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LATENT FINGERPRINTS
Last Review Date June 2, 2025

FOREWORD

The body of knowledge which comprises forensic science is a compilation of procedures adapted from other disciplines that encompass many of the physical and natural sciences. During the history of forensic science, a multitude of scientists have greatly contributed to the protocols, methods and procedures that have become a routine part of analysis. Every effort has been made in this manual to give proper recognition to the authors of specific procedures; however, in some instances, the original source of forensic procedures has been lost in antiquity. For others, the general procedures belong to the public domain and are recorded in many basic references concerning forensic science. In addition, many of the procedures described in this manual have been adapted from standard laboratory practices, and the citation of thousands of references which deserve credit for aiding in the development of these procedures is neither practical nor possible. To all those scientists who have contributed to the knowledge of forensic science contained herein, we do extend collective recognition and gratitude.

Procedures manuals which offer reliable information that is then combined with corresponding training manuals serve as the foundation for effective quality management of analyses. Extensive effort has been made to ensure that the routine procedures described herein will produce accurate and valid analytical results. However, not all possible analyses that may be encountered in casework can be appropriately covered in a procedures manual, nor can all possible variations to a described procedure be included. Therefore, this manual is written with the understanding that minor variations that do not significantly alter the described procedure may be used. An analyst may use a non-routine procedure not specifically stated in this manual, provided all the following conditions are met:

1. The procedure used is based upon documented and scientifically accepted practice.
2. A notation is made on the worksheet indicating the procedure followed is not specified in the procedures manual.
3. The analyst also indicates on the work sheet why the particular procedure was selected over a procedure contained in this manual. Rationale must be detailed sufficiently to withstand close scrutiny by independent examiners.
4. The analyst provides documentation showing that the non-routine procedure had been tested prior to application with evidence. Test criteria shall include test samples that approximate the characteristics of the evidence, the results obtained with the routine procedure, and the results obtained with the non-routine procedure. Documentation will also include related data concerning the non-routine procedure's sensitivity, precision and possible sources of error.
5. The non-routine procedure used will be recorded to a standard such that another scientist of similar skills and experience can understand fully the procedure used and the results obtained.

Additionally, there may be procedures which pertain to all sections. Such is the case with laboratory reagents. In order to standardize the testing and monitor the shelf life of reagents used by analytical sections, the Forensic Sciences Command has developed protocols which are universal for all sections. These protocols regarding reagent expiration and testing are found in the Command Quality Manual.

INTRODUCTION

While general procedures for evidence examination are usually divided into two categories, those for porous and those for nonporous surfaces, each division contains an enormous variety of materials with individual properties that may enhance or diminish the effectiveness of a particular technique. The composition of palmar sweat is predictable to a high degree, yet the components of impression residue may include extraneous matter transferred to friction ridge skin from many possible sources. In some instances, techniques designed to better visualize the contaminants are more productive than those utilized to detect smaller or uncertain quantities of inherent palmar sweat composition. Other circumstances may present a substrate which consists of material so similar to the residue that particular reagents will cause an overall reaction and prevent any distinction between impression and background.

In theory, any contact between the source of an impression and a surface results in a transfer of material between the two objects. Successful detection of that transfer to reveal a sufficient impression requires that the surface is receptive for a deposit, that is, relatively smooth, clean, and dry. The definition of "relatively" is imprecise and highly dependent upon the nature of the transfer medium. Glass is receptive to palmar sweat transfer when dry but not when coated with dew, yet may be receptive to a deposit of sebaceous material even when submerged in water. A piece of metal covered with a film of oil may be unreceptive to a deposit of sebaceous material yet provide a clear, distinct impression when touched by dry, clean skin.

Residue once deposited is immediately subjected to environmental conditions. Heat, humidity, air movements, airborne contaminants, chemical reactions and interactions, light, time, and moisture alter the condition and dictate the chances for detection of any deposit. While any precise determination as to the effects surface condition, transfer medium, and subsequent environment may have on the successful visualization of impression residue is impossible, one determination is very clear. Most factors concerning the survival of the impression are negative and when of sufficient degree or combined in various arrangements will diminish or destroy the likelihood of detection.

Visual examination of evidence is the first step in the processing procedure. Visual examination is the inspection for latent print residue that may be preserved photographically or determined to be unsuitable as it exists. In addition, visual inspection is the mechanism by which processing procedures are selected from observation of the residue, its condition, and composition, and of the article. Expertise is the ability of an examiner to determine as many factors as possible and to select examination approaches accordingly.

Judgment of factors in the selection of processing approaches must be both tempered and augmented by a basic philosophy toward evidence examination. Seeking a visualization of latent print residue, which may or may not be present, without tangible proof creates a common dilemma regarding the extent of the pursuit. Negative results with any given technique are not a sure indication of non-existence and positive results with any given procedure do not provide assurance that the examination is complete. A basic philosophy which demands that exploration continues until all avenues are exhausted or until what is sought is found should guide all evidence examination procedures. Fixed methods of even the best intentions requiring minimum processing steps,

maximum rote check lists, or pre-determined consequences are no substitute for dedicated and reasoned logic to find what is sought, the identity of the suspect whenever possible.

This Procedures Manual is arranged according to protocols for various types of substrate materials and residues encountered in latent print processing. It contains further descriptions when surface condition and/or deposit factors are a major influence upon technique selection. Additional factors may require some modification or adjustment to the technique or sequence of techniques indicated. In some instances procedures which fall into the general processing guidelines for a particular substrate but are inappropriate or destructive due to other factors should be modified so as to accomplish the best possible processing sequence for that specific item. This Procedures Manual cannot list every substrate an examiner will encounter in casework and all procedures are subject to revision as new techniques or research reveals improvement.

Careful consideration should be exercised by the latent print examiner concerning the interference their examination can have on subsequent Forensic Biology and DNA examinations. The best option is for the Forensic Biology section to receive any multi-section Items first, asking the latent print examiner for input during the initial visual inspection. The main reasons for this are as follows:

1. Evidence must first pass through Forensic Biology for stain identification before being submitted to DNA. Every latent print process can potentially interfere with the visual screening necessary to locate a bloodstain prior to DNA analysis.

2. The Forensic Biologist must sometimes use a stereomicroscope to locate trace amounts of bloodstains. The mere handling of evidence by a latent print examiner can unknowingly cause the destruction of this type of stain.

3. Due to the increased sensitivity of DNA profiling technology, many labs now have dedicated Forensic Biology/DNA sections. By receiving multi-section Items first, the Forensic Biologist can locate and remove any stains and properly collect and note any trace evidence observed without the possibility of contamination by the Latent Fingerprint Section.

It should be noted that in cases where the Latent Print section has already processed an Item (i.e. an agency request for DNA is made at a later date), the possibility does exist that a successful DNA analysis can be accomplished. For example, studies conducted by Mr. Oliver Germain (University of Quebec) and Dr. Chantal Fregeau and Dr. Ron Fourney (the Crime Detection Laboratory in Ottawa, Ontario) showed that the blood reagents Amido Black, Crowle's, Ninhydrin, and DFO had no detrimental effects on retrieving useable DNA for PCR-STR DNA analysis. However, the additional variables that can be introduced when evidence is processed by the Latent Print section first should be discussed between the Latent Print and Forensic Biology/DNA sections and documented throughout the examination process. The main variables that should be considered are as follows:

1. Forensic Biology believes that enough stain is present and visible to warrant an attempt to collect and identify.

2. During latent print processing, was the evidence exposed to heat or moisture which could likely cause bacterial growth resulting in rapid degradation of DNA (i.e. use of the heat and humidity chamber during processing or storage of the evidence in plastic)?

3. The increased chance of contamination to the DNA due to processing in a non-dedicated environment.

The technology of DNA profiling is developing at a rapid rate. Also, Latent Print processes and techniques are consistently updated or added. Therefore, the key to effective analysis of a multi-section case is good communication between the Latent Print Section, the Forensic Biology/DNA Section, and the user agency on a case by case basis. Furthermore, as the fields develop, the procedures used and the possible interferences with each other need to regularly be reviewed with relevant experts.

ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization-Porous

METHOD: Chemical Processing of Porous Items

PROCEDURE: **NINHYDRIN**

Reviewed by:

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Forensic Scientist Jamie Lynn Edwards, Chairperson
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Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Ninhydrin, or triketo-hydrindene hydrate, is an extremely sensitive indicator of alpha-amino acids, proteins, peptides and polypeptides. The reaction produces a violet to blue-violet coloring of these substances and is effective with older deposits with even minute amounts of amino acids. While ninhydrin can be used on any surface, normally processing is confined to porous items which have not subsequently become water-soaked or do not contain inherent animal proteins.

One study conducted by Police Scientific Development Branch (PSDB) of the British Home Office explores alternative formulae for ninhydrin solutions used to process latent impression evidence (Kent et al, 1996). This study compared the productivity of several ninhydrin solutions which differed only in their solvent components. Two of the solvents tested, HFE-7100 and Vertrel XF, were found to be non-flammable, non-toxic, have higher evaporation rates and have minimal ink run. These results were examined and validated in a study conducted by the Illinois State Police (Anastasia Petruncio, 1999).

Petroleum ether has also been used as a solvent for ninhydrin processing, but several concerns make petroleum ether a less than ideal alternative. The use of petroleum ether as a solvent for processing latent print evidence has several disadvantages which include flammability, fiber swell, and ink run. In addition, ninhydrin is of limited solubility in petroleum ether, and a small amount of glacial acetic acid must be added to the solution to facilitate solubility. The addition of acetic acid increases the polarity of the solution and the likelihood of ink run for some substrates.

The comprehensive experimentation conducted by Anastasia Petruncio compared HFE- 7100 and Vertrel XF with petroleum ether in relation to productivity, clarity/contrast of the developed detail and ink run. In all of these categories Petruncio found HFE- 7100 and Vertrel XF to be equal or superior to petroleum ether. For detailed examination and comparison see, "A Comparative Study for the Evaluation of Two Solvents for Use in Ninhydrin Processing of Latent Print Evidence," Petruncio 1999.

OTHER RELATED PROCEDURES:

Low Temperature Luminescence
Metal Salt Post Treatment
Physical Developer
Silver Nitrate
Zinc Chloride

SAFETY CONSIDERATIONS

Acetone
Ethanol
Ethyl Acetate
Glacial Acetic Acid
HFE-7100 (methoxy-nonafluorobutane)
Methanol
Ninhydrin
Petroleum Ether
Vertrel XF (HFC 4310mee/ 2,3-dihydrodecafluoropentane)

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

NFPA LISTING				
CHEMICAL	**HEALTH HAZARD**	**FLAMMABILITY HAZARD**	**REACTIVITY HAZARD**	**CONTACT HAZARD**
Acetone	1	3	0	
Ethanol	0	3	0	
Ethyl Acetate	1	3	0	
Glacial Acetic Acid	2	2	1	
HFE 7100	1	0	0	
Methanol	1	3	0	
Ninhydrin	2	0	1	
Petroleum Ether	1	4	0	
Vertrel XF	1	0	1	

Danger! Extremely Flammable! Petroleum Ether. Can vaporize quickly. Readily forms flammable mixtures in air. Consider an extreme hazard!

Warning! Flammable! Acetone and Ethanol. Vapors can ignite readily at room temperatures. Consider a severe hazard.

Vertrel XF and HFE-7100 have low global warming, zero flashpoint, zero ozone depletion and are non-flammable. The U.S. Environmental Protection Agency (EPA) lists HFE-7100 and Vertrel XF as acceptable substitutes for ozone depleting substances.

PREPARATIONS

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

Recommended Preparation- 0.5% concentration:

HFE-7100:

1. Dissolve 5.0 grams of ninhydrin in 45 milliliters of ethanol.

2. When crystals are completely dissolved, slowly add 2 milliliters of ethyl acetate

3. Slowly add 5 milliliters of glacial acetic acid.

4. Add 1 liter of HFE-7100.

5. Allow to stand for five to ten minutes. Two separate layers will form. Discard the top layer. A large separatory funnel can be used to facilitate the separation of the two solutions.

Vertrel XF (HFC4310mee):

1. Dissolve 5.0 grams of ninhydrin in 15 milliliters of ethanol.

2. When crystals are completely dissolved, slowly add 5 milliliters of ethyl acetate.

3. Slowly add 5 milliliters of glacial acetic acid.

4. Add 1 liter of Vertrel XF.

5. Allow to stand for five to ten minutes. Two separate layers will form. Discard the top layer. A large separatory funnel can be used to facilitate the separation of the two solutions.

Petroleum Ether:

1. Dissolve 5.0 grams of ninhydrin in 20 milliliters of ethanol or methanol.

2. When crystals are completely dissolved slowly add 10 milliliters of glacial acetic acid. (Optional - glacial acetic acid may cause inks to run)

3. Add 1 liter of petroleum ether.

4. Allow to stand for five to ten minutes. Two separate layers will form, a large pale yellow layer on top and a smaller darker yellow layer on the bottom. The darker layer is discarded, and the lighter yellow solution is the working solution to be used on evidence. A large separatory funnel can be used to facilitate the separation of the two solutions.

INSTRUMENTATION

See Appendix IV- General Instrumentation.

Environmental chambers will be used to control the heat and relative humidity that the item of evidence is submitted to after processing.

MINIMUM STANDARDS & CONTROLS

The Standards and Controls for the Ninhydrin procedure consist of placing test impressions on porous items to make test prints. The test prints are then immersed in the working solution and subjected to the proper level of heat/humidity. If the test prints are visualized, the working solution can be used to process evidence.

Documentation of the test prints must be recorded in the LAM at the time the reagent is made. Test prints must also be made on a case-by-case basis and documented in the examiner's work notes.

Per QM-14 in the Quality Manual, the Ninhydrin working solution may be stored up to one year, at which time it will be discarded or re-authenticated. If it is re-authenticated, test prints will be run in the same manner as listed above. If impressions are visualized the working solution can be used to process evidence for up to one additional year. The examiner must indicate their initials, the new expiration date, and that the reagent has been re-authenticated on the working solution bottle. The re-authenticated reagent must be updated in the LAM.

Ninhydrin coloration is not permanent and while some impressions have remained visible for years, others have faded in a matter of days. All observed impressions must be photographically preserved as soon as possible.

PROCEDURE OR ANALYSIS

All applications should be done in a fume hood.

A. Dipping (preferred method of application)

1. In a tray large enough to accommodate the evidence pour enough working solution to cover all of the items.

2. Completely immerse each item to be processed in the working solution until the item is completely saturated, usually five seconds or less. The item can be manipulated using tongs or forceps.

3. Remove and allow the item to dry completely.

4. Place the item in the heat/humidity chamber at no greater than 80 degrees Celsius and between 60% and 80% relative humidity.

5. Check the item periodically to monitor the impression development. Care should be taken not to saturate the item with water vapor.

6. Remove the item from the heat/humidity chamber and photograph any developed impressions.

B. Brushing and Spraying (alternate methods of application)

1. **Brushing:** Larger items which will not fit conveniently into processing trays should be painted with the ninhydrin solution using a soft bristle brush. Two inch to four inch nylon paint brushes are adequate. Care must be taken to apply an even and thorough amount to all surfaces.

2. **Spraying:** Spraying methods should be avoided except for very small items involving brief exposure. The health and safety risks from the use of aerosols are unwarranted when other methods are available. Use of spraying as an application technique is only appropriate in a fume hood and when using appropriate PPE.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

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ILLINOIS STATE POLICE

LATENT PRINTS
PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization-Porous

METHOD: Chemical Processing of Porous Items

PROCEDURE: **ZINC CHLORIDE**

Reviewed by:

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Forensic Scientist Jamie Lynn Edwards, Chairperson
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Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

While numerous metal salt solutions will cause a color change of ninhydrin-developed latent print impressions, zinc chloride is selected when the possibility of increased contrast is essential and laser examination would benefit the analysis. The reaction between ninhydrin and zinc chloride causes a change in color of the Ruheman's purple. The fluorescence is weak but observable when illuminated with excitation light in the range of 450 to 530 nanometers, peaking at 488 nanometers. The effectiveness of light absorption and emission depends upon a series of factors that include light intensity, humidity, and temperature.

Zinc chloride luminescence may be increased by extremely low temperatures. For laboratory application, immersing the item in liquid nitrogen usually can produce a marked improvement of both luminescence brightness and contrast. Low temperature luminescence procedures are fully described in a separate procedure in this manual.

OTHER RELATED PROCEDURES:

Low Temperature Luminescence
Metal Salt Post-Treatment
Ninhydrin
Physical Developer

SAFETY CONSIDERATIONS

Ethanol
Glacial Acetic Acid
Isopropanol
Methanol
Zinc Chloride
HFE 7100
Vertrel XF
Forensic Light Sources - see Appendix IV - General Instrumentation

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

NFPA LISTING				
CHEMICAL	HEALTH HAZARD	FLAMMABILITY HAZARD	REACTIVITY HAZARD	CONTACT HAZARD
Ethanol	0	3	0	
Glacial Acetic Acid	2	2	1	
HFE 7100	1	0	0	
Isopropanol	1	3	0	
Methanol	1	3	0	
Petroleum Ether	2	4	0	
Vertrel XF	1	0	1	
Zinc Chloride	3	0	0	

Warning! Flammable! Ethanol and Isopropanol. Vapors can ignite readily at room temperatures. Consider a severe hazard.

