10.10.5 PROCEDURE:

10.10.5.1 Suspend the item to be processed over a glass collection tray.
10.10.5.2 Irrigate the working solution over the item.
10.10.5.3 Rinse with an appropriate solution (methanol or water dependent on the working solution).
10.10.5.4 Allow the item to dry completely.
10.10.5.5 View the item through an orange filter using an alternate light source set in the 450 - 525 nm range. Visualization of developed ridge detail is dependent upon the condition of the item and background interference.
10.10.5.6 Evaluate latent prints for comparable ridge detail.
10.10.5.7 Prints deemed to be of value are marked and photographed. Photography will require the aid of an orange filter on the camera and the use of an ALS.

10.10.6 ADDITIONAL INFORMATION:

10.10.6.1 The use of distilled water in lieu of methanol is useful when methanol may damage the item being processed, as may be the case with some lacquers, plastics, or tapes.
10.10.6.2 If there is concern over background staining, test a small area prior to processing the entire item.
10.10.6.3 The amount and strength of the dye-stain used is left to the analyst's discretion.
10.10.6.4 The pre-mixed Rhodamine 6G and the working solution have an indefinite shelf life when stored at room temperature.
10.10.6.5 Excess reagent shall be collected and placed in the hazardous waste container located in the fume hood.

10.10.7 CONTROL TESTS:

10.10.7.1 Testing of Rhodamine 6G is performed each day prior to use.
10.10.7.2 This test involves placing a drop of the Rhodamine 6G working solution on to a surface.
10.10.7.3 The test is illuminated with an alternate light source as outlined in the procedure section.
10.10.7.4 An analyst shall not proceed with the processing of the evidence until a control test bearing positive results (visible fluorescence) has been carried out and documented in the laboratory case notes and on the control tests work sheet.
10.10.7.5 The area surrounding the intentionally deposited working solution shall serve as a negative control.

10.10.8 SAFETY:

10.10.8.1 Rhodamine 6G is classified as a suspected animal carcinogen, but sufficient evidence of human carcinogenicity has not been established. Rhodamine 6G is thought to be relatively safe when exposure is at low levels. It should never be inhaled or allowed to get into the eyes or mouth, as it is an irritant. If this should occur, the eyes or mouth should be flushed with a generous amount of water and a doctor may be consulted.

10.10.8.2 Methanol is highly *flammable*. It needs to be handled carefully and non-permeable gloves worn during mixing and use of the stain. Methanol is toxic in quantities as small as 30 ml and should not be allowed to come in contact with the skin, eyes, or mouth. It is possible for methanol to be absorbed through the skin. If methanol comes into contact with the eyes or mouth, the area should be flushed with generous amounts of water and a doctor may be consulted. Inhalation of methanol vapors should be kept at a minimum and the stain should be used in a well-ventilated area.

10.10.9 REFERENCES:

An Introduction to Lasers, Forensic Lights and Fluorescent Fingerprint Detection Techniques, E. Roland Menzel, (1991), pages 42-44.

Manual of Fingerprint Development Techniques, British Home Office, (1998), chapter 4

Chemical Formulas and Processing Guide for Developing Latent Prints, U.S. Department of Justice, F.B.I. Laboratory Division, (1994), pages 55-56.

Technical Notes #1-0041, Lightning Powder Co. Inc., pages 1-4.

10.11 SUDAN BLACK

10.11.1 BACKGROUND:

Sudan black B is a dye that stains fatty components to produce a blue-black image. It is considered to be a low-sensitivity method and contaminants such as grease are required as a target to which the reagent can bind.

10.11.2 SCOPE:

10.11.2.1 Sudan black is a dye-stain method used to develop friction ridge detail on non-porous waxy substrates and surfaces contaminated with grease, dried beverages, and foodstuffs. Sudan black will also enhance super-glue developed fingerprints.

10.11.2.2 Sudan black is not suitable for use on porous surfaces or dark colored items.

10.11.2.3 Surfaces that need other forensic examinations such as biology or trace should be carefully evaluated prior to processing to determine if this procedure will have an impact on subsequent examinations.

10.11.3 EQUIPMENT AND MATERIALS:

Beaker
Glass tray
Graduated cylinder
Balance
Spatula
Stirring rod
Glass bottle

10.11.4 REAGENTS:

Sudan Black B powder
Methanol
Distilled water

Sudan Black B Working Solution:

1. Place 15g of sudan black powder into a 2-liter glass beaker.
2. Add 1-liter of methanol and stir with a plastic stirring rod.
3. Add 500 ml of distilled water to the beaker and stir with the stirring rod. Some of the sudan black will not dissolve, but will remain as particulate matter. Pour the solution, including any solid matter, into a clean glass bottle with a tight-fitting screw top.

10.11.5 PROCEDURE:

10.11.5.1 Shake the container of sudan black working solution and pour a sufficient amount into a tray large enough to hold the item of evidence.

10.11.5.2 Soak the item for 2-3 minutes. For large items, irrigate the solution over the surface, catching the run off in a tray for reuse on the item.

10.11.5.3 Rinse the article in cool running tap water.

10.11.5.4 Allow the item to dry at room temperature.

10.11.5.5 Evaluate latent prints for comparable ridge detail.

10.11.5.6 Reprocessing can sometimes enhance faintly developed latent prints.

10.11.5.7 Prints deemed to be of value are marked and photographed. While it is possible to lift the prints with tape, the tape frequently does not lift the print sufficiently and prints that have been lifted have been known to bleed causing the image

to blur. Therefore, it strongly recommended that prints be photographed prior to attempting to lift.

10.11.6 ADDITIONAL INFORMATION:

10.11.6.1 The pre-mixed sudan black and the working solution have an indefinite shelf life at room temperature.

10.11.6.2 Excess reagent shall be collected and placed in the hazardous waste container located in the fume hood.

10.11.7 CONTROL TESTS:

10.11.7.1 Testing of sudan black is performed prior to each use.

10.11.7.2 This test involves the making of a quality (oil based) latent print on a test surface similar to the evidence being examined and following the processing procedure.

10.11.7.3 An analyst cannot proceed with the processing of the evidence until a control test bearing positive results (development of a blue-black print) has been carried out and documented in the laboratory case notes and on the control tests work sheet.

10.11.7.4 The area surrounding the intentionally deposited print shall serve as a negative control.

10.11.8 SAFETY:

10.11.8.1 The sudan black working solution contains methanol. Methanol is toxic in quantities as small as 30 ml and should not be allowed to come in contact with the skin, eyes, or mouth. It is possible for methanol to be absorbed through the skin. If methanol comes into contact with the eyes or mouth, the area should be flushed with generous amounts of water and a doctor may be consulted. Inhalation of methanol vapors should be kept at a minimum and the sudan black should be used in a well-ventilated area.