PREPARATIONS

A 2% zinc chloride solution is generally adequate to produce the desired color change and introduce sufficient zinc for laser or xenon arc excitation. The choice of solvent is determined by the substrate being processed. Substrates that have a potential for ink run or destruction by either ethanol or methanol should be processed with a zinc chloride solution with Vertrel XF or HFE 7100.

Ethanol, Methanol or Petroleum Ether:

1. Completely dissolve 2 grams of zinc chloride in 100 milliliters of the selected solvent.

HFE 7100 or Vertrel XF:

1. Mix 5 milliliters of isopropanol with 25 milliliters of ethanol.
2. Add 5 milliliters of glacial acetic acid and mix.
3. Add 2.3 grams of zinc chloride to the solution and continue stirring until all crystals are dissolved.
4. Add 100 milliliters of HFE 7100 or Vertrel XF.

INSTRUMENTATION

See Appendix IV - General Instrumentation

Environmental chambers will be used to control the heat and relative humidity that the item of evidence is submitted to after processing. The chambers should be calibrated periodically with a hygrometer and thermometer to ensure that the chamber is maintaining the proper level of relative humidity and temperature.

A forensic light source using excitation light of the proper wavelength can be used to illuminate the evidence and produce the desired fluorescence.

Proper safety precautions including avoiding skin exposure and proper eye protection with appropriate optical densities should be utilized when operating forensic light sources. Consult the appropriate user's manuals for the safe use and appropriate eye protection for the specific piece of equipment being utilized.

MINIMUM STANDARDS & CONTROLS

The Standards and Controls for the zinc chloride procedure consist of spraying ninhydrin developed test prints with the zinc chloride solution. Once properly exposed to the zinc chloride solution, the reaction is noted by a color change from purple ninhydrin developed impressions to a red or orange color. The test prints are then subjected to the proper level of heat/humidity. If the color change is observed and the test prints are visualized by the proper wavelength of light, the working solution can be used to process evidence.

Documentation of the test prints must be recorded in the LAM at the time the reagent is made. Test prints must also be made on a case-by-case basis and documented in the examiner's work notes.

While zinc chloride luminescence is often faint and may present difficulties in evaluation and photography, photographic preservation is essential. All observed impressions must be photographically preserved as soon as possible.

PROCEDURE OR ANALYSIS

<u>All applications should be done in a fume hood</u>.

1. Spray the ninhydrin treated surface with an extremely light spray of zinc chloride solution. Avoid a visible wetting of the surface as ninhydrin impressions may be diffused by the solvent.

2. After initial exposure to the zinc chloride solution the ninhydrin impressions will change color from purple to red or orange. If the color change is not noted successive light applications of the zinc chloride solution may be required. Once the color change is noted no additional application is needed.

3. The item is then placed in an environmental chamber for a few minutes. The settings should not exceed 80 degrees Celsius and 80% relative humidity.

4. The item is then examined for fluorescence with a forensic light source set for the appropriate wavelength.

5. Any observed fluorescence should be photographed. An orange filter of the same properties as the protective eye wear used in fluorescent examination is generally adequate in most instances.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

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ILLINOIS STATE POLICE

LATENT PRINTS
PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization-Porous

METHOD: Chemical Processing of Porous Items

PROCEDURE: **PHYSICAL DEVELOPER**

Reviewed by:

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Approved by:

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INTRODUCTION

Physical developer is a product of British Home Office research devised specifically for the examination of wetted or water soaked porous items. This technique is a method which utilizes silver nitrate in an unstable ferrous/ferric redox solution in combination with a detergent solution. Unlike the conventional silver nitrate procedure which reacts with the chlorides of palmar sweat, physical developer deposits freed silver from the solution on any non-water soluble sebaceous material that may be present in a latent print residue. Although this technique was developed for water soaked items it should be used on any porous item, whether water soaked or not. If used sequentially with ninhydrin, the full evidence potential of each item can be realized as these techniques work on different types of residues.

Water soaked or wetted papers rarely contain sufficient amounts of amino acids or salts for effective examination with normal porous surface processes. Components in sweat are either completely removed or diffused throughout the surface. Previous attempts to visualize latent prints on wetted porous items involved air drying and magnetic powder. Under optimum conditions when greasy or oily impressions remain on the surface and fiber swell does not create traps for overall painting, magnetic powder will adhere to the residue. Since physical developer is an immersion process of high sensitivity, the reagent penetrates the porous material to detect any lipids which may be present. This reaction with residue other than palmar sweat increases the usefulness of physical developer as a post-treatment to items processed with ninhydrin. However, physical developer cannot be used after the conventional silver nitrate procedure. Physical developer is a somewhat complicated procedure when initially attempted but can be efficiently incorporated as an examination technique by batch processing eligible items.

Articles which appear too fragile for the maleic acid prewash, such as charred papers or extremely water soaked items, may be introduced directly into the physical developer working solution. Such evidence should be treated one item at a time and the solution must be checked carefully for the effects of contamination. Usually, contamination will precipitate the silver from the working solution in the form of dark reddish brown particles resembling curds.

Physical developer requires special care and exact adherence to procedures. Some glassware and utensils must be dedicated to the technique and reagent contamination must be avoided. Several chemicals must be purchased from sole source vendors due to required purity. In spite of these obstacles, the results often obtained from physical developer can be so productive that it must be included when full evidence exploration of porous items is desired.

OTHER RELATED PROCEDURES:

Ninhydrin
Zinc Chloride

SAFETY CONSIDERATIONS

Chlorine Bleach, Household
Citric Acid
Ferric Nitrate
Ferrous Ammonium Sulfate
Maleic Acid
n-Dodecylamine Acetate
Photofix
Silver Nitrate
Synperonic N

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

NFPA LISTING				
CHEMICAL	HEALTH HAZARD	FLAMMABILITY HAZARD	REACTIVITY HAZARD	CONTACT HAZARD
Chlorine Bleach, Household	2	0	1	
Citric Acid	2	0	0	
Ferric Nitrate	2	0	0	
Ferrous Ammonium Sulfate	1	0	0	
Maleic Acid	2	0	0	
n-Dodecylamine Acetate	3	1	2	
Photofix	1	0	0	
Silver Nitrate	1	0	0	*oxy*
Synperonic-N	1	0	0	

Warning! Toxic! n-Dodecylamine Acetate is possibly toxic via oral, inhalation or absorption. Consider a severe hazard.

PREPARATIONS

Stock Detergent Solution:

1. Pour one liter of distilled water into a 1500 milliliter beaker containing a large magnetic stir bar previously rinsed with distilled water.

2. Add 2.7 grams of n-Dodecylamine Acetate and stir with a magnetic stirrer. If some of the detergent sticks to the weigh boat the weigh boat can be immersed in the solution.

3. Add 4 grams of Synperonic N. Place the weigh boat in the solution as the Synperonic N will adhere to the weigh boat.

4. Stir for thirty minutes.

5. Remove the weigh boats.

6. Pour the solution into a one liter glass bottle, transferring any material not yet dissolved. This solution must not be used for at least 24 hours. At this time there should be no visible solids.

   -One liter of the stock detergent solution is sufficient to make 25 liters of Physical Developer working solution.

Maleic Acid Prewash:

1. Pour one liter of distilled water in a 1500 milliliter beaker.

2. Add 25 grams of Maleic Acid and a large magnetic stir bar rinsed with distilled water.

3. Stir with a magnetic stirrer until all solids are dissolved.

Silver Nitrate Solution:

1. Pour 50 milliliter of distilled water into a 100 milliliter beaker.

2. Add 10 grams of silver nitrate and stir for one minute. If using a magnetic stir bar, you must rinse with distilled water. The chlorine in tap water would combine with the silver nitrate and form a milky colored solution (silver chloride), rendering the solution unusable. Never use tap water for any of the working solutions.

Buffered Ferrous/Ferric Redox Solutions:

1. Pour 900 milliliters of distilled water in a 1500 milliliter beaker.

2. Rinse a large magnetic stir bar with distilled water and place in the beaker and stir.

3. Add the following chemicals in the order given making sure the chemicals are dissolved before adding the next chemical:

   30 grams of Ferric Nitrate
   80 grams of Ferrous Ammonium Sulfate
   20 grams of Citric Acid

4. Stir until all chemicals are dissolved and then stir an additional five minutes.

Combining the Component Solutions for Physical Developer:

1. To the Redox Solution add 40 milliliters of the Stock Detergent Solution and stir.

2. Examine the Silver Nitrate Solution to ensure that all solid material has dissolved. Stir again if needed. Add the entire Silver Nitrate solution to the redox/detergent solution and stir for two minutes.

*Steps one and two must be performed in this order, otherwise the silver will fall out of suspension.

The Physical Developer is now ready for use. This prepares approximately one liter and should be sufficient to process about one hundred checks. The combined working solution is unstable and cannot be stored and should therefore be prepared on an as needed basis.

INSTRUMENTATION

See Appendix IV-General Instrumentation.

MINIMUM STANDARDS AND CONTROLS

The Standards and Controls for the maleic acid prewash procedure consist of using litmus paper or pH paper to test the acidity of the solution. If the test indicates that the solution is acidic, the prewash solution can be used to process evidence.

Test prints will not be done for the component reagents of the working solution (stock detergent solution, silver nitrate solution, or buffered ferrous/ferric redox solution).

The Standards and Controls for the Physical Developer working solution consist of placing test impressions on porous items to make test prints. The test prints are then immersed in the working solution. If the test prints are visualized, the working solution can be used to process evidence. This testing procedure must be done for each working solution at the time the solution is made. Since the depletion of the working solution is unpredictable, test prints should be used frequently to ensure the working solution is working properly.

Documentation of the test prints for maleic acid prewash and physical developer working solution must be recorded in the LAM at the time the reagent is made. Test prints must be made on a case-by-case basis for the physical developer working solution and documented in the examiner's work notes.

Weak impressions resulting from insufficient reactive material (due to exhaustion of chemicals in solution) may benefit from additional processing with the physical developer solution. Frequent use of test prints is recommended to ensure proper reagent reactivity.

All observed impressions must be photographically preserved.

PROCEDURE OR ANALYSIS

The procedure for Physical Developer involves three stages; a prewash, reagent development and rinse. Since the working reagent is unstable, a pre-treatment wash is necessary, unless the items to be processed are too fragile to avoid the introduction of contaminants to the reagent. The rinse stage essentially removes contaminants.

All equipment associated with the prewash and reagent must be dedicated. Trays must be of glass and must be scrupulously clean. Beakers for mixing solutions should be labeled according to the type of solution and should not be used for any other purpose. Plastic or bamboo tongs without serrated edges should be employed for item handling. Rinse trays can be the plastic photographic type but must be clean. Physical Developer reacts with even trace amounts of various rubber products so that rubber tipped tongs cannot be used. Similarly, certain gloves will leave marks upon the evidence which will attract silver deposits. After the prewash any contact of glove to surface must be avoided.

Step 1- Maleic Acid Prewash:

1. Pour enough maleic acid prewash solution in a glass tray to cover the item to be processed.

2. Immerse the item in the solution for five to ten minutes or until bubbles are no longer given off.

Step 2- Physical Developer Solution:

1. Pour enough physical developer solution in a glass tray to cover the items to be processed.

2. Drain the items of excess prewash.

3. Immerse the items in the working solution and gently rock the tray.

4. Keep the items separated and be careful not to crease or handle the items extensively.

5. The processing time will vary and can be as little as one minute or up to twenty minutes. Therefore the examiner should monitor the development very closely to avoid over processing and obliteration of weaker impressions. Remove the item when optimum contrast is observed.

Step 3 -Rinse:

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1. Rinse the items in a tray of tap water with a constant gentle flow of water into the tray. Wash the items in running water for three to five minutes.

Step 4- Drying:

1. Allow the items to dry while lying flat. The items can be blotted carefully to speed the drying process if the item is not fragile.
2. Impressions developed with physical developer are relatively stable. However in most instances all developed impressions should be photographed.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

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1. Lee, Henry C.; Gaensslen, R. E., eds. *Advances in Fingerprint Technology*; Elsevier Science Publishers: NY, 1991.

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ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization-Porous

METHOD: Chemical Processing of Porous Items

PROCEDURE: **SILVER NITRATE**

Reviewed by:

Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Silver nitrate reacts with sodium and potassium chloride in palmar sweat to form silver chloride, a compound more photosensitive than silver nitrate. This procedure is particularly destructive in both general chemical reaction and the amount of water immersion required. Silver nitrate does not yield consistently high success on porous items, is expensive, and prohibits effective laser examinations and therefore should be avoided when processing routine paper or porous items. Yet with certain surfaces, such as raw or unfinished wood and wax-impregnated papers, it is one of the most effective procedures currently available.

OTHER RELATED PROCEDURES:

Iodine
Ninhydrin
Physical Developer
Zinc Chloride

SAFETY CONSIDERATIONS

Ethanol
Glacial Acetic Acid
Isopropanol
Methanol
Silver Nitrate

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

NFPA LISTING				
CHEMICAL	**HEALTH HAZARD**	**FLAMMABILITY HAZARD**	**REACTIVITY HAZARD**	**CONTACT HAZARD**
Ethanol	0	3	0	
Glacial Acetic Acid	2	2	1	

NFPA LISTING				
Isopropanol	1	3	0	
Methanol	1	3	0	
Silver Nitrate	1	0	0	oxy

Warning! Flammable! Ethanol and Isopropanol. Vapors can ignite readily at room temperatures. Consider a severe hazard.

PREPARATIONS

Concentrations of silver nitrate solutions vary from 1 to 10%, with 3% acceptable for most processing and higher concentrations for wood items. Three separate preparations of silver nitrate are available depending on the substrate to be processed. Aqueous silver nitrate solutions are adequate for wood items. Alcohol based solutions are preferred for wax impregnated papers. Silver nitrate solutions should be prepared in small amounts according to immediate need. Silver nitrate is a white crystalline substance that must be stored in dark containers. Working solutions are light sensitive as well and should not be stored for future use.

Preparation for raw wood:

1. Mix 5.0 grams of silver nitrate in 100 milliliters of distilled water and stir until the crystals are completely dissolved.

2. Add 1 milliliter of glacial acetic acid and completely mix.

Preparation for wax impregnated papers:

1. Mix 3.0 grams of silver nitrate in 10 milliliters of distilled water and stir until the crystals are completely dissolved.

2. Then add 90 milliliters of ethanol and 1 milliliters of glacial acetic acid and mix completely.

Preparation for flare/dynamite wrapper type papers:

1. Dissolve completely 6 grams of silver nitrate in 10 milliliters of distilled water and add 100 milliliters of ethanol.

2. Dissolve completely 6 grams of silver nitrate in 10 milliliters of distilled water and add 100 milliliters of methanol.

3. Dissolve completely 6 grams of silver nitrate in 10 milliliters of distilled water and add 100 milliliters of isopropanol.

4. The ethanol solution is mixed with the methanol solution and then with the remaining isopropanol solution.

INSTRUMENTATION

See Appendix IV-General Instrumentation.

MINIMUM STANDARDS AND CONTROLS

The Standards and Controls for silver nitrate consist of placing test impressions on porous items to make test prints and exposing the item to the silver nitrate working solution using the appropriate application device. If the test prints are visualized, the silver nitrate solution is working properly and can be used on evidence.

Documentation of the test prints must be recorded in the LAM at the time the reagent is made. Test prints must also be made on a case-by-case basis and documented in the examiner's work notes.

Due to the instability of the working solution, especially when exposed to light, storage of working solutions is not recommended.

All observed impressions must be photographically preserved.

PROCEDURE OR ANALYSIS

All applications should be done in a fume hood

1. The silver nitrate solution is applied to the item to be processed by immersing, brushing, swabbing or thoroughly spraying the item.

2. The item is then blotted dry to remove all excessive liquid. Development requires that the item is completely dry before the next step.

3. The item is then exposed to light from a photo flood or UV light source. Sunlight may be used but care must be exercised to control this exposure to avoid the silver halide from too rapidly developing.

4. The developed impressions are then photographed. Care must be taken not to overexpose the item to light, which will continue to darken the impressions and substrate.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

REFERENCES

1. Lee, Henry C.; Gaensslen, R. E., eds. *Advances in Fingerprint Technology*; Elsevier Science Publishers: NY, 1991.

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ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization-Porous

METHOD: Chemical Processing of Porous Items

PROCEDURE: **METAL SALT POST-TREATMENT OF NINHYDRIN DEVELOPED IMPRESSIONS**

Reviewed by:

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Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Ninhydrin impressions can be changed from purple to red or orange with the application of metal salt solutions. Faint ninhydrin developed impressions may be enhanced or contrast improved by post treatment with various metal salts. When the background limits contrast with ninhydrin developed impressions a color change may be necessary.

While numerous metal salt solutions will cause a color change of ninhydrin-developed latent print impressions, zinc chloride is selected when laser examination is indicated. Zinc emits a weak but observable fluorescence when illuminated with the excitation light of appropriate wavelengths.

OTHER RELATED PROCEDURES:

Low Temperature Luminescence
Ninhydrin
Physical Developer
Zinc Chloride

SAFETY CONSIDERATIONS

Copper Chloride
Glacial Acetic Acid
Nickel Nitrate
Methanol
Zinc Chloride
Petroleum Ether
HFE 7100
Vertrel XF
Forensic Light Sources - see General Instrumentation Appendix IV

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

NFPA LISTING				
CHEMICAL	HEALTH HAZARD	FLAMMABILITY HAZARD	REACTIVITY HAZARD	CONTACT HAZARD
Copper Chloride	1	0	0	
Ethanol	0	3	0	
Glacial Acetic Acid	2	2	1	
HFE 7100	1	0	0	
Isopropanol	1	3	0	
Methanol	1	3	0	
Nickel Nitrate	3	0	3	
Petroleum Ether	2	4	0	
Vertrel XF	1	0	1	
Zinc Chloride	3	0	0	

Warning! Toxic! Nickel Nitrate and Zinc Chloride. Can cause adverse acute or chronic health affects through inhalation, absorption or ingestion. Consider a severe hazard.