10.11.9 REFERENCES:

Manual of Fingerprint Development Techniques, British Home Office, Chapter 4, (1998).

Lightning Powder Technical Note No. 1-0034, “Sudan Black”, (May, 1995).

11 DIGITAL IMAGING PROCEDURE

11.1 BACKGROUND:

Latent print images are frequently captured, enhanced, and stored using digital devices. The intent of image enhancement is to make details of an image that are less visible more visible. Enhancement may be used to increase the contrast between the print and the substrate, reverse the color of the ridges, etc.

11.2 SCOPE:

This sets forth the Latent Print Section's procedures for the capture, storage, enhancement, and output of latent print digital images.

11.3 RESPONSIBILITIES:

11.3.1 Latent Section Supervisor

11.3.1.1 The Latent Section Supervisor shall act as the Digital Imaging System Administrator or appoint a Digital Imaging System Administrator.

11.3.1.2 The Latent Section Supervisor shall oversee and document the training of each new digital imaging system operator. This includes documenting competency testing.

11.3.1.3 The Latent Section Supervisor shall ensure access is limited to authorized users.

11.3.1.4 The Latent Section Supervisor or designee shall act as a liaison with CJIS and Foray technical staff on system maintenance, upgrades, and when technical difficulties arise.

11.3.1.5 The Latent Section Supervisor or designee shall be the only personnel authorized to delete images or cases entered into Digital Workplace or equivalent software.

11.3.2 Digital Imaging System Administrator

11.3.2.1 The Digital Imaging System Administrator shall update the Latent Print Section Digital Imaging System User's Manual.

11.3.2.2 The Digital Imaging System Administrator shall be responsible for system maintenance to include: deletion of images/cases, archiving, etc.

11.3.2.3 The Digital Imaging System Administrator shall communicate system status to the supervisor and other system users.

11.3.3 Analysts

11.3.3.1 Analysts shall only use enhancement techniques that are supported by their training and/or experience.

11.3.3.2 Analysts shall maintain system security.

11.3.3.2.1 Network and/or program passwords are not to be distributed to unauthorized users. Operators may change their passwords as needed.

11.3.3.3 Analysts shall fill out the Latent Section CD/DVD Log when filing or retrieving archived images from the vault.

11.4 DIGITAL IMAGE CAPTURE

11.4.1 A primary image is the result of the first recording of an image onto media. An original image is an accurate replica (bit-for-bit value) of the primary image.

11.4.2 Friction ridge impressions to be used for comparison purposes shall be captured (color or grayscale) at a minimum resolution of 1000 ppi when the image is sized 1:1. Interpolation from a lower resolution up to 1000 ppi is not permitted. Deviation from this standard shall be documented in the case record and approved by the Latent Section Supervisor.

11.4.3 Grayscale digital imaging shall be at a minimum of 8 bits. Color digital imaging shall be at a minimum of 24 bits.

11.4.4 Friction ridge impression digital images to be used for comparison purposes shall be stored and transmitted without compression or with lossless compression. Capture in a tif or raw file format is recommended.

11.4.5 Digital evidentiary latent print images shall be acquired through a digital imaging system.

11.4.6 Digital imaging system software shall establish a chain of custody from the time of acquisition into the program.

11.4.7 Images shall be designated using a file name structure generated by the digital imaging system software.

11.4.8 Analysts shall use one of the following digital image capture devices to acquire images of the print(s) in question.

11.4.8.1 Flat Bed Scanner

11.4.8.2 Digital Camera

11.4.8.3 Digital Media (e.g. Thumb Drive, CD/DVD, etc.)

11.4.8.4 Outside agencies may submit processed film for digital capture or digitally submit latent print images.

11.4.8.4.1 Images of latent prints should contain a scale.

11.4.8.4.2 It is preferred that existing images be submitted in a loss-less format such as '.tif or RAW" and at as high a resolution as possible.

11.4.9 Original close up images captured by latent section analysts should contain a scale in centimeters.

11.5 DIGITAL IMAGE ENHANCEMENT

11.5.1 Enhancement shall only be conducted on working copies of the original image. Working copies used in forensic case examination shall be saved as a separate copy and shall not replace the original image.

11.5.2 Digital evidentiary images requiring enhancement shall be enhanced via Adobe Photo Shop (using a copy of the original image) through the digital imaging system software.

11.5.3 Enhanced images will be designated using a file name structure generated by the digital imaging system software.

11.5.4 Enhancement history shall be recorded via the digital imaging system software.

11.5.5 All images stored in a secured digital imaging system maintained by ISP Forensic Services shall serve as documentation for the case record.

11.6 DIGITAL IMAGE STORAGE, ARCHIVAL, AND RETRIEVAL

11.6.1 Images, both original and enhanced, shall be temporarily stored on the digital imaging system hard drive until the examination is completed.

11.6.2 Once completed, the case's originating analyst shall make an entry in the Digital Imaging Notebook on the "Cases to be Archived" form. The entry shall contain the date entered, analyst's initials, and complete case number to be archived.

11.6.3 A backup shall be completed by the ISP CJIS staff on a routine server backup schedule.

11.6.4 Archiving of images shall be completed by the LPS Supervisor or Digital Imaging System Administrator on an as needed basis.

11.6.4.1 It is recommended that images be recorded on Write-once Compact Disk Recordable DVD+R.

11.6.4.2 The DVD shall be stored in the evidence vault.

11.6.5 DVDs shall be logged in and out of the vault using the "Latent Section DVD Log" sheet. The log shall detail the DVD title, date out/date returned, requesting analyst, and the person checking it in or out.

11.6.6 Cases with no statute of limitation shall be stored on the digital imaging server hard drive indefinitely.

11.7 QUALITY CONTROL:

11.7.1 Performance checks shall be conducted on equipment as needed.

11.7.2 When a problem is noted with a particular piece of equipment, software program, etc., the Digital Imaging System Administrator and/or Latent Section Supervisor shall be notified.

11.7.3 If it is determined that the situation is persistent or cannot be easily rectified, an entry shall be made on the "Instrument Maintenance Log".

11.7.3.1 The log shall detail the date, the person making the entry, the piece of equipment/software involved, and relevant details of the situation.

11.7.4 Effected equipment/software shall be taken off line and all users notified.

11.7.5 If necessary, technical support shall be sought and/or the equipment repaired before being put back into operation.