Warning! Flammable! Ethanol and Isopropanol. Vapors can ignite readily at room temperatures. Consider a severe hazard.

Warning! Reactive! Nickel Nitrate. May react explosively with water or is capable of detonation or explosive reaction, but requires a strong initiating source or must be heated under confinement before initiation. Consider a severe hazard.

PREPARATIONS

To obtain a red color, a 2% solution of copper chloride or zinc chloride is used. Orange is obtained with a 2% solution of nickel nitrate mixed in a like manner. The choice of solvent is determined by the substrate being processed. Substrates that have a potential for ink run or destruction by ethanol or methanol should be processed with a metal salt solution with Vertrel XF or HFE7100.

Ethanol, Methanol or Petroleum Ether:

1. Completely dissolve 2 grams of the metal salt chosen in 100 milliliters of the selected solvent.

HFE 7100 or Vertrel XF:

1. Mix 5 milliliters of isopropanol with 25 milliliters of ethanol.

2. Add 5 milliliters of glacial acetic acid and mix.

3. Add 2.3 grams of the metal salt selected to the solution and continue stirring until all crystals are dissolved.

4. Add 100 milliliters of HFE 7100 or Vertrel XF.

INSTRUMENTATION

See Appendix IV - General Instrumentation.

Environmental chambers will be used to control the heat and relative humidity that the item of evidence is submitted to after processing. The chambers should be calibrated periodically with a hygrometer and thermometer to ensure that the chamber is maintaining the proper level of relative humidity and temperature.

Forensic light sources can be used to illuminate the evidence and produce the desired fluorescence.

Proper safety precautions including avoiding skin exposure and proper eye protection with appropriate optical densities should be utilized when operating forensic light sources. Consult the appropriate user's manuals for the safe use and appropriate eye protection for the specific piece of equipment being utilized.

MINIMUM STANDARDS & CONTROLS

The Standards and Controls for the metal salt post-treatment procedure consist of spraying ninhydrin-developed test prints with the solution. Once properly exposed to the metal salt solution, the reaction is noted by a color change from purple ninhydrin-developed impressions to a red or orange color. The test prints are then subjected to the proper level of heat/humidity. If the color change is observed and the test prints are visualized by the proper wavelength of light, the metal salt solution can be used to process evidence.

Documentation of the test prints must be recorded in the LAM at the time the reagent is made. Test prints must also be made on a case-by-case basis and documented in the examiner's work notes.

Due to the damage potential of the metal salt application, suitable ninhydrin-developed impressions should be treated only after photographic preservation and only when the possibility of increased contrast is essential. All observed impressions from metal salt post-treatment must be photographically preserved.

PROCEDURE OR ANALYSIS

All applications should be done in a fume hood

1. Spray the ninhydrin treated surface with an extremely light spray of metal salt solution. Avoid a visible wetting of the surface as ninhydrin impressions may be diffused by the solvent.

2. After initial exposure the ninhydrin impressions will change color from purple to red or orange. If the color change is not noted successive light applications of the metal salt solution may be required. Once the color change is noted no additional application is needed.

3. The item may be placed in an environmental chamber for a few minutes to attempt to improve contrast. The settings should not exceed 80 degrees Celsius and be between 60% and 80% relative humidity.

4. Any impression showing improved contrast should be photographed.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

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ILLINOIS STATE POLICE

LATENT PRINTS
PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization Non-Porous

METHOD: Physical Processing Non-Porous

PROCEDURE: **POWDERS AND PARTICULATES**

Reviewed by:

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Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

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

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

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

Magnetic powders are powder-coated, fine iron filings subject to magnetic attraction. These adhere to moisture to a lesser degree than carbon powders, but can be applied with less destructive force to the surface.

Particulate developers are substances which produce extremely fine particle residue upon burning. Materials with a high hydrocarbon content such as camphor, pine knots, or crumbled masking tape burn slowly and release soot in large quantities. Fine particulate carbon soot adheres extremely well to more viscous moisture while heat from the flame softens the residue. White or light-colored soot may be produced by burning magnesium ribbon.

Most commercial black fingerprint powders have a high carbon base. According to the manufacturer's particular formula and production methods, the carbon base may be from a variety of sources, including lamp black, bone, or wood charcoal. Ground carbon alone cannot match the adhesion ability of fine particle carbon soot, but commercial powders contain milled carbon of highly uniform size and shape along with additional ingredients to preserve the milled condition and retard air moisture absorption.

OTHER RELATED PROCEDURES:

Cyanoacrylate Ester

SAFETY CONSIDERATIONS

Commercially Prepared Powders
Camphor
Magnesium Ribbon

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

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

PREPARATIONS

No specific preparations are needed as the powders and materials being used are commercially prepared.

INSTRUMENTATION

See Appendix IV-General Instrumentation.

MINIMUM STANDARDS & CONTROLS

The Standards and Controls for the Powders and Particulates consist of ensuring that the powders or materials being used are in the proper condition. Powders should not be exposed to high humidity or moisture. Powders may clump if exposed to excessive moisture or contaminants. Moisture content and contaminants may be minimized by keeping the stock container closed as much as possible and using containers with small amounts of powder to work from. This will minimize the moisture content as well as reduce any contamination of the stock container with substances from the item being processed. Powders may also be kept in desiccators designed to reduce the moisture in the

atmosphere in the enclosed desiccator unit. Due to its inherent ability to adhere to residue, there is no need to do test impressions.

Powder and particulate-developed latent impressions must be properly preserved. Experiments have revealed that the developed latent impressions have a weaker adhesion to the surface than undeveloped, and, as a result, are more susceptible to damage from accidental contact. Two methods of preservation are normally afforded the powder or particulate-developed latent: photography and lifting. Caution should be taken when lifting to ensure that the lift will be successful. If the lift can not be made with confidence that it will be successful, the developed friction ridge detail should be photographed prior to lifting.

PROCEDURE OR ANALYSIS

Standard Powders:

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

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

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

Magnetic Powders:

Magnetic powder must be applied with a magnetic application device. Wands which contain a movable magnet attract the powder when the magnet is depressed and release the powder when it is raised. Contact between powder and surface is completed without bristles and is more light and

delicate than the fiberglass brush. However, the particle size, larger than standard powder, has a tendency to paint some surfaces. Excessive powder can sometimes be removed by passing the magnetic wand without powder near the surface. Since the magnetic attraction holding the iron particles is relatively weak, the supply can be depleted quickly. Surface areas examined generally must be processed more slowly with magnetic powders, and great care must be exercised to prevent actual contact between the end of the wand and the surface.

Particulate/Soot Powders:

Particulate developers such as camphor are ignited and the surface exposed to the rising soot. The surface must not be placed in the flame and must be moved to ensure an even coating of particulate material. Excessive coatings should be avoided. When the surface contains an adequate, even layer of soot, the surface is lightly brushed, preferably with a fiberglass brush dedicated for use with particulate developers, until the non-adhering soot is removed. This technique can only be applied to surfaces that will not be affected by the heat from the ignited camphor. Surfaces such as plastics should not be processed using this technique due to the extreme heat produced.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

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ILLINOIS STATE POLICE

LATENT PRINTS
PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization Non-Porous

METHOD: Physical Processing Non-Porous

PROCEDURE: **SMALL PARTICLE REAGENT**

Reviewed by:

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Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

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

Molybdenum disulfide is a lipid-sensitive reagent. Refinements in the surfactant solution have improved the uniformity of suspension. SPR is very effective in the secondary treatment of cyanoacrylate ester developed impressions by adhering to faint impressions generally better than powders and particulates. Molybdenum disulfide is produced in various particle sizes. Smaller particle sizes are more effective.

OTHER RELATED PROCEDURES:

Cyanoacrylate Ester Fuming
Powders and Particulates

SAFETY CONSIDERATIONS

Molybdenum Disulfide
Tergitol 7 (liquid form)

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

NFPA LISTING				
CHEMICAL	HEALTH HAZARD	FLAMMABILITY HAZARD	REACTIVITY HAZARD	CONTACT HAZARD
Molybdenum Disulfide	2	1	0	
Tergitol-7	1	1	1	

PREPARATION

Surfactant Stock Solution:

1. Dissolve 8 milliliters of Tergitol 7 in 500 milliliters of distilled water. This will make approximately 10 liters of working solution.

SPR Suspension- Working Solution:

1. Add 10 grams of molybdenum disulfide to 50 milliliters of the surfactant stock solution. Add the molybdenum disulfide slowly and stir continuously.

2. The mixture should be a creamy consistency free of any dry powder.

3. While stirring continuously add the mixture to 900 milliliters of distilled water.

INSTRUMENTATION

See Appendix IV-General Instrumentation.

MINIMUM STANDARDS AND CONTROLS

The Standards and Controls for the small particle reagent procedure consist of placing test impressions on either a porous or non-porous surface to make test prints. The test prints are then immersed in or sprayed with the working solution, rinsed, and allowed to dry. If the test prints are visualized, the working solution can be used to process evidence.
Documentation of the test prints must be recorded in the LAM at the time the reagent is made.

All observed impressions must be photographically preserved. SPR lifts easily from dried, processed, nonporous surfaces but all developed impressions should be photographed prior to lifting. The intense black color generally facilitates photographic preservation. Faint impressions may benefit from a reprocessing of the item.

PROCEDURE OR ANALYSIS

Immersion Technique:

1. Shake the working solution well and place in a shallow tray such as a photographic tray. The tray should be filled until it will cover the item to be processed.

2. Stir the solution again and before each item is placed into the solution.

3. Place the item to be processed in the liquid to lie as flat as possible in the tray.

4. Allow the item to remain in the suspension and the molybdenum particles to settle on the item for 30 seconds.

5. The item is then turned over and again allowed to set for 30 seconds.

6. This procedure is continued until all surfaces have been exposed to the solution.

7. The item is then placed into a tray of clear tap water. The tray can be rocked or a flow of tap water can be established in the tray. The excess SPR will readily be removed.

8. The item is allowed to dry.

9. All impressions should be photographed and can subsequently be lifted.

Wash Bottle Application:

1. Spray a flow of SPR over the surface of the item.

2. Wash the surface with a light to moderate flow of clear tap water.

3. The item is allowed to dry.

4. All impressions should be photographed and can subsequently be lifted.

Larger items may be processed using a wash bottle to spray a flow of SPR over the surface. For outdoor application of very large items, such as a wet automobile, a garden sprayer can be used. Generally light to moderate flows of rinse water will not dislodge the molybdenum disulfide particles.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

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ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization Non-Porous

METHOD: Physical Processing Non-Porous

PROCEDURE: **CYANOACRYLATE ESTER FUMING**

Reviewed by:

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Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

_____

Kellen Hunter
Acting Patterned Evidence Program Manager

INTRODUCTION

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

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

Loctite products contain a cyanoacrylate ethyl ester and have proved to be quite effective for fuming. Loctite 495 Super Bonder provides a liquid useful for heat acceleration techniques while Hard Evidence is a gel which reacts to exposure to air. Any product containing ethyl ester generally will be more effective when subsequent laser dye applications are indicated. Cyanoacrylate ester fuming is highly effective with nonporous items made of plastics or metal. It is superior to any other method for the processing of gun metal.

OTHER RELATED PROCEDURES:

Powders and Particulates
Small Particle Reagent

SAFETY CONSIDERATIONS

Cyanoacrylate Ester

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

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

NFPA LISTING				
CHEMICAL	HEALTH HAZARD	FLAMMABILITY HAZARD	REACTIVITY HAZARD	CONTACT HAZARD
Cyanoacrylate Ester(superglue)	2	2	1	

PREPARATIONS

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

Follow the manufacturer's instructions regarding storage and expiration of cyanoacrylate ester.

INSTRUMENTATION

Cyanoacrylate Fuming Chambers

See Appendix IV-General Instrumentation.

MINIMUM STANDARDS & CONTROLS

The Standards and Controls for cyanoacrylate ester fuming procedure requires the use of test prints. Processing should be terminated when test prints have reached optimum development. However, all items should be watched carefully as faster or slower development may occur. Overdevelopment can obscure impressions due to total surface polymerization. Test prints must be done with each batch of items processed.

Documentation of the test prints must be recorded in the examiner's work notes.

All observed impressions must be photographically preserved prior to any additional processing. Powders and particulate developers are also effective and often permit additional photographic and lifting preservation.

PROCEDURE OR ANALYSIS

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

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

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

A convenient and effective method is the use of an exclusive product, Loctite Hard Evidence. Cyanoacrylate esters are mixed in a gel with chemicals that produce fairly rapid but controlled volatilization upon exposure to air. The product is available in pouches which are easily peeled open to commence the volatilization, but which can be resealed to stop the reaction. Each pouch will produce fumes for ten to fifteen hours dependent upon ambient temperature; however, volatilization slows with exposure so that more time must be allowed for pouches approaching exhaustion. Hard Evidence does have a shorter shelf life than liquid cyanoacrylate ester compounds. Pouches anticipated to be stored for longer than six months should be refrigerated (but not frozen) and allowed to reach room temperature before use. However, previously opened pouches should not be refrigerated. Opened pouches which may not be used again for some time should additionally be sealed with tape to prevent gradual release of fumes.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

REFERENCES

1. Lee, Henry C.; R. E. Gaensslen. “Cyanoacrylate Fuming”; *Identification News*, 1984, 34, 6, 8-14.

2. Lee, Henry C.; Gaensslen, R. E., eds. *Advances in Fingerprint Technology*; Elsevier Science Publishers, NY, 1991.

3. Lennard, Christopher J.; Pierre A. Margot. “Sequencing of Reagents for the Improved Visualization of Latent Fingerprints”; *Journal of Forensic Identification*, September/ October 1988, 38, 5, 197-210.

4. Kent, Terry, ed. *Fingerprint Development Techniques;* Heanor Gate Publisher: Derbyshire, England, 1993.

5. Pounds, C.A.; R.J. Jones. "Physicochemical Techniques in the Development of Latent Fingerprints"; *Trends in Analytical Chemistry*, 1983, 2, 8, 180-183.

ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization Non-Porous

METHOD: Chemical Processing Non-Porous

PROCEDURE: **ARDROX**

Reviewed by:

Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Ardrox is a fluorescent dye stain used on non-porous items after cyanoacrylate ester fuming. Ardrox has an affinity for adhesion to polymerized latent prints even at levels below visual observation. Excitation of Ardrox with a long-wave ultraviolet (UV) lamp produces fluorescence.

OTHER RELATED PROCEDURES:

Cyanoacrylate Ester Fuming
Rhodamine 6G
MRM 10

SAFETY CONSIDERATIONS

Ardrox
Isopropanol
Methanol
Methyl Ethyl Ketone
Forensic Light Sources - see Appendix IV - General Instrumentation

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

PREPARATIONS

The examiner can choose from several preparations of Ardrox solutions. The preparation chosen is primarily dependent on the reaction of the substrate to the solvent used for dilution of the Ardrox. While a 1% or 2% Ardrox in methanol or isopropanol solution is productive for most surfaces, substrates that react with the alcohols can be treated with either the aqueous solution or Methyl Ethyl Ketone (MEK) preparation. Undiluted Ardrox can also be used to process items when the substrate reacts with the solvents. The preparations described below are to be used with undiluted Ardrox. If instructions for preparing the Ardrox are provided by the manufacturer, the manufacturer's directions should be followed in order to prepare a 1-2% solution of diluted Ardrox.

Methanol/Isopropanol:

1. Mix 5.0 milliliters of Ardrox with 500 milliliters of methanol or isopropanol.

MEK

1. Mix 1.0 milliliters of Ardrox in 9.0 milliliters of isopropanol.
2. Add 15.0 milliliters of methyl ethyl ketone.
3. Add 75.0 milliliters of distilled water and mix.

Undiluted Ardrox.

1. No preparation is required.

Aqueous Ardrox.

1. Mix 1.0 milliliter of Ardrox in 100 milliliters of water.

INSTRUMENTATION

See Appendix IV-General Instrumentation.

High Intensity Ultraviolet Light Source
Forensic Light Source

Items treated with the Ardrox solution can be examined with any long wave UV light source, or with the blue light of a laser or forensic light source. In most cases, UV illumination is preferable to laser or xenon arc excitation, particularly to facilitate photography.

Proper safety precautions including avoiding skin exposure and proper eye protection with appropriate optical densities should be utilized when operating ultraviolet light sources, lasers or alternate light sources. Consult the appropriate user's manuals for the safe use and appropriate eye protection for the specific piece of equipment being utilized.

MINIMUM STANDARDS & CONTROLS

The Standards and Controls for the Ardrox procedure consist of immersing or spraying cyanoacrylate ester-developed test prints with the working solution. Allow the solution to remain on the test prints for several minutes, then examine them using the appropriate light source. If fluorescence is observed, the working solution can be used to process evidence.

Documentation of the test prints must be recorded in the LAM at the time the reagent is made.