11.7.6 Actions taken to repair or correct the problem shall be documented on the "Instrument Maintenance Log."

11.7.7 Image calibration shall be checked, as needed by comparing the scale in the printed image with a standard metric scale.

11.8 TRAINING

11.8.1 Analysts utilizing imaging technologies shall be trained and tested for competency in the standard operating procedures and the operation of the relevant imaging technologies.

11.8.2 Formal training may be modified at the discretion of the Latent Section Supervisor dependent upon previous training and/or experience.

11.8.3 Recommended formal training consists of:

11.8.3.1 Reviewing the ISP-FS Latent Print Section Digital Imaging Procedure.

11.8.3.2 Reviewing the ISP Latent Print Section Digital Imaging User's Manual.

11.8.3.3 Review of relevant chapters of the Adobe Photoshop Users Manual and/or completion of a digital imaging course that utilizes Adobe Photoshop.

11.8.3.4 Satisfactory creation and digital processing of a mock-case using a digital imaging system and Adobe Photoshop software or equivalent software.

11.8.3.5 Satisfactory completion of a written test.

11.8.4 Continuing education shall be provided as courses become available through outside sources such as Foray, the FBI, etc.

11.8.5 Competency testing shall be repeated when significant changes in hardware or software are made (e.g. manufacturer/vendor changes).

11.9 REFERENCES:

International Association for Identification "Resolution 97-9."

Digital Workplace Quick Reference Guide

Scientific Working Group on Imaging Technologies (SWGIT), "Definitions and Guidelines for the use of Digital Image Technologies in the Criminal Justice System," Version 2.3-June 6, 2002.

Scientific Working Group on Imaging Technologies (SWGIT), "Recommendations and Guidelines for the Use of Digital Image Processing in the Criminal Justice System," Version 1.2-February 2001.

Scientific Working Group on Imaging Technologies (SWGIT), "Guidelines and Recommendations for Training in Imaging Technologies in the Criminal Justice System," Version 1.2-December 6, 2001. *Forensic Science Communications,* April 2002-Volume 4-Number 2.

Scientific Working Group on Imaging Technologies (SWGIT), "Guidelines for Field Applications of Imaging Technologies in the Criminal Justice System," Version 2.3, December 6, 2001. *Forensic Science Communications,* April 2002-Volume 4-Number 2.

12 FRICTION RIDGE EXAMINATION METHODOLOGY

12.1 BACKGROUND:

12.1.1 Friction ridges are formed on the palmar portion of the hands and the plantar portion of the feet during fetal development.

12.1.2 The friction ridge arrangement is permanent throughout the life of the individual, barring trauma or disease.

12.1.3 Friction ridge skin is unique. No two areas of friction skin have ever been found to be duplicated between two individuals or within the same person.

12.1.4 An impression representative of the unique details of friction ridge skin may be transferred upon contact with a surface.

12.1.5 An impression containing a sufficient quantity and quality of detail may be identified to or excluded from a particular source.

12.1.6 No scientific basis exists for requiring a pre-determined minimum number of friction ridge characteristics to be present in two impressions in order to establish a positive identification.

12.1.7 Identification/Exclusion is supported by the theories of biological uniqueness and permanence, probability modeling, and empirical data gained through more than one hundred years of operational experience.

12.2 SCOPE:

Analysts shall apply the concepts of Analysis, Comparison, Evaluation, and Verification herein referred to as ACE-V methodology to all friction ridge impressions preserved by the Latent Section or submitted by our customer agencies. The ACE-V methodology utilizes a qualitative and quantitative assessment of Level 1, Level 2, and Level 3 details.

12.3 EQUIMPENT AND MATERIALS

Magnifiers
Pointers
Digital imaging system

12.4 PROCEDURE:

12.4.1 ANALYSIS is the assessment of a friction ridge impression to determine suitability for comparison.

12.4.1.1 The value of friction ridge impressions is assessed according the Quality (clarity of observed features) and Quantity (amount of features and area) of features, the specificity of features and the relationships they possess. Quality and Quantity of detail may be influenced by the anatomical source (finger, palm, etc.), condition of the friction ridge skin, type of matrix, deposition factors, substrate considerations, environmental factors, development mediums, and preservation methods.

12.4.1.1.1 Level One Detail consists of overall ridge flow and pattern configuration. Level one detail may include information enabling orientation and can be used to determine anatomical source (i.e., finger, palm, foot, etc.). Anatomical information may be used to prioritize the potential corresponding areas and limit unnecessary comparisons. Certain orientation indicators such as recurves, deltas, creases, and scars may provide specific guidance on where to begin the comparison. Level one detail also includes general morphology (e.g., presence of incipient ridges, overall size). Level one detail cannot be used alone to individualize but may be used to exclude.

12.4.1.1.2 Level Two Detail consists of the individual ridge path, presence or absence of ridge path deviation (ending ridge, bifurcation and dot or continuous ridge), and ridge path morphology (e.g., size and shape). Level two detail is used in conjunction with level one detail to individualize or exclude.

12.4.1.1.3 Level Three Detail is confined to small shapes on individual ridges, relative pore positions, and other specific skin morphology (e.g., secondary creases, ridge breaks, etc.). Level three detail is used in conjunction with level one and two detail to individualize or exclude.

12.4.1.1.4 Other features associated with friction ridge skin (e.g., creases, scars, warts, paper cuts, blisters) may also be considered. These features may be permanent or temporary and exist as level one, two, or three detail. These other features may be used in conjunction with friction ridge detail to individualize or exclude.

12.4.1.2 Minimum quality assurance measures are associated with each level of complexity according to the following:

12.4.1.2.1 Non-Complex Prints - Limited documentation of the relevant features used as a basis for a conclusion. Standard verification.

12.4.1.2.2 Complex Prints Extensive documentation of the relevant features (i.e. charts or diagrams) used as a basis for a conclusion. Should consider the possibility of an enhanced verification and review procedure (e.g., a blind verification, multiple verifiers).

12.4.1.2.3 A non-complex impression may be classified as complex if modifying factors are present such as low specificity of features, significant distortion (e.g., multiple tap, superimposed impression, extreme pressure leading to tonal reversal, and slippage), high tolerances, or the original conclusion is contested during verification.

12.4.1.2.4 An impression categorized initially as complex may be classified as non-complex if modifying factors are present such as high specificity of features, presence of creases, scars, and open fields.

12.4.1.2.5 Justification for reassignment of complexity shall be documented.

12.4.1.3 Impressions deemed "of value" contain sufficient quantity and quality of ridge detail to warrant a comparison in the opinion of the analyst. The determination of sufficiency is based on the assessment of the discriminating strengths of the features and their arrangements. Impressions deemed "of value" proceed to the comparison step if there are known exemplars with which to compare and/or to AFIS once comparisons are completed or when there are no known exemplars with which to compare.

12.4.1.4 Impressions that do not contain sufficient detail to warrant a comparison in the opinion of the analyst are deemed to have "insufficient ridge detail" (IRD). This conclusion is noted as such in the case documentation.

12.4.1.5 Analysis of the unknown print also includes the selection of a suitable target area (core, delta, etc.) for use during comparison.

12.4.1.6 Analysis occurs independently of the Comparison, Evaluation and Verification steps of ACE-V.

12.4.1.7 An arc over the top of a print represents the anatomical source (i.e. finger) and anatomical orientation, unless otherwise noted.

12.4.1.8 A bracket symbol documents the anatomical source (i.e. palm, footprint), if the orientation is known it shall indicated with a directional arrow.

12.4.1.9 Latent prints of no value; the presence of friction ridge impressions that are of no value shall be documented. Documentation, May be accomplished by making a “no value” notation (e.g., “NV”) on a lift, photograph, or legible copy retained as part of the case record or indicating in case notes that “no value” impressions are present on a lift or photograph.

12.4.2 COMPARISON is the side-by-side, back and forth, observation of friction ridge detail to determine weather the detail in two impressions is

in agreement or disagreement based upon features, sequences, and spatial relationships within the tolerances of clarity and distortion. Comparison begins with the determination of dissimilarity or similarity between two impressions at Level 1.
If the analysis phase provides indicators as to the probable anatomical area, a side by side comparison with the appropriate area of the known prints is conducted. In the absence of indicators, all areas of available known impressions must be compared.

12.4.2.1 If similarity is determined within tolerance at Level 1 a target group is selected from the features observed during the analysis phase and is then searched within the corresponding area of the other impression. Additional arrangements of features are compared between impressions in a cyclical process to evaluate disagreement or agreement between the impressions. If the initial target group is not found, alternative target groups may be selected and compared.

12.4.2.2 Comparison is based on similarity, sequence, and spatial relationship.

12.4.2.3 Comparison is carried out in an objective manner beginning with the unknown (or impression of poorest quality) and comparing to the known (or impression of better quality).

12.4.2.4 Requests for original Fingerprint cards held by the Idaho State Police Bureau of Criminal Identification (BCI) shall proceed as outlined in Idaho State Police Procedure 11.02 section G.

12.4.2.4.1 The analyst shall make certified copies of the card(s) and/or scan the original card(s) into the digital imaging system. These copies/digital images shall be used for comparison purposes and the original cards returned to BCI.

12.4.2.5 The current national resolution standard for the transmission of 10-print images is approximately 500 ppi.

12.4.2.5.1 The following exemplars shall be considered to meet or exceed this standard and may be used for comparison purposes: original card, high quality photocopies and/or AFIS archive printouts traceable to a single source, copies obtained from the FBI, and digital images of original exemplars.

12.4.2.5.2 Examples of images not meeting these standards are 1:1 faxed images, low quality photocopies. These lower resolution images may at times be used for exclusion based on level 1 detail depending on the clarity of the image.

12.4.3 EVALUATION is the formulation of a conclusion based upon analysis and comparison of friction ridge impressions. Conclusions that may be reached are Identification, Exclusion, or Inconclusive.

12.4.3.1 Identification is the decision by the examiner that there are sufficient features in agreement to conclude that two areas of friction ridge impressions originated from the same source. Identification of an impression to one source is the decision that the likelihood that the impression was made by another (different) source is so remote that it is considered a practical impossibility.

12.4.3.1.1 Identification shall be determined by a qualified analyst, applied to a common area in both impressions, based on quantity and quality of detail, contain no unexplainable discrepancies, and shall be reproducible.

12.4.3.1.2 No two prints will ever be exactly the same in *all* respects. Explainable differences are features that differ between a known and unknown print but can be explained as a result of distortion, slippage, twisting, printing defects, overlapping prints, etc.

12.4.3.2 Exclusion is the decision by a qualified examiner that there are sufficient features in disagreement to conclude that two areas of friction ridge impressions did not originate from the same source.

12.4.3.2.1 Exclusion of a subject can only be reached if all relevant comparable anatomical areas are represented and legible in the known exemplars. Conclusion should be that the subject is excluded from having made an impression based on the available exemplars. Exclusions shall refer to the available exemplars unless otherwise stated in the case notes.

12.4.3.2.2 Exclusions shall be determined by a qualified analyst, applied to all reasonable comparable anatomical areas, be based on quantity and quality of the friction ridge detail, and be reproducible.

12.4.3.3 Inconclusive findings may result from the absence of sufficient friction ridge details (lack of quantity or clarity in the questioned impression) to effect a conclusion of identification or exclusion (e.g. corresponding features are observed but not sufficient to individualize). Like wise dissimilar features may be observed but not be sufficient to exclude (e.g. indecipherable distortion). Inconclusive findings may also be attributed to the absence of complete and legible known prints (e.g. poor quality fingerprints or a lack of comparable areas).

12.4.3.3.1 Inconclusive conclusions shall not be construed as a statement of possible or probable identification as those conclusions are outside the acceptable limits of the science.

12.4.3.3.2 Inconclusive results shall be determined by a qualified analyst, be based on quantity and quality of the friction ridge detail of the unknown and/or available known exemplars, contain insufficient agreement or disagreement of the friction ridge details, and be reproducible.

12.4.4 VERIFICATION is the independent confirmation of ACE methodology by another qualified analyst to either support or refute the conclusions of the original examiner.

12.4.4.1 A qualified analyst shall verify all latent print comparisons and/or identifications.

12.4.4.2 Analysts shall not verify any conclusions with which they are not comfortable. Comfort level is a function of training and experience.

12.4.4.3 Analysts are encouraged to work out differing conclusions through collaboration. If the differing conclusion(s) cannot be resolved, the ISP Quality Manual Section 15.9.4.3 "conflict resolution" policy will be followed.

12.4.4.4 Analysts do not need to conduct the verification analysis on non-hit latent prints generated by the AFIS computer. If a potential hit is generated the ACE-V methodology will be followed.

12.4.5 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.

12.4.5.1 Blind verification may be used in situations where a single identification and/or single exclusions exist in casework.

12.4.5.2 Blind verification may be used in casework with complex identifications or exclusions (e.g. high distortion, background interference, etc).