Per QM-14 in the Quality Manual, the Ardrox working solution may be stored up to one year, at which time it will be discarded or re-authenticated. Re-authentication can be accomplished by viewing a treated test print with the appropriate light source and noting its fluorescence. If the desired fluorescent properties are observed, the working solution can be used to process evidence for up to one additional year. The examiner must indicate their initials, the new expiration date, and that the reagent has been re-authenticated on the working solution bottle. The re-authenticated reagent must be updated in the LAM.

Although Ardrox and Rhodamine 6G may be used in any order, Ardrox staining is removed by methanol while Rhodamine 6G will not be removed by a water rinse. Since excessive background staining with Rhodamine 6G generally cannot be removed, the use of Ardrox staining before Rhodamine 6G may be beneficial.

All observed impressions must be photographically preserved.

PROCEDURE OR ANALYSIS

All applications should be done in a fume hood

Undiluted Ardrox application:

1. Completely cover the item to be processed with undiluted Ardrox by immersion or by squirt bottle.

2. Allow the liquid to remain on the item for about ten minutes.

3. Rinse the item under tap water until no yellow color remains.

4. Allow the item to dry and examine with the appropriate light source.

5. Photograph any impressions observed.

Diluted Ardrox application:

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

2. Allow the solution to remain on the item for several minutes to ensure proper adherence of the Ardrox to the cyanoacrylate developed impressions.

3. Examine the item using the appropriate light source without rinsing to determine if background staining has occurred. If not, proceed with the examination and photograph all developed impressions.

4. If background staining is observed and prevents adequate photographic preservation, expose the item to a light tap water rinse.

5. Allow the item to dry completely and examine with the appropriate light source.

6. Photograph any impressions observed.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

REFERENCES

1. Trozzi, T.; Schwartz, R.: Hollars, M. *Processing Guide for Developing Latent Prints*; Federal Bureau of Investigation, Laboratory Division, U.S. Department of Justice, U.S. Government Printing Office: Washington, DC, 2000

2. Lee, H. C.; Gaensslen, R.E *Advances in Fingerprint Technology*, 2nd ed.; CRC Press: Boca Raton, FL, 2001

3. Menzel, E. Roland, *Fingerprint Detection with Lasers, 2nd ed.*; Marcel Dekker, Inc.: New York, 1999.

ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization Non-Porous

METHOD: Chemical Processing Non-Porous

PROCEDURE: **RHODAMINE 6G**

Reviewed by:

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Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Rhodamine 6G is a fluorescent dye stain used on non-porous items after cyanoacrylate ester fuming. Rhodamine 6G has an affinity for adhesion to polymerized latent prints even at levels below visual observation. Excitation of Rhodamine 6G with a forensic light source of the appropriate wavelength produces fluorescence.

OTHER RELATED PROCEDURES:

Ardrox
MRM 10
Cyanoacrylate Ester Fuming

SAFETY CONSIDERATIONS

Isopropanol
Methanol
Rhodamine 6G
Synperonic N
Forensic Light Sources - see Appendix IV - General Instrumentation

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

PREPARATIONS

The examiner can choose from two preparations of Rhodamine 6G solutions. The preparation chosen is primarily dependent on the reaction of the substrate to the solvent used. A 0.01% to 0.001% Rhodamine 6G in methanol or isopropanol, weight to volume, is productive for most surfaces with methanol being the preferred solvent. Working solutions of Rhodamine 6G should be prepared in small amounts. Aqueous Rhodamine 6G solutions should be used when methanol or other organic solvents will be destructive to the surface being treated.

Methanol/Isopropanol Formula: (0.01% solution)

1. Dissolve 0.1 grams of Rhodamine 6G in 1.0 liter of methanol or isopropanol.

Aqueous Formula: (0.01% solution)

1. Dissolve 0.1 grams of Rhodamine 6G in 1.0 liter of distilled water.

2. Add 3-6 drops of Synperonic N and gently stir.

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

INSTRUMENTATION

See Appendix IV-General Instrumentation.

Forensic Light Sources

Forensic light sources that produce the proper wavelength of light can be used to illuminate the evidence and produce the desired fluorescence.

Proper safety precautions including avoiding skin exposure and proper eye protection with appropriate optical densities should be utilized when operating forensic light sources. Consult the appropriate user's manuals for the safe use and appropriate eye protection for the specific piece of equipment being utilized.

MINIMUM STANDARDS & CONTROLS

The Standards and Controls for the Rhodamine procedure consist of immersing or spraying cyanoacrylate ester-developed test prints with the working solution. Allow the solution to remain on the test prints for several minutes, then examine them using the appropriate light source. If fluorescence is observed, the working solution can be used to process evidence.

Documentation of the test prints must be recorded in the LAM at the time the reagent is made. Per QM-14 in the Quality Manual, the Rhodamine 6G working solution may be stored up to one year, at which time it will be discarded or re-authenticated. Re-authentication can be accomplished by viewing a treated test print with the appropriate light source and noting its fluorescence. If the desired fluorescent properties are observed, the working solution can be used to process evidence for up to one additional year. The examiner must indicate their initials, the new expiration date, and that the reagent has been re-authenticated on the working solution bottle. The re-authenticated reagent must be updated in the LAM.

All observed impressions must be photographically preserved.

PROCEDURE OR ANALYSIS

All applications should be done in a fume hood.

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

2. Rinse the item with methanol and allow to dry.

3. Examine the item with a forensic light source at the appropriate wavelength using the appropriate eyewear.

4. If the developed latent prints are faint, additional application of the Rhodamine 6G solution may be attempted.

5. Photograph any impressions observed.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

REFERENCES

1. Trozzi, T.; Schwartz, R.: Hollars, M. *Processing Guide for Developing Latent Prints*; Federal Bureau of Investigation, Laboratory Division, U.S. Department of Justice, U.S. Government Printing Office: Washington, DC, 2000

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4. Menzel, E. Roland, *Fingerprint Detection with Lasers, 2nd ed.*; Marcel Dekker, Inc.: New York, 1999.

ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization Non-Porous

METHOD: Chemical Processing Non-Porous

PROCEDURE: **MRM 10**

Reviewed by:

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Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

MRM 10 is a fluorescent dye stain containing MBD, Rhodamine 6G and Maxillon Flavine 10 GFF which is used on non-porous items after cyanoacrylate ester fuming. MRM 10 has an affinity for adhesion to polymerized latent prints even at levels below visual observation. Excitation of MRM 10 with a forensic light source of appropriate wavelengths, such as long-wave ultraviolet and laser, produces fluorescence.

OTHER RELATED PROCEDURES:

Ardrox
Cyanoacrylate Ester Fuming
Rhodamine 6G

SAFETY CONSIDERATIONS

Acetone
Acetonitrile
Ardrox
Isopropanol
Yellow 40 (Maxillon Flavine 10 GFF)
MBD 7-(p-methoxybenzylamino)-4-nitrobenz-2-oxa-1,3 diazole
Methanol
Petroleum ether
Rhodamine 6G
Forensic Light Sources - see Appendix IV - General Instrumentation

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

PREPARATIONS

Stock solutions for preparation of MRM 10 stock solution:

1. Rhodamine 6G stock solution:

   Dissolve 1 gram Rhodamine 6G in 1 liter methanol

2. MBD stock solution:

Dissolve 1 gram MBD 7-(p-methoxybenzylamino)-4-nitrobenz-2-oxa-1,3 diazole in 1 liter acetone.

3. Yellow 40 (Maxillon Flavine 10 GFF) stock solution:

   Dissolve 2 grams Yellow 40 in 1 liter methanol.

Preparation of MRM 10 stock solution is made by combining the following stock solutions and chemicals (one liter of MRM 10 stock solution will make 20 liters of working solution):

1. 60 mL Rhodamine 6G stock solution.
2. 60 mL Yellow 40 stock solution
3. 140 mL MBD stock solution
4. 400 mL methanol
5. 200 mL 2-propanol
6. 160 mL acetonitrile

MRM 10 working solution is prepared as follows:

A working solution is prepared by adding 50ml of MRM 10 stock solution to 1 liter of petroleum ether.

Rinse:

1. Petroleum ether (if background interference occurs the item can be rinsed using petroleum ether). No preparation needed.

INSTRUMENTATION

See Appendix IV - General Instrumentation.

High Intensity Ultraviolet Light Source
Forensic Light Sources

Items treated with the MRM 10 solution can be examined with any long wave UV light source, with laser light or other forensic light sources.

Proper safety precautions including avoiding skin exposure and proper eye protection with appropriate optical densities should be utilized when operating ultraviolet light sources, lasers or alternate light sources. Consult the appropriate user's manuals for the safe use and appropriate eye protection for the specific piece of equipment being utilized.

MINIMUM STANDARDS & CONTROLS

Test prints will not be done for the component reagents of the working solution (Rhodamine 6G stock solution, MBD stock solution, Yellow 40 stock solution, or MRM 10 stock solution).
The Standards and Controls for the MRM 10 working solution procedure consist of immersing or spraying cyanoacrylate ester-developed test prints with the working solution. Allow the solution to remain on the test prints for several minutes, then examine them using the appropriate light sources (long-wave ultraviolet light and green/532nm laser light). If fluorescence is observed, the working solution can be used to process evidence.

Documentation of the test prints must be recorded in the LAM at the time the reagent is made.

Per QM-14 in the Quality Manual, the MRM10 working solution and its various stock solution components may be stored for up to one year, at which time they will be discarded or re-authenticated. Re-authentication can be accomplished by viewing a treated test print with the appropriate light source and noting its fluorescence. If the desired fluorescent properties are observed, the MRM10 working solution and its various stock solution components can be used to process evidence for up to one additional year. The examiner must indicate their initials, the new expiration date, and that the reagent has been re-authenticated on the working solution bottle. The re-authenticated reagent must be updated in the LAM.
All observed impressions must be photographically preserved.

PROCEDURE OR ANALYSIS

All applications should be done in a fume hood.

MRM 10 working solution application:

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

2. As the item is being processed, the waste MRM 10 solution should be collected and allowed to evaporate in a fume hood. Do not pour waste or excess solution down the drain due to flammability hazard.

3. Examine the item with a long-wave ultraviolet light source and a laser, or an alternate forensic light source at the appropriate wavelengths, using appropriate eyewear.

4. If background staining is observed and prevents adequate photographic preservation, expose the item to a petroleum ether rinse.

5. If the developed latent prints are faint, additional application of the MRM 10 solution may be attempted.

6. Photograph any observed impressions using an appropriate filter.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

REFERENCES

1. Trozzi, T.; Schwartz, R.; Hollars, M. *Processing Guide for Developing Latent Prints*; Federal Bureau of Investigation, Laboratory Division, U.S. Department of Justice, U.S. Government Printing Office: Washington, DC, 2000

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ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization Specialized Processing Techniques

METHOD: Non-Destructive Porous/Non-Porous

PROCEDURE: **INHERENT LUMINESCENCE**

Reviewed by:

Forensic Scientist Katharine Mayland, Chairperson
Latent Prints Command Advisory Board

Approved by:

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Some components of latent print residue, including Vitamin B complexes, may luminesce when illuminated by a forensic light source. Various contaminants may become part of the latent print residue and may inherently luminesce as well. The inherent luminescence procedure is a non-destructive technique and is particularly useful on items that may be damaged by other techniques.

SAFETY CONSIDERATIONS

Forensic Light Sources

Proper safety precautions including avoiding skin exposure and proper eye protection with appropriate optical densities should be utilized when operating ultraviolet light sources, lasers or alternate light sources. Consult the appropriate user's manuals for the safe use and appropriate eye protection for the specific piece of equipment being utilized.

PREPARATIONS

No specific preparations required.

INSTRUMENTATION

See Appendix IV - General Instrumentation

Forensic Light Sources

Forensic light sources that produce the excitation light of an appropriate wavelength can be used to illuminate the evidence and produce the desired fluorescence.

MINIMUM STANDARDS AND CONTROLS

All observed impressions must be photographically preserved.

PROCEDURE OR ANALYSIS

The procedure for this technique consists of examining the item with the forensic light sources using appropriate filtration. All observed impressions must be photographed.

MINIMUM QUALITY STANDARDS AND CONTROLS

See Appendix II.

REFERENCES

1. Dalrymple, Brian E.; J. M. Duff; E. Roland Menzel. "Inherent Luminescence of Fingerprints by Laser"; *Identification News*, January 1977, 22, 1, 3-6.

2. Menzel, E. Roland. *Fingerprint Detection with Lasers*; Marcel Dekker: NY, 1980; pp 108.

ILLINOIS STATE POLICE

LATENT PRINTS
PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization Specialized Processing Techniques

METHOD: Non-Destructive Porous/Non-Porous

PROCEDURE: **IODINE FUMING**

Reviewed by:

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Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Iodine is a sensitive indicator of various fatty oils which are often present in latent print residue. Iodine is absorbed by the oily material which turns a temporary reddish-brown color. While absorption is quite rapid and can be pronounced, no chemical change occurs. When exposure to the iodine ceases, the oily material releases the iodine molecules slowly. The color begins to fade and after several hours, the iodine may be completely dissipated. Re-exposure will most often repeat the process while maintained exposure prevents dissipation.

Iodine is effective with relatively fresh oily deposits, but for those older than two weeks, the reaction may not occur or be too faint for recognition. Iodine is normally not destructive and may detect deposits with insufficient amino acids for effective ninhydrin reaction. The application of 7, 8-benzoflavone may be used to intensify weak iodine discolorations of latent print residue.

Iodine is toxic and very corrosive to nearly all metals. It can be used to process nearly all types of surfaces but is normally used with porous items.

OTHER RELATED PROCEDURES:

7, 8-benzoflavone

SAFETY CONSIDERATIONS

Iodine

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

PREPARATIONS

No specific preparation of the iodine crystals is required.

INSTRUMENTATION

See Appendix IV-General Instrumentation.

Fuming Cabinets

Iodine Gun

MINIMUM STANDARDS AND CONTROLS

The Standards and Controls for the iodine procedure consist of exposing a test print to the iodine fumes using the appropriate application device. If the test print is visualized, indicated by a reddish-brown discoloration in the area of the test print, the crystals/application technique can be used to process evidence. This procedure must be done for each new application.

Documentation of the test print must be recorded in the examiner's case notes.

All iodine developed impressions are transitory and once removed from exposure to the iodine fumes must be preserved as quickly as possible. All observed impressions must be photographically preserved.

PROCEDURE OR ANALYSIS

All applications should be done in a fume hood.

Iodine is most effectively utilized with vapors from sublimating crystals. Direct contact of iodine crystals to actual items should be avoided. Sublimation occurs at low temperature, but heat accelerates the action. Confined vapors provide for the best reaction and the least health risk.

1. Fuming Cabinet:

   Cabinets which permit adequate space for evidentiary items, fume containment, and gentle heat to accelerate sublimation are sometimes used. See Appendix IV - General Instrumentation.

2. Iodine Fuming Gun:

   Large or immobile items can also be processed with direct iodine vapor from an iodine fuming gun. This device creates vapors within a tube which are directed toward the surface to be examined by forced air movement, either by a compressed air source or the use of a squeeze bulb. The residue is exposed to the vapors for a short amount of time, resulting in the immediate release of the absorbed iodine. Any developed latent impressions must be preserved immediately See Appendix IV - General Instrumentation.

3. Zip Lock Plastic Bag:

   An alternative to a fuming cabinet is a Zip-Lock type transparent plastic bag. A small amount of iodine crystals is poured into the bag, the item inserted and the bag sealed. The

crystals are held between the fingers or grabbed by the hand to provide additional heat to hasten sublimation. The bag may be periodically shaken to improve the distribution of iodine vapors, but close contact of crystals to the item should be minimized. Oily latents will discolor in a matter of minutes.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

REFERENCES

1. Cowger, James F. *Friction Ridge Skin Comparison and Identification of Fingerprints*; Boca Raton: CRC Press, 1993.

2. Lee, Henry C.; Gaensslen, R. E., eds. *Advances in Fingerprint Technology*; Elsevier Science Publishers: NY, 1991.

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ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization Specialized Processing Techniques

METHOD: Porous/Non-Porous

PROCEDURE: **7, 8-BENZOFLAVONE**

Reviewed by:

Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Iodine fuming of oily material may produce faint or incomplete reactions due to the age of the latent or the uneven distribution of oil upon the skin at the time of contact. Additional exposure to iodine may fail to intensify such reactions. 7,8-benzoflavone acts as a catalyst which bonds iodine to the detected oily matter and effects a color change from a transitory reddish brown to a permanent blue-black. 7,8-benzoflavone may develop additional detail and makes previously visible impressions more distinct. .

OTHER RELATED PROCEDURES:

Iodine

SAFETY CONSIDERATIONS

7, 8-Benzoflavone
Cyclohexane
Methylene Chloride

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

PREPARATION

1. Mix 0.3 grams of 7,8-benzoflavone in 10 milliliters of methylene chloride and stir until the crystals are completely dissolved.

2. Add 90 milliliters of cyclohexane and thoroughly mix.

INSTRUMENTATION

See Appendix IV-General Instrumentation.

MINIMUM STANDARDS & CONTROLS

The Standards and Controls for the 7, 8-benzoflavone procedure consist of exposing a test print to the iodine fumes. If the test print is visualized, indicated by a reddish-brown discoloration in the

area of the test print, the 7, 8-benzoflavone is applied. The color change from reddish-brown to blue-black indicates the 7, 8-benzoflavone is working correctly and can be used on evidence. This testing procedure must be done for each working solution at the time the solution is made.

Documentation of the test print must be recorded in the LAM at the time the reagent is made. Test prints must also be made on a case-by-case basis and documented in the examiner's case notes.