12.4.6 OUTSIDE AGENCY VERIFICATION is the examination of friction ridge detail previously examined by an examiner not associated with Idaho State Police Forensic Services.

12.4.6.1 ISP Latent Section will conduct outside agency verifications as if they are a new case submitted for examination.

12.4.6.2 All procedures and guideline shall be followed when conducting outside agency verifications.

12.4.7 REFERENCES:

The Scientific Working Group on Friction Ridge Analysis, Study and Technology (SWGFAST) - *SWGFAST documents are officially published in the Journal of Forensic Identification*

Fingerprint Whorld, Vol. 26, No. 101, July 2000, "Scientific Comparison and Identification of Fingerprint Evidence", pages 95-106. *Pat A. Wertheim.*

Journal of Forensic Identification, Vol. 41, No. 1, Jan/Mar 1991, "Ridgeology," pages 16-64. *Davis R. Ashbaugh.*

13 AFIS

13.1 BACKGROUND: AFIS (automated fingerprint identification system) is a system that includes a database of tenprint fingerprint cards, latent prints, and palm prints. AFIS also includes software that is utilized to search the database. The Idaho State Police is a member of the Western Identification Network (WIN). WIN is a consortium of several western states, referred to as central sites that share their AFIS databases. ISP contracts with WIN to maintain our database and AFIS software. WIN provides all necessary computers, scanners, printers, and software need to conduct AFIS searches. WIN also provides ISP access to the databases of central site members, other state and local agencies, and the FBI. The intention of these procedures is to provide analysts with searching parameters for latent inquiries of the AFIS databases.

13.2 TECHNICAL CASE REQUIREMENTS: All latent print cases cannot be AFIS searched. In order to be considered for AFIS searching, the case must contain at least one latent print impression that meets a combination of the following technical requirements.

13.2.1 Finger: Latent print impressions from the first joint of the finger can be considered for an AFIS search. Second and third finger joint impressions cannot be processed in AFIS at this time.

13.2.2 Palm: Latent print impressions from the palmar area of the hand can be considered for an AFIS search. This includes the Writers palm, Thenar, Hypothenar, and Interdigital areas of the palm.

13.2.3 Minutiae Number: Routinely, only latent prints containing at least 7 (seven) minutiae located in the above described areas should be considered for AFIS processing.

13.2.4 Core/Axis: It is not necessary to have the core area visible in the latent impression; however it is necessary to be able to place an approximate core and axis for the impression.

13.2.5 An analyst can use his/her discretion when evaluating the overall suitability of the latent print to determine whether or not the latent is of AFIS quality.

13.2.6 Latent prints can be acquired in the AFIS computer by the means of direct scans, digital image transfer, and electronic image transfer. As technology advances additional secured image files are acceptable.

13.3 DATABASES: Analysts may search the databases of WIN and IAFIS. Analysts should be guided by their experience, knowledge of the AFIS system's capabilities, laboratory workload and common sense when choosing which databases to search.

13.4 DATABASE SELECTION: The following criteria categorize AFIS search parameters by crime type and severity. If the analyst cannot determine the severity either by the crime listing on the submittal form, the investigative

report, or by timely conversation with the investigator, then the lowest search parameters should be used.

13.4.1 Analysts may limit any of the searches based on the circumstances of the case.

13.4.2 Latent Section Supervisor may, as the circumstances of a case dictate, modify these search criteria.

13.4.3 Cases with latents meeting the Technical Case Requirements should be searched using the Idaho and WIN database.

13.4.4 IAFIS SEARCHES: IAFIS searches should be conducted on all crimes against persons cases if possible. IAFIS searches may also be conducted on property cases when warranted (i.e. requested by the agency or high dollar amount).

13.4.5 Latent print analysts are responsible for ensuring that the database and algorithm selection standards outlined above are followed when choosing and searching a latent print in AFIS.

13.5 AFIS SEARCHING PROCEDURE: Generally, the sequence for searching latent prints in AFIS will be:
Latent Inquiry (LI) - Idaho only
Latent Re-Inquiry (LRI) the remaining WIN database
IAFIS search, if applicable, and
LRI searches, if applicable

13.5.1 If possible, AFIS searches should only be undertaken once all latents have been excluded to the available known exemplars for possible victims, suspects, and/or named subjects.

13.5.2 Cases shall be entered in to WIN utilizing ID 04 followed by the case number, followed by a C, M, or P to denote regional lab, and then the three digit latent number.

13.5.3 Qualified AFIS trained Forensic Scientists may search latent prints generated by/for other analysts. Forensic Scientists shall not perform the technical review of an AFIS search they performed. Latent prints can be searched from hard copies or electronic copies. Copies of latent prints to be searched are not considered to be evidence.

13.5.4 Candidate lists generated by AFIS searches will be stored on the computer hard drive for twenty days. The AFIS system automatically purges old candidate lists.

13.6 LATENT INQUIRY (LI Idaho Only/LRI WIN)
The LI/LRI search will perform a search of the latent print against the ten print databases. Other functions, such as additional LRI's and registration, must be performed separately. LI/LRI searches will be conducted as follows:

13.6.1 LI/LRI searches will generally be made of latent prints that meet the Technical Case Requirement criteria.

13.6.2 The Number of Candidate Images selected will be no less than 30 candidates. If the analyst intends to perform an LC Merge (see LC

Merge below) then the Candidate List may contain a maximum of 255 candidates.

13.7 MODIFYING CHARACTERISTICS: Modified minutiae and core/axis searches can be conducted using the Re-Edit search mode. Modified searches will be conducted using the Latent Re-Inquiry (LRI) function. If the initial search was based on a specific modifying characteristic (e.g., pattern, axis, core, or zone), adjustments can be made to the characteristic and the additional search performed.

13.7.1 At times it may be beneficial to conduct additional database searches using modified search parameters, for example, include incipient ridges, large ridges, wide ridges, search multiple cores and axis, and/or search possible reference pattern types.

13.8 SEARCHING MULTIPLE LATENT PRINTS FROM A CASE: For simultaneous impressions, the analyst will search all suitable impressions in AFIS unless a search of the first simultaneous impression results in an identification.

13.8.1 If a case consists of multiple latent prints made by the same finger, it is only necessary to search one latent impression unless different areas of that finger are present in different impressions.

13.9 CANDIDATE LIST SID NUMBER MERGE (LC Merge function): Cases searched in AFIS containing two or more latent prints that were not identified in the searches may have the LC Merge function performed on them. Candidate list merge checks consist of scanning each latent print candidate list bearing the specified laboratory case number and comparing each list to determine if the same SID number appears on two or more case candidate lists. If the same SID number appears on two or more candidate lists, AFIS will respond by displaying the case, exhibit number and the SID number for the latent print analyst to perform a comparison.