The 7,8-benzoflavone bond with iodine to oily material is relatively stable; however, the bond is destroyed by acetone and other organic solvents. Subsequent ninhydrin processing usually removes any 7,8-benzoflavone impressions. Therefore, all observed impressions must be photographically preserved as soon as possible.

PROCEDURE OR ANALYSIS

All applications should be done in a fume hood

1. Articles which have displayed some reaction to iodine are re-exposed until maximum intensity is reached.

2. Lightly spray the iodine developed area with the 7,8-benzoflavone solution.

3. An immediate color change will be noted.

4. The developed impressions are photographed.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

REFERENCES

1. Lennard, Christopher J.; Pierre A. Margot. "Sequencing of Reagents for the Improved Visualization of Latent Fingerprints"; September/October 1988, 38, 5, 197-210.

2. Mashiko, Kenzo; Makato Ishizaki. "Latent Fingerprint Processing Iodine 7,8-Benzoflavone Method"; *Identification News*, November 1977, 3-5.

ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization Specialized Processing Techniques

METHOD: Non-Destructive Porous/Non-Porous

PROCEDURE: Digital Reflected Ultraviolet Imaging System (RUVIS)

Reviewed by:

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Forensic Scientist Katharine Mayland, Chairperson
Latent Prints Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Friction ridge skin impressions sit on top of non-porous substrates. When shortwave UV light hits the substrate at certain angles, the light reflects off of the substrate at the angle of incidence. Any irregularities on the surface, such as raised ink, textured areas, or fingerprint impressions, will cause the shortwave UV light to scatter at different angles. The RUVIS camera detects this scattered light, and the RUVIS software allows the examiner to view and capture images of friction ridge impressions on difficult-to-photograph substrates. The RUVIS procedure is a non-destructive technique and is particularly useful on smooth, non-porous surfaces that have reflective properties.

SAFETY CONSIDERATIONS

Forensic Light Sources

Proper safety precautions including avoiding skin exposure and proper eye protection with appropriate optical densities should be utilized when operating ultraviolet light sources, lasers, or alternate light sources. Consult the appropriate user's manuals for the safe use and appropriate eye protection for the specific piece of equipment being utilized.

PREPARATIONS

No specific preparations required.

INSTRUMENTATION

See Appendix IV – General Instrumentation

Forensic Light Sources

A digital Reflected Ultraviolet Imaging System (RUVIS) can be used to visualize impressions on smooth, reflective surfaces, both before and after other types of processing.

MINIMUM STANDARDS AND CONTROLS

All observed suitable impressions must be photographically preserved.

PROCEDURE OR ANALYSIS

The procedure for this technique consists of examining the item with the RUVIS. All observed suitable impressions must be photographed.

MINIMUM QUALITY STANDARDS AND CONTROLS

See Appendix II – Minimum Standards & Controls

REFERENCES

1. Sears, V.G., Bleay, S.M., Bandey H.L., and Bowman, V.J. (2012) A methodology for finger mark research. *Science and Justice*, (52), 145-160.

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

3. Keith, L.V. and Runion, W. (1998) Short-wave UV Casework Applications. *Journal of Forensic Identification*, 48(5), 563-569.

4. Edwards, J.L., Cox, M., Giacometti, E. "*Validation of the Digital Reflected Ultraviolet (UV) Imaging System (RUVIS).*" Illinois State Police, Division of Forensic Services, validation project 2015-04.

5. SceneScope RUVIS UHD System. (2016, December 20). Retrieved from http://www.spexforensics.com/applications/scenescope-ruvis-uhd-system

ILLINOIS STATE POLICE

LATENT PRINTS
PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization Specialized Processing Techniques

METHOD: Blood Protein Enhancement Porous/Non-Porous

PROCEDURE: **NINHYDRIN**

Reviewed by:

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Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Ninhydrin is a protein indicator particularly sensitive to alpha amino acids. Ninhydrin is also sensitive to the proteins present in blood. Blood impressions as well as other protein based impressions will be intensified and additional detail not previously visible may be revealed. Ninhydrin can be used on any surface but should primarily be used on porous items. Non-porous items are in most instances better processed by using one of the other blood protein enhancement techniques listed below. Porous items can be processed with ninhydrin visualizing both blood proteins and other alpha amino acids.

OTHER RELATED PROCEDURES:

Amido Black
Coomassie Staining Solution
Crowle's Staining Solution

SAFETY CONSIDERATIONS

See Chemical Processing of Porous Items – Ninhydrin.

PREPARATIONS

See Chemical Processing of Porous Items - Ninhydrin

INSTRUMENTATION

See Appendix IV-General Instrumentation.

MINIMUM STANDARDS & CONTROLS

See Chemical Processing of Porous Items - Ninhydrin.

PROCEDURE OR ANALYSIS

See Chemical Processing of Porous Items - Ninhydrin.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

REFERENCES

1. Clay, W. Jr. "Fluorisol - The Solvent of Choice for Ninhydrin Detection of Latent Fingerprints"; *Identification News*, April 1981.

2. Cowger, James F. *Friction Ridge Skin Comparison and Identification of Fingerprints*; Boca Raton: CRC Press, 1993.

3. Lee, Henry C.; Gaensslen, R. E., eds. *Advances in Fingerprint Technology*; Elsevier Science Publishers: NY, 1991.

4. Lennard, Christopher J.; Pierre A. Margot. "Sequencing of Reagents for the Improved Visualization of Latent Fingerprints"; *Journal of Forensic Identification*, September/ October 1988, 38, 5, 197-210.

5. Kent, Terry, ed. *Fingerprint Development Techniques*; Heanor Gate Publisher: Derbyshire, England, 1993.

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ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization Specialized Processing Techniques

METHOD: Blood Protein Enhancement Porous/Non-Porous

PROCEDURE: **AMIDO BLACK**

Reviewed by:

Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Amido black or naphthalene black 10B is a protein indicator particularly sensitive to those proteins present in blood. While other techniques for the enhancement of blood impressions are available, they may pose serious health hazards or display a reaction for short durations. Amido black is a safer, permanent procedure which can be used on porous or non-porous surfaces. Amido black may prevent subsequent biological examination and therefore may only be used after biological examination of the evidence. However, amido black can be applied after cyanoacrylate fuming in many cases (see McCarthy and Grieve, 1989).

OTHER RELATED PROCEDURES:

Coomassie Staining Solution
Crowle's Staining Solution
Ninhydrin

SAFETY CONSIDERATIONS

Amido Black
Glacial Acetic Acid
Methanol

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

NFPA LISTING				
CHEMICAL	**HEALTH HAZARD**	**FLAMMABILITY HAZARD**	**REACTIVITY HAZARD**	**CONTACT HAZARD**
Amido Black	2	0	0	
Glacial Acetic Acid	2	2	1	
Methanol	1	3	0	

PREPARATIONS

Amido Black Working Solution

1. Dissolve 2.0 grams of amido black 10B in 100 milliliters of acetic acid.

2. Add 900 milliliters of methanol and thoroughly mix.

Rinse #1

1. Mix 100 milliliters of glacial acetic acid with 900 milliliters of methanol.

Rinse #2

1. Mix 50 milliliters of glacial acetic acid with 950 milliliters of distilled water.

INSTRUMENTATION

See Appendix IV-General Instrumentation.

MINIMUM STANDARDS & CONTROLS

The Standards and Controls for the amido black 10 B procedure consist of testing a small area on the evidence, which is not critical to the fingerprint analysis to ensure that the substrate will not be adversely affected by the working solution. Any blood proteins in these areas will be stained a dark blue-black.

The Standards and Controls for the amido black working solution consist of placing a blood test impression on either a porous or non-porous surface to make test prints. Synthetic blood can be used. Allow the blood impressions to dry completely. The test prints are then immersed in or sprayed with the working solution. If the test print is stained a dark blue-black color, the working solution can be used to process evidence.

The Standards and Controls for Rinse #1 consist of using litmus paper or pH paper to test the acidity of the solution. If the test indicates that the solution is neutral, the solution can be used to process evidence.

The Standards and Controls for Rinse #2 consist of using litmus paper or pH paper to test the acidity of the solution. If the test indicates that the solution is acidic, the solution can be used to process evidence.

Documentation of the test prints must be recorded in the LAM at the time the reagent is made.

Per QM-14 in the Quality Manual, the Amido Black working solution and rinses may be stored up to one year, at which time they will be discarded or re-authenticated. Re-authentication of the working solution can be accomplished by testing the solution on blood test prints. If dark blue-black impressions are visualized, the working solution can be used to process evidence for up to one additional year. Re-authentication of the rinses can be accomplished by testing the solutions with litmus or pH paper. If the test indicates the proper result, the rinses can be used to process evidence for up to one additional year. The examiner must indicate their initials, the new expiration date, and that the reagent has been re-authenticated on the working solution bottle. The re-authenticated reagent must be updated in the LAM.

Amido black is extremely stable; however, all observed impressions must be photographically preserved. Dried impressions which lose contrast may be re-immersed in the second rinse solution and photographed.

PROCEDURE OR ANALYSIS

All applications should be done in a fume hood.

1. Blood proteins must be fixed prior to amido black application. This can be accomplished by:

   -Baking the item at 100^{O}C for 30 minutes. Heat-sensitive items may be baked at a lower temperature for a longer time or another fixing technique attempted.

   -If the blood proteins are dried, by chemically fixing with methanol.

2. Amido black 10 B working solution is applied to the item by immersing the item in the working solution in a large tray, ensuring complete coverage of the area to be examined, or by using a squirt bottle.

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

3. The item is then rinsed with the first rinse solution followed by the second rinse solution until optimum contrast has been observed.

4. The developed impressions are then photographed.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

REFERENCES

1. British Home Office. "Chemical Development and Intensification of Sweat and Blood Marks, Etc;;" May 1981.

2. Lee, Henry C.; Gaensslen, R. E., eds. *Advances in Fingerprint Technology*; Elsevier Science Publishers: NY, 1991.

3. Kent, Terry, ed. *Fingerprint Development Techniques*; Heanor Gate Publisher: Derbyshire, England, 1993.

4. McCarthy, Mary M.; David L. Grieve. "Preprocessing with Cyanoacrylate Ester Fuming for Fingerprint Impressions in Blood"; *Journal of Forensic Identification*, 1989, 39, 1, 23-32.

ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization Specialized Processing Techniques

METHOD: Blood Protein Enhancement Porous/Non-Porous

PROCEDURE: **COOMASSIE STAINING SOLUTION**

Reviewed by:

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Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Coomassie Brilliant Blue R250 is a protein stain which is sensitive to the proteins in blood and palmar sweat. Coomassie may be used to enhance blood impressions on porous or non-porous items. Blood impressions do not require heat fixing of the proteins although residue must be dry prior to application. While not preferred, biological analysis may be conducted after the staining procedure. However, Coomassie's Brilliant Blue R250 can be applied after cyanoacrylate fuming in many cases (see McCarthy and Grieve, 1989).

OTHER RELATED PROCEDURES:

Amido Black 10B
Crowle's Staining Solution

SAFETY CONSIDERATIONS

Coomassie Brilliant Blue R250
Glacial Acetic Acid
Methanol

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

NFPA LISTING				
CHEMICAL	**HEALTH HAZARD**	**FLAMMABILITY HAZARD**	**REACTIVITY HAZARD**	**CONTACT HAZARD**
Brilliant Blue	2	0	0	
Glacial Acetic Acid	2	2	1	
Methanol	1	3	0	

PREPARATIONS

Coomassie Working Solution:

1. Dissolve 0.44 grams of Coomassie brilliant blue R250 in 200 milliliters of methanol.

2. Add 200 milliliters of distilled water and 40 milliliters of glacial acetic acid.

De-staining Solution:

1. Mix 200 milliliters of methanol with 200 milliliters of distilled water.

2. Add 40 milliliters of glacial acetic acid.

INSTRUMENTATION

See Appendix IV-General Instrumentation.

MINIMUM STANDARDS & CONTROLS

The Standards and Controls for the Coomassie staining procedure consist of testing a small area on the evidence that is not critical to the fingerprint analysis to ensure that the substrate will not be adversely affected by the working solution. Any blood proteins in these areas will be stained a dark blue.

The Standards and Controls for the Coomassie working solution consist of placing a blood or sweat test impression on a non-porous surface to make test prints. Synthetic blood can be used. Allow the impressions to dry completely. The test prints are then immersed in or sprayed with the working solution. If the test print is stained a dark blue color, the working solution can be used to process evidence.

The Standards and Controls for the de-staining solution consist of using litmus paper or pH paper to test the acidity of the solution. If the test indicates that the solution is neutral or weakly acidic, the solution can be used to process evidence.

Documentation of the test prints must be recorded in the LAM at the time the reagent is made.

Per QM-14 in the Quality Manual, the Coomassie working and de-staining solutions may be stored up to one year, at which time they will be discarded or re-authenticated. Re-authentication of the working solution can be accomplished by testing the solution on blood or palmar sweat test prints. If dark blue impressions are visualized, the working solution can be used to process evidence for up to one additional year. Re-authentication of the de-staining solution can be accomplished by testing the solution with litmus or pH paper. If the test indicates the proper result, the de-staining solution can be used to process evidence for up to one additional year. The examiner must indicate their initials, the new expiration date, and that the reagent has been re-authenticated on the working solution bottle. The re-authenticated reagent must be updated in the LAM.

While stained impressions are relatively stable, all observed impressions must be photographically preserved. Dried impressions which lose contrast may be re-immersed in the de-staining solution and photographed.

PROCEDURE OR ANALYSIS

All applications should be done in a fume hood.

Application by immersion:

1. The article is immersed in the staining solution and removed after 2 minutes of agitation.

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

2. It is then transferred to a de-staining solution. After 1 minute, the solution is agitated until the background discoloration fades.

3. Faint reactions will require a return to the staining solution for longer exposure. Repeated staining and de-staining can be performed until optimum intensity is reached.

4. All developed impressions should be photographically preserved.

Application by squirt bottle:

1. Repeated flows of staining solution can be poured or applied by squirt bottle over large surfaces for about 5 minutes or until maximum contrast is observed. Agitate the working solution before application to the evidence.

2. Application of the staining solution is followed by applying the de-staining solution.

3. All developed impressions must be photographically preserved.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

REFERENCES

1. British Home Office. "Chemical Development and Intensification of Sweat and Blood Marks, Etc."; May 1981.

2. Lee, Henry C.; Gaensslen, R. E., eds. *Advances in Fingerprint Technology*; Elsevier Science Publishers, NY, 1991.

3. Kent, Terry, ed. *Fingerprint Development Techniques*; Heanor Gate Publisher: Derbyshire, England, 1993.

4. McCarthy, Mary M.; David L. Grieve. "Preprocessing with Cyanoacrylate Ester Fuming for Fingerprint Impressions in Blood"; *Journal of Forensic Identification*, 1989, 39, 1, 23-32.

5. Norkus, P.; Kevin Noppinger. "New Reagent For The Enhancement Of Blood Prints"; *Identification News*, 1986, 26, 4, 5 & 15.

ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization Specialized Processing Techniques

METHOD: Blood Protein Enhancement Porous/Non-Porous

PROCEDURE: **CROWLE'S STAINING SOLUTION**

Reviewed by:

Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Crowle's staining solution is a protein stain which is sensitive to the proteins in blood and palmar sweat. It can be used for enhancement of blood prints on both porous and non-porous items. Crowle's solution is similar to Coomassie but contains no organic solvents. While not preferred, biological analysis may be conducted after the staining procedure. However, Crowle's stain can be applied after cyanoacrylate fuming in many cases (See McCarthy and Grieve, 1989).

OTHER RELATED PROCEDURES:

Amido Black 10B
Coomassie Staining Solution

SAFETY CONSIDERATIONS

Coomassie Brilliant Blue R250
Crocein Scarlet 7B
Glacial Acetic Acid
Trichloroacetic Acid

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

NFPA LISTING				
CHEMICAL	**HEALTH HAZARD**	**FLAMMABILITY HAZARD**	**REACTIVITY HAZARD**	**CONTACT HAZARD**
Coomassie Brilliant Blue R250	2	0	0	
Crocein Scarlet 7B	2	0	0	
Glacial Acetic Acid	2	2	1	
Trichloroacetic Acid	2	0	0	

PREPARATIONS

Crowle's Staining Solution:

1. Dissolve 2.5 grams of Crocein Scarlet 7B in 50 milliliters of glacial acetic acid.
2. Add 1.5 grams of Coomassie Brilliant Blue R250 and thoroughly mix.
3. Add 30 milliliters of trichloroacetic acid.
4. Dilute with 1000 milliliters of distilled water.

De-staining Solution:

1. Mix 3 milliliters of glacial acetic acid with 1000 milliliters of distilled water.

INSTRUMENTATION

See Appendix IV-General Instrumentation.

MINIMUM STANDARDS & CONTROLS

The Standards and Controls for the Crowle's staining procedure consist of testing a small area on the evidence that is not critical to the fingerprint analysis to ensure that the substrate will not be adversely affected by the working solution. Any blood proteins in these areas will be stained a dark reddish color.

The Standards and Controls for the Crowle's working solution consist of placing a blood or sweat test impression on either a porous or non-porous surface to make test prints. Synthetic blood can be used. Allow the impressions to dry completely. The test prints are then immersed in or sprayed with the working solution. If the test print is stained a dark reddish color, the working solution can be used to process evidence.

The Standards and Controls for the de-staining solution consist of using litmus paper or pH paper to test the acidity of the solution. If the test indicates that the solution is neutral or weakly acidic, the solution can be used to process evidence.

Documentation of the test prints must be recorded in the LAM at the time the reagent is made.

Per QM-14 in the Quality Manual, Crowle's working and de-staining solutions may be stored up to one year, at which time they will be discarded or re-authenticated. Re-authentication of the working solution can be accomplished by testing the solution on blood or palmar sweat test prints.

If dark reddish colored impressions are visualized, the working solution can be used to process evidence for up to one additional year. Re-authentication of the de-staining solution can be accomplished by testing the solution with litmus or pH paper. If the test indicates the proper result, the de-staining solution can be used to process evidence for up to one additional year. The examiner must indicate their initials, the new expiration date, and that the reagent has been re-authenticated on the working solution bottle. The re-authenticated reagent must be updated in the LAM.

While stained impressions are relatively stable, all observed impressions must be photographically preserved. Dried impressions which lose contrast may be re-immersed in the de-staining solution and photographed.

PROCEDURE OR ANALYSIS

All applications should be done in a fume hood.

Application by immersion:

1. Items are processed, whenever possible, by total immersion in the staining solution in a large tray.

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

2. Full development will take from 2 to 30 minutes; however, after 2 minutes the article may be removed and checked for latent print development.

3. The item is then placed in the de-staining solution and agitated.

4. Additional development may be accomplished by a return to the staining solution as often as required to obtain optimum development. Agitation during the staining and de-staining procedures is necessary to insure even and thorough contact.

5. All developed impressions must be photographically preserved.

Application by squirt bottle:

1. Repeated flows of staining solution can be poured or applied by squirt bottle over large surfaces for about 5 minutes or until maximum contrast is observed. Agitate the working solution before application to the evidence.

2. Application of the staining solution is followed by applying the de-staining solution until optimum contrast is achieved.

3. All developed impressions must be photographically preserved.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

REFERENCES

1. British Home Office. "Chemical Development and Intensification of Sweat and Blood Marks, Etc." May 1981.

2. Lee, Henry C.; Gaensslen, R. E., eds. *Advances in Fingerprint Technology*. Elsevier Science Publishers: NY, 1991.

3. Kent, Terry, ed. *Fingerprint Development Techniques*; Heanor Gate Publisher: Derbyshire, England, 1993.

4. McCarthy, Mary M.; David L. Grieve. "Preprocessing with Cyanoacrylate Ester Fuming for Fingerprint Impressions in Blood"; *Journal of Forensic Identification*, 1989, 39, 1, 23-32.

5. Norkus, Paul; Kevin Noppinger. "New Reagent For The Enhancement Of Blood Prints"; *Identification News*, 1986, 26, 4, 5 & 15.

ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization Specialized Processing Techniques

METHOD: Sticky Side of Tape Processing

PROCEDURE: **GENTIAN VIOLET**

Reviewed by:

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Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Gentian violet (crystal violet) is a sensitive dye stain which stains epithelial cells and other portions of latent print residue transferred upon surface contact. The presence of sebum appears to serve as an excellent transfer medium for sloughed epidermal cells and as a result, gentian violet is usually effective on surfaces which readily hold the deposited sebum, such as the adhesive side of tapes. The high sensitivity of gentian violet immediately stains the skin upon contact, therefore, leak proof gloves are required for examinations. Accidental staining of hands is relatively harmless, but usually cannot be destained. Disappearance of discoloration is a result of cell sloughing.

Dark-colored tapes may not present sufficient contrast to permit photographic preservation of impressions visualized with gentian violet. Using a method which attempts to transfer the gentian violet stain to a glazed paper surface may be the only method available to visualize impressions on dark tape. While this method can be successful, other processing methods like sticky side powder may be preferred when processing dark-colored tapes.

OTHER RELATED PROCEDURES:

Sticky Side Tape Powder Technique

SAFETY CONSIDERATIONS

Gentian Violet

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

NFPA LISTING				
CHEMICAL	HEALTH HAZARD	FLAMMABILITY HAZARD	REACTIVITY HAZARD	CONTACT HAZARD
Gentian Violet	2	0	0	

PREPARATIONS

Gentian violet working solution- 0.1% concentration preferred**.**

Higher concentrations are sometimes used, but increased amounts of gentian violet are difficult to dissolve and can create an increased background discoloration**.**

1. Dissolve 1.0 grams of gentian violet in one liter of distilled water.

INSTRUMENTATION

See Appendix IV-General Instrumentation.

MINIMUM STANDARDS & CONTROLS

The Standards and Controls for the gentian violet procedure consist of placing test impressions on the adhesive side of clear tape to make test prints. The test prints are then immersed in the working solution and rinsed with water. This process can be repeated if needed. If the test prints are visualized, the working solution can be used to process evidence.

Documentation of the test prints must be recorded in the LAM at the time the reagent is made. All observed impressions must be photographically preserved immediately. Contrast may decrease as the substrate dries. Stained impressions which fade as the tape dries may be improved by immersing the tape in a tray of clear water and photographing the impressions while the tape is submerged.

PROCEDURE OR ANALYSIS

1. Immerse item to be processed in the working solution in a large tray.

2. Allow the item to remain completely immersed for approximately 30 seconds while agitating.

3. Remove the item from the working solution and rinse excess stain from the item by washing with a gentle flow of cold tap water.

4. This process may be repeated until optimum contrast is reached between the impressions developed and the background.

5. Photograph any developed impressions.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

REFERENCES

1. Arima, T. "Development of Latent Fingerprints on Sticky Surfaces by Dye Staining or Fluorescent Brightening"; *Identification News*, February 1981.

2. Cowger, James F. *Friction Ridge Skin Comparison and Identification of Fingerprints*; Boca Raton: CRC Press, 1993.

3. Kent, Terry, ed. *Fingerprint Development Techniques*. Heanor Gate Publisher: Derbyshire, England, 1993.

ILLINOIS STATE POLICE

LATENT PRINTS
PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization Specialized Processing Techniques

METHOD: Sticky Side of Tape Processing

PROCEDURE: **STICKY SIDE POWDER**

Reviewed by:

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Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

The use of powder suspensions to develop impressions on the sticky side of tape has proven to be an effective alternative to the gentian violet technique. The use of powder suspensions to maximize contrast is the preferred technique on dark colored tapes lacking the availability of vacuum metal deposition. The consistent performance of powder suspensions on the adhesive side of tapes may, in the future, relegate the gentian violet technique to a secondary role when processing the adhesive side of tapes.

OTHER RELATED PROCEDURES:

Gentian Violet

SAFETY CONSIDERATIONS

Photo Flo 200
Sticky Side Powder

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

NFPA LISTING				
CHEMICAL	**HEALTH HAZARD**	**FLAMMABILITY HAZARD**	**REACTIVITY HAZARD**	**CONTACT HAZARD**
Photo Flo 200	1	1	0	

PREPARATION

1. Combine Photo Flo 200 with tap water at a ratio of 1:1.

2. Add Sticky Side Powder to the solution and stir until the mixture is the consistency of a thick paste.

INSTRUMENTATION

See Appendix IV-General Instrumentation.

MINIMUM STANDARDS & CONTROLS

The Standards and Controls for the sticky side powder procedure consist of placing test impressions on the adhesive side of tape to make test prints. The test prints are then immersed in or painted with the working solution and rinsed with water. This process can be repeated if needed. If the test prints are visualized, the working solution can be used to process evidence.

Studies have shown that many powders can be used other than "Sticky Side Powder". This allows for the selection of a powder that will give maximum contrast with the background of the item being processed. If using powders other than "Sticky Side Powder", test prints on a similar type of tape must be done, as not all powders work well in this type of application.

Documentation of the test prints must be recorded in the LAM at the time the reagent is made. Impressions developed by the powder technique do not readily fade, however, all observed impressions must be photographically preserved.

PROCEDURE OR ANALYSIS

1. Immerse item to be processed in the working suspension or paint the mixture on the sticky side of the tape using a soft bristled brush.

2. Allow the suspension to remain on the item for approximately 10 seconds.

3. Remove the item from the suspension and rinse excess suspension from the item by washing with a gentle flow of cold tap water.

4. This process may be repeated until optimum contrast is reached between the impressions developed and the background.

5. Photograph any developed impressions.

MINIMUM QUALITY STANDARDS AND CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

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ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization Specialized Processing Techniques

METHOD: Thermal Paper Processing

PROCEDURE: 1,2 Indanedione Processing for Thermal Paper

Reviewed by:

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Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

First synthesized by a research group at the University of Pennsylvania in 1996, 1, 2-Indanedione reacts with amino acid constituents frequently found in latent impressions. While only a faint pink color change accompanies this reaction, latent impressions will brightly fluoresce under green [532 nanometer (nm)] light. 1, 2-Indanedione can be used on any porous material; however, at this time it has only been validated for use for thermal paper within the Illinois State Police (Hornickel, 2012). Types of thermal papers include but are not limited to: lottery tickets; parking, gas, and restaurant receipts; bus tickets; movie tickets; boarding passes; and prescription bottle labels. Normally, processing is confined to thermal papers that have not subsequently become water-soaked or do not contain inherent animal proteins.

Thermal paper is a specialty paper consisting of several layers bonded together. The top layer, or thermal layer, is activated by heat from a thermal print head. The thermal layer consists of a mixture of color former, color developer, and sensitizer. As the thermal printhead moves across the paper, the sensitizer melts allowing the color former and color developer to come together and produce a dark image. Current ninhydrin processing techniques for porous items could have a potentially damaging effect on thermal paper. The presence of heat and/or polar solvents such as ether and acetone cause the over-activation of the thermal layer by melting the sensitizer throughout. This reaction causes large portions of the paper to turn dark gray or black. The darkened background can obscure information printed, or written, on the paper and reduce the contrast between the background and any latent impressions that develop.

1, 2-Indanedione can be used on conventional paper for the purpose of test prints. However, if Ninhydrin must be used to process a piece of evidence consisting of both conventional and thermal types of paper, 1, 2-indanedione must be used prior to Ninhydrin or ThermaNin.

OTHER RELATED PROCEDURES:

Low Temperature Luminescence
Ninhydrin
ThermaNin
Metal Salt Post Treatment
Physical Developer
Silver Nitrate
Zinc Chloride

SAFETY CONSIDERATIONS

Proper safety precautions including avoiding skin exposure and proper eye protection with appropriate optical densities should be utilized when operating forensic light sources. Consult the appropriate user manuals for the safe use and appropriate eye protection for the specific piece of equipment being utilized.

This procedure involves hazardous materials. Proper caution should be exercised, and the use of personal protective equipment (protective eyewear, lab coat, gloves) should be used to avoid exposure to dangerous chemicals. Processing should be conducted in a fume hood. Consult the appropriate MSDS for each chemical prior to use.

NFPA LISTING				
Chemical	**Health Hazard**	**Flammability Hazard**	**Reactivity Hazard**	**Contact Hazard**
1,2-indanedione (solid)	1	0	0	
Ethyl acetate	1	3	0	
HFE-7100	3	0	0	

PREPARATIONS:

1. Dissolve 0.2 grams of 1, 2-indanedione in 70mL ethyl acetate.
2. Add 930 mL of HFE-7100.

Caution! 1,2-Indanedione is light sensitive. The powder and all solutions should be stored in a dark dry place when not in use. Always store in a light-blocking container, preferably in an amber glass bottle.

INSTRUMENTATION

See Appendix IV – General Instrumentation.

Forensic Light Sources. To visualize the developed latent impressions, evidence should be viewed using a laser at 532nm or other green light source.

Environmental chambers. Heat and humidity can be used to accelerate the development of test impressions when using conventional paper only. Heat and humidity should not be used when processing thermal paper evidence.

MINIMUM STANDARDS & CONTROLS

The Standards and Controls for the 1, 2-Indanedione procedure consist of placing test impressions on porous items to make test prints. The test prints are then immersed in or sprayed with the working solution until saturated and allowed to dry. If the test prints are placed on conventional paper, they can be placed in a humidity chamber to accelerate development. If the test prints are visualized, the working solution can be used to process evidence.

Documentation of the test prints must be recorded in the LAM at the time the reagent is made. Test prints must also be made on a case-by-case basis and documented in the examiner's work notes.

Fluorescence from 1, 2-Indanedione is not permanent and may fade within days. All observed impressions must be photographically preserved as soon as possible.

PROCEDURE OR ANALYSIS

All applications should take place in a fume hood.

A. Spraying

1. Pour working solution into a plastic spray bottle.
2. Spray each item with the working solution until the item is saturated.
3. Allow each item to dry completely.
4. Place item in the dark (a drawer or cabinet works well) for 24 hours.
5. View the item under laser light and photograph any developed latent prints.

B. Immersion

1. In a tray large enough to hold the evidence, pour enough working solution to cover items.
2. Immerse each item in the working solution until the item is saturated.
3. Remove each item and allow to dry completely.
4. Place item in the dark (a drawer or cabinet works well) for 24 hours.
5. View the item under laser light and photograph any developed latent prints.

MINIMUM QUALITY STANDARDS & CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

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ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Fingerprint Visualization Specialized Processing Techniques

METHOD: Thermal Paper Processing

PROCEDURE: ThermaNin

Reviewed by:

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Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

ThermaNin, or 2-isononylninhydrin (INON) is a Ninhydrin hemiketal that results from the reaction of 3, 5, 5-trimethyl-1-hexanol and Ninhydrin. ThermaNin depends on the presence of water either in the atmosphere or in the paper being processed to convert back to Ninhydrin and 3, 5, 5-trimethyl-1-hexanol. Ninhydrin then reacts with amino acids present in latent impressions; however, any more water than this trace amount will cause ThermaNin to break up into its components more rapidly. The addition of a small amount of isopropanol should aid in water absorption. When processing thermal paper, the paper will turn dark if ThermaNin has already converted back. This indicates a failure of the working solution and should be discarded and remade before continuing.

ThermaNin can be used on any porous material; however, at this time it has only been validated for use for thermal paper within the Illinois State Police (Mandi Hornickel 2012). Types of thermal paper include, but are not limited to: lottery tickets; parking, gas, and restaurant receipts; bus tickets; movie tickets; boarding passes; and prescription bottle labels. Normally, processing is confined to thermal papers that have not subsequently become water-soaked or do not contain inherent animal proteins.

Thermal paper is a specialty paper consisting of several layers bonded together. The top layer, or thermal layer, is activated by heat from a thermal print head. The thermal layer consists of a mixture of color former, color developer, and sensitizer. As the thermal print head moves across the paper, the sensitizer melts allowing the color former and color developer to come together and produce a dark image. Current Ninhydrin processing techniques for porous items could have a potentially damaging effect on thermal paper. The presence of heat and/or polar solvents such as ether and acetone cause the over-activation of the thermal layer by melting the sensitizer throughout. This reaction causes large portions of the paper to turn dark gray or black. The darkened background can obscure information printed, or written, on the paper and reduce the contrast between the background and any latent impressions that develop.

ThermaNin is meant as a replacement for Ninhydrin on thermal papers; however, conventional types of paper can be used for test prints only. When using conventional paper for test prints, they can be placed in the humidity chamber to accelerate development. Test prints comprised of thermal paper are preferred but are not necessary.

OTHER RELATED PROCEDURES:

Low Temperature Luminescence
Ninhydrin
1,2-Indanedione
Metal Salt Post Treatment
Physical Developer
Silver Nitrate
Zinc Chloride

SAFETY CONSIDERATIONS

ThermaNin
Isopropanol
Ethyl acetate
HFE-7100

This procedure involves hazardous materials. Proper caution should be exercised, and the use of personal protective equipment (protective eyewear, lab coat, gloves) should be used to avoid exposure to dangerous chemicals. Processing should be conducted in a fume hood. Consult the appropriate MSDS for each chemical prior to use.

NFPA LISTING				
Chemical	**Health Hazard**	**Flammability Hazard**	**Reactivity Hazard**	**Contact Hazard**
ThermaNin (solid)	NL			
Isopropanol	1	3	0	
Ethyl acetate	1	3	0	
HFE-7100	3	0	0	

PREPARATIONS:

1. Dissolve 4.0 grams of ThermaNin in 5mL of isopropanol and 15mL of ethyl acetate.
2. Add 980 mL of HFE-7100.

Caution! The ThermaNin working solution has no lasting shelf-life and therefore must be prepared on a per-use basis.

INSTRUMENTATION

See Appendix IV – General Instrumentation.

Lighting. Latent impressions are purple in color and can be viewed under ambient light.

Environmental chambers. Heat and humidity can be used to accelerate the development of test impressions when using conventional paper only. Heat and humidity should not be used when processing thermal paper evidence.

MINIMUM STANDARDS & CONTROLS

The Standards and Controls for ThermaNin consist of placing test impressions on porous items to make test prints. The test prints are then immersed in or sprayed with the working solution until saturated and allowed to dry. If the test prints are placed on conventional paper, they can be placed in a humidity chamber to accelerate development. If the test prints are visualized, the working solution can be used to process evidence.

Documentation of the test prints must be recorded in the LAM at the time the reagent is made. Test prints must also be made on a case-by-case basis and documented in the examiner's work notes.

Impressions developed with ThermaNin may fade to a lighter shade of purple. All observed impressions must be photographically preserved as soon as possible.

PROCEDURE OR ANALYSIS

Processing should take place in a fume hood.

A. Spraying

1. Pour Working solution into a plastic spray bottle.
2. Spray each item with the working solution until the item is saturated.
3. Allow each item to dry completely.
4. Place item in the dark (a drawer or cabinet works well) for 24 hours.
5. View the item with ambient light and photograph any developed latent prints.