13.10 LATENT PRINT TO LATENT PRINT SEARCHES - (L/LI). These are the searches of latent prints against the previously searched latent prints on file in the unsolved (unidentified) latent print database.

13.11 AFIS PRIORITY SEARCHES: different databases require different searching priorities.

13.11.1 Idaho Only/WIN searches utilizing the standard algorithm will be conducted at a priority 6 (normal) search. When using ELMA's the priority must be manually changed to a 9.

13.11.1.1 Priority 1 searches will be performed for rush homicide cases and cases where/there is an urgent need to notify the submitting agency of the results of the AFIS search. Each WIN-OPS representative may elect to modify a search to a Priority 1 for high profile crimes within their state without prior notification

to WIN. In cases where the WIN-OPS representative carries out the priority change, the following information is to be forwarded to the WIN office:

1. Date of priority change
2. Brief narrative of the offense
3. Hit/No hit
4. If hit, where the hit was effected
5. Other interesting facts
6. Submit to WIN

13.11.2 IAFIS searches will be prioritized by selecting the appropriate crime type under the dropdown labeled "priority" under the "Case Information" tab.

13.12 AFIS CASE DOCUMENTATION: Documentation of AFIS searches and results shall be maintained as administrative documentation (AFIS Packet) consisting of the following:

13.12.1 LEXS Page - AFIS Latent Print Minutiae, Core/Axis, and Zone print out showing the latent print as it was searched.

13.12.2 LI Candidate List - Every search conducted in AFIS will result in generating a candidate list of subjects in score order (probability of matching the search print). Print a hard copy of the candidates reviewed during the AFIS search.

13.12.3 If an AFIS Hit is made as a result of an AFIS search, the split screen images of the search print and candidate print will be printed out and included in the AFIS Packet.

13.12.3.1 Split screen images, and any other AFIS generated fingerprint or tracing images, will not be utilized to make a positive identification. Identifications can only be made as a result of comparing the actual latent prints (or photographic or high resolution copies thereof) and actual known print cards (or photographic or high resolution copies thereof).

13.12.4 The AFIS worksheet will be incorporated into the case notes. If a "no hit" result was obtained from a search performed by a second Forensic Scientist, the reporting analyst will review the documentation and initial the conclusion on the AFIS worksheet.

13.13 REGISTERED LATENTS: Latent prints that remain unidentified at the conclusion of the AFIS search should be registered in the WIN Unidentified Latent Database (ULD). If a registered latent is later identified, it should be deleted from the ULD. Prints stored the database are not considered to be evidence.

13.13.1 Latent registered in IAFIS shall be conducted in cases against persons or at the discretion of the analyst.

13.14 TENPRINT TO LATENT INQUIRY CANDIDATE LISTS: Analysts are responsible for periodically reviewing their TLI lists for possible candidates. If the TLI candidate list produces a possible candidate, the submitting agency will be consulted regarding the statute of limitations for that case. If the statute has not expired, the analyst will request the case latent prints from the agency or use file digital images to complete the examination. If the statute has expired, the analyst may delete the print from the database.

13.15 DATABASE MAINTENANCE: WIN periodically publishes lists of latent prints currently registered in the AFIS Unsolved Latent Database. These lists are generally published annually. ISP Forensic Services Latent Section is responsible for maintaining latent prints that remain in the unsolved latent prints database.

13.15.1 The Latent Section Supervisor shall review the list of registered unsolved latent database searches and remove all latent searches that have exceeded the case statute of limitations.

13.15.2 Database maintenance shall be conducted annually.

13.16 QUALITY CHECK POLICY: Latent search procedures will follow the ISP Latent Print Analytical Method for AFIS searching. Quality control checks will be conducted each day before the system is used. Quality controls will be logged on a log sheet and AFIS case record worksheet. Controls only need to be run for the type of latents searched that day. For example, if you are only running a palm, there is no need to do the quality control check for fingerprints.

13.16.1 Quality check procedure:

1. Launch LI search of the latent prints from the control targets that has been loaded in the "D" drive Lextemp Quality Assurance subfolder. Select the control target that corresponds to search type. In the input new data box, fill in Case/Lift fields with the state/Terminal ID Date of Test/Latent ID

Control Targets results

Rolled Control 1	#6 UUB0000004
Rolled Control 2	#3 UUB0000011
Rolled Control 3	#3 UUB0000016
Slap Control 1	#1 UU99999030
Slap Control 2	#10 UU99999111
Slap Control 2	#2 UU99999111
Palm Control 1	L/H UUP0000006
Palm Control 2	R/I UUP0000007
Palm Control 3	R/I UUP0000008

2. No human intervention on the pre-extracted latent .lex file
3. Compare candidate list to the known candidate list exemplar
4. Frequency should be once a day as the first search of each date the FW-L is used on casework.
5. Variations of the known hit appearing on the default candidate list should be reported to WIN staff. The position on the candidate list may change over time.

13.16.2 Latent prints used for quality checks are supplied by WIN on the Win website.

13.16.3 WIN conducts random calibration checks of the WIN Database throughout the calendar year. WIN notifies the participating agencies of the results.

13.16.4 The Latent Print Supervisor or designee will completely review one AFIS case per month. The case to review will be selected at random from the cases performed during the month. The review will consist of all candidates reviewed by the original scientist and all AFIS documentation. A log of case numbers and the date of review for the cases reviewed will be maintained by the supervisor.

13.17 TRAINING: All analysts utilizing AFIS shall be trained and tested for competency in the standard operating procedures and the operation of the system.

13.17.1 Formal training may be modified at the discretion of the Latent Section Supervisor dependent upon previous training and/or experience.

13.17.2 Recommended formal training consists of:

13.17.2.1 Reviewing the ISP-FS Latent Print Section AFIS Procedure.

13.17.2.2 Reviewing the following NEC documents or equivalent:

GWS–NSW
GWS-L
GWS-L Quick Reference Guide
GWS-L Update Difference Quick Reference Guide
NEC ELMA Best Practices

13.17.3 Completion of the "Latent Training Checklist"

13.17.4 Supervised entry of AFIS cases

13.17.5 Satisfactory completion of a competency and/or written test.

13.17.5.1 Competency testing shall be repeated when significant changes in hardware or software are made.

13.17.6 Continuing education shall be provided as needed and as courses become available.

13.18 LIMITATIONS

13.18.1 Matching a latent print to a tenprint card in AFIS is dependent on the quality of the tenprint exemplars. If the exemplars are of poor quality or have poor friction ridge detail, they may not be appear on the AFIS generated candidate list (or may appear low on the candidate list).

13.18.2 Searches are limited to NEC/WIN participants and the IAFIS database. All other AFIS databases/vendors cannot be accessed by this system.

13.18.3 When multiple tenprint cards are entered for an individual, AFIS automatically evaluates each print and uses the best available print for comparison (e.g. the right index and right middle finger may come from different cards). AFIS continually updates and a new (better) print may be available after the initial search.

13.18.4 The AFIS terminal generates a candidate list and while the program tries to rank candidates, a potential match may be generated from any candidate on the list.

13.18.5 The AFIS terminal may create a different candidate list each time a query is performed.

13.19 REFERENCE

WIN AFIS Latent Fingerprint Best Practices, September 2002
WIN-OPS Manual Revision 2008, September 2008
WIN-OPS QA Procedure Outline, April 2004
WIN Latent Inquiry Quick Reference Guide, October 2008
NEC Users Guides
NEC Core and Axis User Guide
NEC Matching Algorithms (ELMA) Best Practices, July 2007

Manuals can all be found at http://secure.winid.org/training.asp. The state representative will send notification of any updates or deletions on the website.

14 CASE WORK DOCUMENTATION AND REPORT WRITING

14.1 Case work documentation and report writing will be according to ISPFS Quality Manual, Section 5.10 Reporting the Results.

14.2 Documentation shall be to the extent that another qualified analyst would be able to determine each examination activity conducted, their sequence, results of the activities, and any conclusions reached.

14.2.1 As each development method is completed it is noted in sequence on the examination worksheet or electronically in the LIMS system and the evidence is visually examined for the presence of comparable ridge detail.

14.2.2 When comparable ridge detail is observed, it should be preserved prior to additional processing.

14.2.2.1 Comparable ridge detail may be photographed upon initial examination, as additional detail develops, after a specific method, and/or prior to a subsequent method.

14.2.2.1.1 Latent print photographs/images and/or case documentation shall include a scale, unique case identifier, date, analyst's initials, impression source (description or source identifier), and significant information about the orientation and/or position of the latent print on the object through description, photography, and/or diagram.

14.2.2.2 Prints developed via powder processing may be lifted in lieu of photography.

14.2.2.2.1 Latent print lifts shall contain the unique case identifier, date, analyst's initials, impression source (description or source identifier), and significant information about the orientation and/or position of the latent print on the object through description and/or diagram.

14.2.3 Latent print examination documentation shall include which prints were analyzed, compared, evaluated, and the conclusions reached.

Documentation shall be made at or near the time of the examination and shall be in the form of a worksheet or electronically in the LIMS system and may include annotated images, narrative, annotated legible copies, sketches, AFIS or electronic records or any combination of these methods.

Extent of documentation is related to the complexity of the examination. The friction ridge impression alone is not sufficient documentation.

14.2.3.1 Each latent impression analyzed shall have an individualizing numeric designation (1.1, 1.2., etc).

14.2.3.2 The comparison value of each impression will be noted. If the examiner changes the “of value” decision, it shall be documented along with the reason for changing the “of value”

decision. Any conclusions reached up to the point the examiner changes the "of value" decision shall be documented.

14.2.3.3 Documentation of latent impressions marked of value shall include, the anatomic source of the impression (finger tip, palm, etc.), anatomical orientation, pattern if discernable (L-slant loop, whorl, etc.) and level of clarity (1, 2, 3), and the substrate, development medium, preservation method and may also include matrix, deposition pressure, lateral movement, rotational movement or other friction ridge skin details, if known.

14.2.3.3.1 If re-analysis of the latent print during the comparison results in new information (e.g. significant change to the orientation, anatomical source or additional ridge detail), supplemental notes shall be added and dated.

14.2.3.4 Latent impressions on the reverse side of lift cards or on the edge of tape lifts that are obviously deposited by the person creating the lift card need not be preserved or analyzed, but documentation shall be recorded in case notes.

14.2.3.5 Analysts shall document to whom the latents were compared, the results of those comparisons, the identify of the verifier, and date verified.

14.2.3.5.1 Documentation of identifications shall include an annotation in proximity to the latent or in the description field of the digital imaging system, that includes the date of the identification, the initials of the analyst, unique identifier(s) of the exemplar(s) used to reach the conclusion, and the area identified (ex. finger #, palm etc.). The analyst shall also date and initial all exemplars used to effect the identification(s).

14.2.3.5.2 The verifying analyst shall date and initial in proximity to the identified impression(s) and on all exemplars used to effect the identification(s) or in the description field of the digital imaging system. Verification shall also include the conclusion of the verifying examiner, and unique identifier(s) of the exemplar(s) used to reach the conclusion if those used differ from those of the original examiner.

14.2.3.5.3 Documentation of an exclusions shall include, at a minimum, which specific impression was excluded, unique identifier(s) of the exemplar(s) used to reach the conclusion. Initials/signature of examiner, and date conclusion was reached.

14.2.3.5.4 Documentation of inconclusive findings shall include, at a minimum, which specific impression

was compared, the specific anatomical source if applicable, unique identifier(s) of the exemplar(s) used to reach the conclusion, and shall include the reason(s) for the inconclusive finding. These reasons should be based on the complete exemplars and not the individual finger impressions on the exemplars (ex. latent lacks sufficient quantity/quality for identification, insufficient friction ridge detail in agreement, exemplars smudged, over-inked/under-inked, incomplete exemplars, no exemplars (palms, tips not recorded, etc.). Initials/signature of examiner, and date conclusion was reached.

14.2.3.5.5 Documentation of consultations shall be documented and include: Which specific impression(s) was reviewed, the nature and result of the consultation (e.g. reviewed individualization), initials/signature of examiner(s), and date of consultation. If examiners have significant interaction on a particular print, the consulted examiner shall not be used as the verifier for that particular print.

14.2.4 The original or reproduction suitable for comparison of both the compared latent impressions and the known exemplars must be retained as part of the case record.

14.2.4.1 When the laboratory cannot ensure that the original latents or exemplars used and relied upon in the examination, will be maintained by the contributing agencies, the laboratory must maintain an image of the actual data.

14.2.4.1.1 Case documentation shall contain machine copies or electronic scans of all latent lift cards submitted by the customer. All latents deemed of value for comparison shall be preserved in the digital imaging system.

14.2.4.1.2 Case documentation shall contain originals or machine copies or electronic scans of all known exemplars used in the comparison. Known exemplars submitted by the customer agency shall be copied prior to being returned. Copies must be suitable for comparison.