B. Immersion

1. In a tray large enough to hold the evidence, pour enough working solution to cover items.
2. Immerse each item in the working solution until the item is saturated.
3. Remove each item and allow to dry completely.
4. Place item in the dark (a drawer or cabinet works well) for 24 hours.
5. View the item with ambient light and photograph any developed latent prints.

MINIMUM QUALITY STANDARDS & CONTROLS

See the Latent Prints Procedures Manual, Appendix II, and the Quality Manual, QM-14.

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ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Miscellaneous Procedures

METHOD: Acquiring Known Finger and Palm Standards

PROCEDURE: **FINGERPRINT, PALMPRINT AND MAJOR CASE PRINT RECORDING**

Reviewed by:

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Forensic Scientist Katharine Mayland, Chairperson
Latent Prints Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Fingerprint recording may be done for several reasons but the most common type of recording encountered by the latent print examiner are those impressions taken of an individual in association with a criminal charge. This type of fingerprint card contains inked reproductions of the friction ridge skin area on the distal finger section used for classification and search in a criminal record file. While adequate for classification purposes and subsequent establishment of prior criminal history, such recordings encompass a relatively small portion of the available friction ridge skin area contained on the inside of the hands. Fortunately, about 60% of latent print impression evidence are deposits from these distal joint areas and thus a majority of latent prints can be compared with the submission of a standard fingerprint card.

Palm prints are recordings of the area between the wrist and digits which may also include the phalangeal portions of the fingers and the outside edge of the palm. Such recordings are not taken for criminal history purposes but strictly for latent print comparisons. Major case prints are a more elaborate friction ridge skin recording procedure which attempts to produce standards of all papillary skin of the hands including the extreme sides and tips of the fingers.

While examiners are seldom involved in the fingerprint, palm print, or major case print recording process, they should be familiar with the procedures required to obtain full, legible inked standards in case the demand does arise or requests for instructional assistance are made. Without adequate inked standards, thorough comparison procedures are often futile.

OTHER RELATED PROCEDURES:

Post Mortem Recording

SAFETY CONSIDERATIONS

Only general laboratory safety precautions are required for this procedure. No hazardous materials are used in this procedure.

PREPARATIONS

No specific preparations are required for this procedure.

INSTRUMENTATION

See Appendix IV-General Instrumentation.

MINIMUM STANDARDS & CONTROLS

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

PROCEDURE OR ANALYSIS

1. **Inked Fingerprint**

   All inked friction ridge recordings should be taken using black fingerprint ink impressed on a standard, white fingerprint card. This eight-inch by eight-inch heavy stock document contains areas marked for a sequence of rolled inked impressions beginning with the right thumb and ending with the left little finger, two areas for simultaneous or plain inked impressions of index, middle, ring, and little fingers of both hands, and two areas for plain or flat inked impressions of the thumbs. This design is used worldwide with minor variations of document size.

   Proper inked recordings are highly dependent upon the ink preparation. Many brands of fingerprint inks are available, all generally yielding satisfactory results. Ink is applied to the fingers from a plate or slab which serves as a device for insuring a thin, uniform coating. Glass slabs are preferred, for they are easily cleaned, and when backed by a white card or paper reveal an accurate image of the ink adherence to the finger. Plates bearing ink from previous recordings should be cleaned and a fresh supply of ink applied. A small amount of ink about the size of a match head is placed near an edge of the plate, another in the middle, and a third near the opposite end. A clean rubber roller is used to distribute the ink evenly over the slab. The roller should be lifted occasionally during the process and allowed to spin freely to prevent unintentional layering from the supply deposits. A properly prepared plate will conceal all signs of the white backing but, when touched, will show a crisp, high contrast negative impression. It is much easier to add more ink when necessary than to remove an excessive coating.

   The fingerprint card is placed in a holder specifically designed for fingerprint recording. This device is essential for it prevents the card from moving during the recording procedure while exposing the designated printing areas. The card is positioned to place the top row, marked for the right hand, in the exposed area of the holder.

   Individuals being fingerprinted must have clean and dry hands. Dirt, grease, lotions, or creams will prevent ink adhesion to all areas of the finger and prevent complete recordings. Excessive perspiration sometimes caused by the stress of the situation may interfere with the ink application but can be minimized with the use of alcohol wiped onto the fingers, then removed, immediately before the inking process.

The recorder generally stands to the left of the person being printed and grasps the right thumb securely. The recorder's thumb and index finger should firmly seize the individual's thumb by the first joint for maximum control, and the recorder's remaining fingers used to cover the individual's thumb is rolled from one side to the other in the ink supply using a steady motion. Digits most approximate cylinders in shape and should be placed perpendicular to the front edge of the plate and rolled through an arc of 180 degrees or more. Direction of flow should be from the awkward to the comfortable. Due to the natural rotation of the forearm, thumbs usually are turned toward the center of the individual's body while fingers are rolled towards the outside.

The right thumb is recorded on the card with the same action as the ink was applied. The movement should be a steady, fluid flow from the right edge of the individual's thumb toward the recorder to the left edge. Stops or hesitations during the roll will produce unevenness and smears, and any reverse of direction will result in a double impression that masks detail. Once the right thumb is recorded, the index finger is inked and printed in the same manner except it is rolled from the left edge away from the recorder to the right.

After the right hand is completed, the card is repositioned in the holder and the left hand printed. The ink is redistributed on the slab to restore the even coating and the procedures are repeated using opposite direction for the individual rolls. Some recorders prefer to change stance for the left hand to a position right of the individual but many find the same stance more comfortable. The left hand is recorded with the same procedure except the direction of the roll for each digit is reversed.

Plain impressions are recorded with a new coating of ink by placing the four fingers together and pressing them lightly to the ink and straight down on the card. Similarly, the thumbs are reprinted with the vertical movement. Plain impressions display the least amount of distortion to characteristic depiction and serve as a check for correct rolled impression sequence.

2. **Palm Prints**

Palm prints are recorded on blank white stock or cards with minimal markings. Eight by eight inch cards commonly available may be satisfactory for many recordings but may prohibit a full printing from wrist to fingertip of some individuals. Eleven-inch heavy paper may be more useful. Palm prints are taken by two methods: 1) placing the inked hand onto the card positioned on a flat surface, and, 2) affixing the card to a cylinder and rolling the hand down the length of the card. Since many people have a depressed area in the center of the palm, the cylinder method is usually superior.

An even coating of ink is applied to the palm and full length of the fingers using the ink roller. Some streaking is unavoidable but is usually of no great concern. Care must be exercised, however, to apply ink to all areas, including the outer edge of the palm. If a cylinder is not available, the inked hand is simply placed on the card with the fingers slightly spread and

pressed firmly. Movement of the hand once positioned on the card must be prevented. The hand is then removed with a straight upward motion. The hand is then turned until the thumb is pointing up, placed to the outer side of the recorded print in a clear area and pressed to the card. A slight roll to the inside of the hand is executed. This will duplicate some portions of the previously recorded impression as a reference for the newly recorded detail.

Cylinder recording requires a device with a sufficient circumference to accommodate the full length of the card without an overlap. A large arson can or a paint can may work well. The card is held in place with rubber bands or other elastic material slipped over both edges. After the palm is thoroughly and evenly inked, the wrist is placed near the bottom of the card and the hand pressed against the card as the cylinder is slowly rolled away from the individual. The recorded must insure that firm contact is maintained until the fingertips are reached. A slight spread of the fingers will reduce bulging of palmar areas and permit as complete as recording as possible. The outside of the palm may be printed with the card on a flat surface.

3. **Major Case Prints**

Major case prints is a phrase coined by the Federal Bureau of Investigation for those friction ridge recordings which attempt to depict all papillary skin areas often required when major crimes are committed. In addition to fingerprints and palm prints, areas not often recorded are inked and printed separately. These include the extreme side of all fingers and fingertip areas immediately surrounding the nail. Sides and tips may be inked using the supply slab or roller as long as all portions are evenly coated. A blank card is used. The recording is usually done with six motions per digit, the first by placing the full length of one side of the digit flat on the card and lifting the palm until the digit is perpendicular to the card at the nail, the second, by placing the full length of the center of the digit on the card and lifting the palm, and the third, using the other side of the digit. The fourth aims the digit at about a forty-five degree angle to the card using one side of the digit starting at about the middle of the joint and rolling toward the extreme tip, the fifth, a repeat with the center portion of the digit, and the sixth, the opposite side. All ten fingers should be recorded to reveal all sections of ridge structure. In addition, areas of the palm may be segmented, especially areas near the base of the fingers, using different angles between hand and card, to obtain full and legible recording.

MINIMUM QUALITY STANDARDS AND CONTROLS

See Appendix II.

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ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Miscellaneous Procedures

METHOD: Acquiring Known Finger and Palm Standards

PROCEDURE: **POST MORTEM RECORDING OF FRICTION RIDGE SKIN**

Reviewed by:

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Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Deceased persons may be identified by various methods including fingerprint identification. Generally, post mortem fingerprint recording is done by investigators and the latent print examiner may be involved in the submission of fingerprints to AFIS or the comparison of the post mortem prints to previously recorded standards.

Occasionally, a laboratory may receive severed hands from the deceased for examination. Various methods have been designed to obtain satisfactory recorded impressions. Method of death, environmental conditions, and degree of decomposition can alter the effectiveness of techniques.

The techniques described in this section shall deal with the premise of submitted severed hands and may not be the only techniques available. New techniques are constantly being developed and published in current literary sources.

OTHER RELATED PROCEDURES:

Inked fingerprint, palm print and major case print recording.

SAFETY CONSIDERATIONS

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

PREPARATION

No specific preparations are required for this procedure.

The evidence must be stored in a laboratory refrigerator before and after examination to avoid further deterioration of the skin.

INSTRUMENTATION

See Appendix IV-General Instrumentation.

MINIMUM STANDARDS & CONTROLS

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

PROCEDURE OR ANALYSIS

1. Inked Fingerprint Recording

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

2. Powder Processing

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

3. Silicone Rubber Casting

Silicone rubber casting material may be used to produce extremely accurate recordings of friction ridge skin areas. However, casts yield reproductions which are inverted to the skin formations, that is, the furrows appear as raised areas and the ridges as depressions. Thin casts can be flattened between glass slides and photographed using backlighting. If the casts are too thick to permit proper light transmission, the casts may be used as molds for a second generation cast. A light spray of window cleaner, such as Windex, is applied to the cast and additional silicone rubber material poured into these molds. The resulting positive cast may be photographed using oblique lighting or inked or powdered and lifted.

4. **Epidermal Gloving**

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

5 **Dermal Photography**

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

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

6. **Special Skin Conditions**

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

Dehydrated or mummified fingers often result in skin too hard and inflexible for complete recording. Restoration of near normal pliancy can be accomplished by soaking the skin in a 3% potassium hydroxide in warm water solution. The skin is checked periodically until soft enough for recording purposes, then rinsed in distilled water and dried. Another less destructive technique is to use a dish washing liquid such as Palmolive to rehydrate and soften the skin. The hands or fingers are soaked in the dish washing liquid until they become pliable. A high

lanolin content hand lotion is worked into the skin and removed immediately before recording also may be beneficial. The less destructive Palmolive technique should be attempted prior to the sodium hydroxide procedure.

MINIMUM QUALITY STANDARDS AND CONTROLS

See Appendix II.

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ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Miscellaneous Procedures

METHOD: Electronic Detection Procedure

PROCEDURE: **AUTOMATED FINGERPRINT IDENTIFICATION SYSTEM (AFIS)**

Reviewed by:

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Forensic Scientist Katharine Mayland, Chairperson
Latent Prints Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

AFIS is a laboratory instrument that can be used to perform searches of latent prints and deceased fingerprints, provide candidate lists and images for comparison and any subsequent identification in those cases received and selected for AFIS processing. The use of the AFIS instrumentation is a highly technical and complex undertaking. Further information in the use and application of this equipment is contained in the GWS-L User Guide (revision number 2006.08.07) provided by NEC. Technical case requirements are found in Appendix V - Minimum AFIS Standards and Controls.

ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Miscellaneous Procedures

METHOD: Fingerprints on Human Skin

PROCEDURE: **FINGERPRINTS ON HUMAN SKIN**

Reviewed by:

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Forensic Scientist Katharine Mayland, Chairperson
Latent Prints Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Obtaining identifiable latent impressions from human skin has long been of great interest to those investigating violent crimes. Typically, this function would be performed by Crime Scene Services personnel. However, on occasion latent print examiners have been asked to assist at the scene. Before doing so, the examiner might choose to refer to the journal articles listed below. The circumstances of the body will dictate which method is likely to be the most productive. Several comprehensive studies of the conditions which contribute to success are presented in these articles. This section is presented as a reference. No single procedure is best for all conditions and the examiner must weigh the options in light of current literature.

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ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

PROTOCOL: Latent Impression Comparison

METHOD: Analysis, Comparison, Evaluation and Verification of Latent Prints

PROCEDURE: **OBSERVATION**

Reviewed by:

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Forensic Scientist Katharine Mayland, Chairperson
Latent Prints Command Advisory Board

Approved by:

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Brian Mayland
Patterned Evidence Program Manager

INTRODUCTION

Latent impression examination and comparison is conducted using the Analysis, Comparison, Evaluation, and Verification (ACE-V) methodology. ACE-V is a method used to describe the application of the scientific method to the examination and comparison of latent impressions. This procedure has been adopted by the Scientific Working Group on Friction Ridge Analysis, Study and Technology (SWGFAST).

In the ACE-V method, analysis (suitability) is the determination that a sufficient amount of information is detected in the unknown to justify a comparison to known standards. Comparison is the observation of individualizing features in sequential arrangement in the unknown and known to determine agreement or disagreement. Evaluation is the determination of a conclusion based upon comparison. Verification is the independent application of the ACE process by another competent examiner.

When an examiner is provided with appropriate known standards, he or she must apply the methodology to all impressions unless examination is deferred and appropriate notation is made on the worksheet. Findings as the result of evaluation are limited to one of the following: Identification, No Identification/Exclusion, and Inconclusive. All Latent Print notes packets will include the following statement: "When applicable, the definition of an Identification is the strongest association between two or more items."

INSTRUMENTATION

Magnifier - see Appendix IV, General Instrumentation

MINIMUM STANDARDS AND CONTROLS

Examiners will take a proficiency test annually. This test will involve examiners performing analysis and comparisons of latent impressions. If an examiner successfully completes this test, he or she will be deemed competent to perform analysis and comparisons of latent impressions in case work.

Minimum Standards and Controls - See Appendix II Minimum Standards and Controls.

ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

APPENDIX II: MINIMUM STANDARDS & CONTROLS

Reviewed by:

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Approved by:

Kellen Hunter
Acting Patterned Evidence Program Manager

MINIMUM LATENT PRINT STANDARDS AND CONTROLS

Powders and Reagents

I. Powders

A. Commercial stock containers should be used to refill working powder containers for daily use.

B. Individual hair (or fiber) brushes or an appropriate applicator should be used for different colors or types of powders.

C. Contaminated powders should not be returned to stock containers.

D. Magnetic/conventional powder mixtures may be replenished by periodic addition of conventional (nonmagnetic) powder to ratio maintain a homogenous mixture.

E. A "60 mesh sieve" can be used when deemed necessary to periodically purge magnetic and conventional working powder containers of undesirable contaminants and large powder particles. Mortar/pestle grinding may be used as an alternative technique.

F. Due to the inherent ability of powders to adhere to and discolor latent print residue, test impressions are not required prior to evidence application.

II. Reagents

A. A log of all stock chemicals, manufactured reagents, and in-house reagents will be maintained and retained in the LAM.

1. Stock chemicals and manufactured reagents will be entered into the LAM when they are received at the laboratory. The record will be updated as the chemicals and reagents are re-authenticated or consumed. The record will include the following:
    a. Asset type (chemical or reagent name)
    b. Lot number
    c. Assigned Section
    d. Quantity and units (example: Quantity:4, Units: Liters)
    e. Received by
    f. Date received
    g. Expiration date, if applicable
    h. Current location
2. In-house reagents will be entered into the LAM upon preparation. The record will be updated as the reagents are re-authenticated or consumed. The record will include the following:
    a. Asset type (reagent name)
    b. Lot/Batch number
        i. The lot number will be the preparation date and will be entered in the format "month.day.year" (for example, "12.15.2023").
        ii. Some labs may include additional alphanumeric information at the end of the lot number to provide more information specific to their lab (for example, "12.15.2023C").
    c. Assigned Section

d. Quantity and units (example: Quantity:4, Units: Liters)
e. Prepared by
f. Preparation date
g. Expiration date
h. Components of the reagent including lot numbers when appropriate
i. Authentication information (test print/control), when applicable
    i. Specific test print/control methods for each reagent can be found in the Latent Prints Procedures Manual.
    ii. For reagents that cannot be tested (such as components of Physical Developer, Small Particle Reagent, and MRM), "N/A" will be entered in the LAM Test Print field.
j. Current location

B. Reagents will be kept in appropriate containers labeled in the following manner:
    1. Stock chemicals and manufactured reagents will be labeled with:
        a. Name of the chemical
        b. Lot number
        c. Expiration date
        d. Initials of the person who received the chemical
        e. Date it was received
        f. Hazard label or appropriate pictogram
    2. In-house reagents will be labeled with:
        a. Name of the reagent
        b. Concentration (where appropriate)
        c. Lot/Batch number
        d. Preparer's initials
        e. Preparation date
        f. Expiration date
        g. Storage conditions, if relevant
        h. Hazard label or appropriate pictogram
C. Exact reagent concentrations are not critical to latent print analyses in that the reagents are merely used to visualize ridge detail for comparison purposes. A slightly weaker or stronger solution than usually employed may differ slightly from the norm in the ridge contrast produced but may still be considered acceptable provided a test print/control develops clear ridge detail.
D. Minimum standards and controls for specific chemical preparations are in the Latent Prints Procedures Manual.
E. Any reagent preparations that require documentation of a test print in the case notes are specifically noted in the Latent Prints Procedures Manual.
F. See QM-14 of the Quality Manual

<u>Balances</u>

I. Balances will be checked monthly and in accordance with QM-11 of the Quality Manual

Preservation of Images

NOTE: For the purposes of this document, the terms "photography" and "photograph" encompass all photographic media and methods, including conventional cameras, film, silver halide prints, digital image captures using digital cameras and scanners, and digital printer output.