When known, the medium (i.e. ink, live scan, powder lift) and origin (i.e. printed from archive, agency submission, etc.) shall be documented within the case record.

Known prints deemed insufficient for comparison, or that contain any factors that adversely affect the comparison shall be documented. The quality and quantity of the information present will dictate the extent of the documentation. These factors include: Incomplete recording of the friction ridge skin Missing anatomical sources (i.e. palms, areas of fingers, etc.) Unclear recording of the friction ridge skin

14.2.4.1.3 Exemplars used to effect an identification, shall be preserved in the digital imaging system prior to being returned.

14.3 The report shall be as clear and concise as possible, convey the analytical findings and conclusions, and will be supported by scientific procedures.

14.3.1 The report is generally divided into three sections: EVIDENCE DESCRIPTION, EXAMINATION, and CONCLUSION. For example, the **Evidence Description** section shall include a Lab #/Agency exhibit. # (if applicable), The **Examination** shall include processing, exams/comparisons, AFIS submissions, etc. The **Conclusions** section shall include the results for each latent examined in the case and/or results for each item processed if no latents were recovered. Identifications shall include who the print was identified to, and which exemplar(s) was used to effect the identification(s). Inconclusive results shall include the reason for the inconclusive result. This section shall also include requests for further exemplars and instances where no exemplars were found.

14.4 The case file should contain the following items if generated:
Report;
Examination documentation packet (notes, exam worksheets, copies/forms, digital imaging reports);
Administrative documentation (copies of submission forms, communication logs, agency reports, AFIS documentation, etc.).

14.5 The verifying analyst shall perform the technical and administrative review on the case. In the event that the verifying analyst is unavailable, the section supervisor may perform the reviews.

14.6 DNA database fingerprint comparison and verifications will be conducted as per ISPFS Latent Section established procedures.

14.6.1 Comparisons may be conducted electronically on screen or using printouts of known exemplars. Exemplars will be generated from established databases.

14.6.2 Verifications will be conducted according to Latent Analytical Method 12.4.4.

14.6.3 DNA database samples that are not associated with the correct state identification numbers (SID#) will be searched through the AFIS database for possible candidates. Established AFIS guidelines will be followed.

14.6.4 Non confirmed/identified DNA database cards will be returned to the Biology Section.

14.6.5 Initials and date of analysis will be placed on the DNA database cards. Initials will serve as necessary conformation documentation. No report will be generated.

14.6.6 If the name or SID# does not correspond with the verified fingerprint the card shall be stamped with a "discrepancy" stamp and the information obtained from AFIS will be recorded on the card.

14.7 The latent section shall conduct annual proficiency testing in latent print comparison and latent print processing.

14.7.1 Testing shall be in accordance with ISPFS Quality Manual section 15.9.3.

14.7.2 Copies and or scans are sufficient documentation of latent prints and exemplars for latent comparison proficiency tests. Images need not be entered into the digital imaging system.

14.7.3 Only case number and initials shall be documented on proficiency tests. No annotation of identifications shall be made due to other analysts taking the same test.

14.8 Report writing and case documentation will be modified with the implementation of a Laboratory Information Management System (LIMS). Report writing and case documentation will follow ISPFS procedures.

Appendix A
Latent Section Instrument Maintenance

Manufacturer's instrument manuals designated with * are on file in the latent section.

ALS*
For ALS maintenance see method 8.1.

Balance*
Balance is checked annually by an external source. Intermediate checks may be conducted as needed and documented on the QC worksheet. The allowable deviation from the standard weights is 0.01g or 0.1%, whichever is greater (.01g deviation for the 0.10g & 1.00g and 0.1g for the 100g weights).
If the balance fails an annual check, the check will be repeated. If the balance still fails, it will be taken out of service until it can be recalibrated or repaired. The balance shall be tagged indicating that it is out of service. Maintenance, service calls, etc. will be recorded in the maintenance log.
Balances and ASTM weights used for checks are calibrated yearly by an outside source.

CAE Fuming Chambers*
Refer to the manufacturer's instrument instruction manual for operational details.
Maintenance shall consist of cleaning the chambers or tanks as needed.

Cameras*
General maintenance consists of wiping camera bodies with a soft cloth, blowing off lenses and mirrors to remove dust or dirt, and then cleaning with a soft cloth or eyeglass cleaner.
If a camera malfunctions, it will be taken out of service until it can be repaired. The camera shall be tagged indicating that it is out of service. Maintenance, service, etc. will be recorded in the maintenance log.

Chemical Exhaust Hoods (commercially purchased hoods*)
All hoods are equipped with continuous flow monitoring devices. Capture velocity at the open face of the commercially purchased hoods is at least 100 feet/minute. Capture velocity at the open face of the sink hoods ranges between 75-100 feet/minute.
If a hood fails a monthly check, the check will be repeated. If the hood still fails, it will be taken out of service until it can be repaired. The hood shall be tagged indicating that it is out of service.
General maintenance consists of cleaning. Filters are changed regularly by building maintenance staff. Additional maintenance shall be conducted as needed and will be recorded in the maintenance log.

Eyewashes and showers*
Function shall be checked monthly and documented on the QC worksheet. The purpose of this check is to flush the lines, check for leaks, etc. The eyewashes and shower are also checked annually by building maintenance. Maintenance, service, etc. will be recorded in the maintenance log.

Heat/Humidity Chamber*

The float valve, wick, drain, water reservoir, and distilled water filter will be checked prior to each use and documented on the Instrument Maintenance Log. Refer to the manufacturer's instrument instruction manual for details. The afore mentioned maintenance need not be performed more than annually.

When using the chamber for ninhydrin processing, the glass should be warm to the touch and condensation within the chamber should be visible.

When using the chamber for DFO, the glass should be warm to the touch and no condensation should be visible.

If the above specifications are not observed, refer to the manufacturer's instrument instruction manual section on preventive maintenance and faultfinding. If the problem cannot be resolved, the chamber will be taken out of service until it can be repaired. The chamber shall be tagged indicating that it is out of service.

Maintenance, service calls, etc. will be recorded in the maintenance log.

KSI*

For KSI maintenance see method 8.2.

Magnifying Glasses

Magnifying glasses should be cleaned regularly with a high quality lens cleaner and soft cloth. No caustic chemicals should be applied to the lens.

Powder Station Exhaust Vents

Filters are washed periodically and replaced regularly by the building maintenance staff. Additional maintenance is performed as needed. Maintenance, service calls, etc. will be recorded in the maintenance log.