I. All impressions deemed suitable will be preserved by lifting or photography as required by the Latent Prints Procedures Manual prior to the application of any potentially destructive processing technique. In the event two or more processing techniques visualize the same suitable impression, the suitable impression that, in the judgement of the examiner, reveals the most detail will be preserved.

II. In instances when at least one suspect has been identified, and the Command Directives, ESH Appendix 22, XI.A allows deferral, the examiner has the option to preserve only those impressions examined and deemed suitable for comparison. Some processes require photographic preservation of all potentially suitable impressions that are developed (e.g. Ninhydrin).

III. An analytical quality photograph of all latent impressions that have been examined and deemed suitable for comparison will be kept on the Illinois State Police Foray Authenticated Digital Asset Management System (ADAMS). Any markings related to the examination of the evidence will be documented.

A. Markings include any suitability markings, identification markings, and verification markings. They do not include the standard case information markings (case number, item number, initials, date).

B. Photographs of suitable latent impressions will be at a minimum resolution of 1000 ppi.

1. Any deviation from this minimum criterion shall be documented on a case-by-case basis.

IV. If an impression is identified, a photograph of analytical quality of the known standard that was used to make the identification must be retained in the case file or on the Illinois State Police Foray ADAMS.

A. Photographs will be at a minimum resolution of 1000ppi.

1. Known standards downloaded electronically into the Illinois State Police ADAMS from an ABIS or NGI repository will be at their original resolution of 500 ppi or higher.
2. Any deviation from this minimum criterion shall be documented on a case-by-case basis.

V. All original photographs and scanned images will include a scale. The scale does not have to be visible in subsequent processed images provided the original photograph showing the scale is available. Any changes to resolution in the processed image must be documented. When it is not possible to capture a scale and the latent print simultaneously in the original photograph (i.e. laser shot), a reference photograph showing the scale and a second photograph showing the detail in the latent print is acceptable.

A. Known standards downloaded electronically into the Illinois State Police ADAMS from an ABIS or NGI repository do not need a scale.

VI. All lifts and photographs received from an outside agency will be returned to the submitting agency or the agency listed on the evidence receipt.

VII. Lifts generated by the examiner will be sub-itemized and treated as evidence.

Information to be Included on Lifts and Photographs

I. Each lift and photograph will include the following minimum information, which may be physically written on the item, appear visually in the image, or be associated with a digital image:

A. Laboratory case number
B. The initials or name of the examiner
C. Item and/or sub-item number
D. The date the lift or photograph was received or generated
E. The latent designator for each suitable impression (See Latent Designator Rules)
   1. The same impression visualized by two or more processing techniques will be assigned the same designator.
F. Identified impressions:
   1. Name of the subject appearing on the known standard that was used to make the identification.
   2. The known impression to which the latent was identified.
   3. The initials or name of the examiner making the identification and the date the identification was made. In the case of multiple impressions, a single set of initials or name of the examiner and date on the lift or photograph will suffice for all impressions identified to the same subject on the same date.
   4. The initials or name of the verifying examiner and the date the verification was made. In the case of multiple impressions, a single set of initials or name of examiner and date on the lift or photograph will suffice for all impressions verified to the same subject on the same date.
   5. For identifications and verifications, examiner markings may appear in the asset description in the Illinois State Police ADAMS system.
G. All verifications will be documented by the verifying examiner in the Verification panel in the Laboratory Information Management System (LIMS).

H. Digital images will be maintained in accordance with Latent Prints Procedures Manual Appendix VIII, Minimum Digital Imaging Standards and Controls.
I. If an examiner prints out a digital image and places any markings on it, or if the verifier places markings on it, the print out containing the markings must be scanned into the Illinois State Police Foray ADAMS. No hard copies will be maintained.

Latent Designator Rules

I. Latent designators will be numeric/numeric and will begin with the DFS Item number.

II. Latent designators will always have at least three numbers (i.e. 1-1-1). The first number represents the DFS Item number. The second number represents the article of evidence in the Item. The third number represents the latent number from that article of evidence.
   A. Latent designators on sub-items will be alpha/numeric to list the sub-item number (i.e. 1A-1-1).

III. For example: Item #1 is a gun and a magazine. There is one print on the gun and two prints on the magazine. The print on the gun would be 1-1-1. The prints on the magazine would be 1-2-1, 1-2-2.

IV. For example: Item #4 is three plastic baggies. There is one print on one baggie and the other two baggies have no suitable latent prints. The print on the baggie would be 4-1-1.

Worksheets and Laboratory Information Management System (LIMS) Matrix Panels

Worksheets in the Latent Prints Section are considered the output that can be printed after the LIMS panel information is filled out. The LIMS data entry screens listed below are used to document information regarding specific items of evidence and will be referred to as "panels" on the following pages.

The data entry fields in the LIMS that are indicated with a red asterisk (*) are mandatory in order for a worksheet and report to be generated. While a specific field may not be indicated as mandatory with the asterisk, it may still be required per policy based on the specific case situation. The following pages detail these requirements. Non-mandatory, or optional, fields that are left blank in the LIMS panels will not appear on the created worksheets.

I. LIMS - Latent Print Processing Panel
   A. The following minimum information must be documented:
      1. Item description
      2. All applicable packaging and repackaging

a. Both the packaging and repackaging fields in the LIMS are for the outermost packaging/repackaging only. Additional interior packaging may be documented in the Packaging Comments.

3. All examinations performed in the order in which they were performed
4. Documentation of test prints/controls run, when applicable (listed as "+/- Control" in the LIMS)
    a. Only document test prints/controls in the case notes if it is required per the reagent's Minimum Standards & Controls in the Latent Prints Procedures Manual.
5. The results of each examination in terms of non-duplicate suitable latent impressions that were developed
6. The method(s) of preservation for each suitable latent impression
7. The type of deferral used, if applicable

II. LIMS – Latent Analysis Panel

A. An analysis entry will be completed for all latent impressions deemed suitable for comparison. The following minimum information must be documented:
    1. The impression number (latent designator)
    2. An image of the latent impression in its correct anatomical orientation, if known. If orientation is unknown, it will be noted in the comments.
        a. The image will be annotated to at least the point at which suitability is established.
            i. Annotations made at the analysis stage will be marked in blue. If any additional annotations are used (i.e. zoning or shading), the annotation and color of the annotation must be clearly defined in the Comments area of the Analysis panel.
    3. The type of latent impression (finger, palm, etc.)
    4. Level One and Level Two detail
    5. The substrate
    6. The processing technique used to develop the latent impression
    7. The impression quality
    8. The analysis result
    9. The database analysis result
    10. Whether or not the print was searched in a database

III. LIMS – Latent Print Comparison Panel

A. A comparison entry will be completed for all latent impressions identified to a probative subject. The following minimum information must be documented:
    1. The impression number (latent designator)
    2. An image of the latent impression and the corresponding standard in their correct anatomical orientation.

a. The images must include documentation which illustrates the presence of Level One, Level Two, and Level Three detail that was used to support the conclusion reached. Detailed annotations will be used to illustrate the corresponding agreement of detail between the unknown and known impressions. Only those details used to provide a basis for the conclusion reached need to be marked.
   i. Annotations made at the Comparison stage will be marked in blue for detail that was observed in the Analysis stage. Annotations for detail that was observed and used only after comparison to the known standard will be marked in yellow.
   ii. If any additional annotations are used (i.e. zoning or shading), the annotation and color of the annotation must be clearly defined in the Comments area of the Comparison panel.

IV. LIMS – Database Search Results Panel

A. The following minimum information must be documented in the Database Search Results Panel for all latent impressions searched in a database:
   1. The impression number (latent designator)
   2. The database searched
   3. The result of the search
      a. For database identifications, the identifier type (FBI, IR, SID) and the identifier number (FBI number, IR number, SID number) must be documented.
   4. Latent registration, if applicable (ABIS or NGI)
   5. Latent to Latent Inquiry
   6. Latent Deletion or Case Deletion, if applicable
   7. Rejected searches must be documented as described in Data Rejection, section III.B.2 of the Latent Prints Procedures Manual Minimum Standards & Controls, LP-APP-II.

V. LIMS – Standards Panel

A. All standards used for comparison to latent impressions will be entered in the Standards Panel. The following minimum information must be documented:
   1. The subject name as it appears on the standard
   2. The type of standard (fingerprint, palmprint, etc.)
   3. Source from where the standard was obtained (submitted by agency, SID-IL, etc.)
   4. The Item number or appropriate database number (SID, FBI number, IR number)
   5. The reason the standard was obtained
      a. Standards submitted by the agency or obtained as a result of the agency providing a SID number, FBI number or IR number are obtained for comparison.
      b. Standards obtained as a result of a database hit are obtained for an ABIS or NGI identification.

VI. LIMS – Results Table Panel

A. All suitable impressions and the results of any comparisons of those impressions to known standards will be documented on the Results Table Panel. The Results Table Panel will be filled out with the following minimum information:
   1. The impression number (latent designator)
   2. The result of the comparison, including the type of additional standards needed, if applicable

VII. LIMS – Latent Print Remarks Panel
   A. Appropriate remarks will be utilized on a case-by-case basis.
   B. Remarks other than the provided options will not be used. Slight modifications in wording to the existing remarks may be made to accommodate different case scenarios; however, the overall context of the remark cannot change.

VIII. LIMS – Abbreviations
   A. Abbreviations are used to more efficiently document evidence in matrix panel fields within the LIMS and within the Illinois State Police Foray ADAMS. Only the below listed abbreviations may be used. These abbreviations are only to be used in fields that do not populate to the report and fields that would not be used to gather data within the LIMS. If a field has a drop down option with the abbreviation completely spelled out, the complete word(s) will be what is used. Although the abbreviations listed are capitalized, lower case abbreviations are allowed.
      a. Packaging and laboratory mark abbreviations:
         i. S = Sealed (when preceding any other codes)
         ii. PL = Plastic
         iii. PB = Paper Bag
         iv. PLB = Plastic Bag
         v. PE = Paper Envelope
         vi. PLE = Plastic Envelope
         vii. Bx = Box
         viii. Cn = Can
         ix. O = Original
         x. UO = Unopened Original

      b. Examination Abbreviations
         i. A = Ardrox/UV
         ii. AB = Amido Black
         iii. AgNO3 = Silver Nitrate
         iv. ALS = Alternate Light Source
         v. Aq = Aqueous/Water Based
         vi. CB = Coomassie Staining Solution
         vii. CF = Cyanoacrylate Fuming
         viii. CS = Crowle's Staining Solution

ix.	GV	=	Gentian Violet
x.	IL	=	Inherent Luminescence
xi.	IN	=	1,2-Indanedione
xii.	L	=	LASER
xiii.	MRM(L)	=	MRM 10/LASER
xiv.	MRM(UV)	=	MRM 10/UV
xv.	N	=	Ninhydrin
xvi.	P	=	Powder
xvii.	PD	=	Physical Developer
xviii.	R	=	Rhodamine/LASER
xix.	RUVIS	=	Reflected Ultraviolet Imaging System
xx.	SPR	=	Small Particle Reagent
xxi.	SSP	=	Sticky Side Powder
xxii.	TN	=	ThermaNin
xxiii.	UV	=	Ultraviolet Light
xxiv.	V	=	Visual
xxv.	ZnCl2	=	Zinc Chloride

c. Other Abbreviations

i.	Ø	=	Identification
ii.	ASA	=	Assistant State's Attorney
iii.	BOI	=	Illinois State Police Bureau of Identification
iv.	DCC	=	Discharged Cartridge Case(s)
v.	DSL	=	Database Suitable Latent(s)
vi.	FED	=	Further Examination Deferred
vii.	FP	=	Fingerprint(s)
viii.	FPS	=	Fingerprint Standards
ix.	LC	=	Live Cartridge(s)
x.	NASL	=	No Additional Suitable Latent(s)
xi.	NADSL	=	No Additional Database Suitable Latent(s)
xii.	NDSL	=	No Database Suitable Latent(s)
xiii.	NEC	=	No Examination Conducted
xiv.	NSL	=	No Suitable Latents(s)
xv.	NS/NV	=	Not Suitable/No Value
xvi.	PP	=	Palmprint(s)
xvii.	PPS	=	Palmprint Standards
xviii.	RBS	=	Red Brown Substance
xix.	RDV	=	Ridge Detail Visible
xx.	SL	=	Suitable Latent (s)
xxi.	SN	=	Serial Number

<u>Laboratory markings on Items</u>

I. The packaging in which the items were received will contain or be marked with the following information when received:
   A. Laboratory case number
   B. Item number and sub-item number, if given
   C. Initials of the examiner
   D. Date received by the examiner

II. Whenever possible and practical, the items themselves will be marked with the following information:
   A. Laboratory case number
   B. Item number and sub-item number, if given
   C. Initials of the examiner
   D. Date received, date worked, or date repackaged by the examiner

Sub-itemizing Evidence Preserved for Other Sections

I. Evidence that is observed during latent print examination and is preserved for the potential use of other sections in the laboratory must be sub-itemized by either the latent print examiner or the other section in question. This evidence can include but is not limited to apparent hairs/fibers, swabs of reddish-brown stains, and other types of impression evidence like footwear impressions. At times, the most efficient approach may be for the latent print examiner to preserve this evidence. The latent print examiner may consult with the other section in question to determine the best way to preserve the evidence.

II. For evidence that is sub-itemized by the latent print examiner:
   A. The evidence will be sealed in packaging that is appropriate for that type of evidence.
      1. For photographs of apparent footwear or other impression evidence:
         a. The evidence will be photographed and saved in the Illinois State Police ADAMS system.
         b. A copy of the photograph(s) will be made to a CD or DVD for return to the agency.
         c. The CD or DVD will be sealed in appropriate packaging.
   B. A LIMS sub-item number will be generated for that evidence.
      1. If the sub-item will be retained in the parent packaging, a label for the sub-item should not be printed.
      2. If the sub-item will be separated from the parent item, a LIMS label will be printed and affixed to the sub-item packaging.
   C. The Latent Print report will include a description of the sub-itemized evidence.

Observation

I. Suitability
   A. A latent impression is suitable if the determination is made that there is sufficient information in an impression to be of value for comparison. Sufficiency is the product of the quality and quantity of the objective data under observation.
   B. Impressions determined to be suitable for comparison will be marked by notation on lift or photo or by other notation that may accompany a digital image and will be minimally documented with the following:
      1. An analysis entry in the LIMS Latent Print Analysis Panel
      2. Latent designators embedded in the file name or image
   C. Any impression not marked or marked "ns" or "nv" was determined to be not suitable for comparison by the examiner. Exceptions may be made if:
      1. Examination was deferred and the deferral is stated in the notes
      2. If the impression is captured digitally and notations accompany the image. Appropriate forms of notation will include:
         a. An analysis entry in the LIMS Latent Print Analysis Panel
         b. Notations made in the Illinois State Police Foray ADAMS
         c. Latent designators embedded in the file name or image

II. Identification
   A. The standard for identification is agreement of sufficient friction ridge details in sequence.
      1. Conditions that will be satisfied:
         a. Determined by a competent examiner
         b. Applied to a common area in both impressions
         c. Based on a quantity and quality of the friction ridge details
         d. Absent any unexplainable discrepancies
         e. Reproducible conclusion
      2. All identifications will be verified by another competent examiner. Refer to TCH 4 to see the verification policy in full.
      3. Basic Principles
         a. There is no scientific basis for requiring that a predetermined number of corresponding friction details be present in two impressions in order to effect an identification.
         b. Identification is supported by the theories of biological uniqueness and permanence and empirical data through more than one hundred years of operational experience.

III. No Identification/Exclusion
   A. The standard for no identification/exclusion is disagreement of friction ridge details:
      1. Conditions that will be satisfied:

a. Determined by a competent examiner
b. Applied to all comparable areas
c. Presence of an unexplainable discrepancy
d. Based on sufficient quantity and quality of the friction ridge details
e. Reproducible conclusion

2. Basic Principles
   a. The presence of one unexplainable discrepancy is sufficient to exclude
   b. Distortion is not an unexplainable discrepancy and is not a basis for no identification/exclusion
   c. No Identification/Exclusion is supported by the theories of biological uniqueness and permanence and empirical data.

IV. Inconclusive

A. The standard for an inconclusive finding is the absence of sufficient friction ridge details in the unknown impression and/or the known standards to effect a conclusion of identification or no identification/exclusion.

1. Conditions that will be satisfied:
   a. Determined by a competed examiner
   b. Based on quantity and quality of the friction ridge details in the latent impression and/or known standards
   c. Insufficient agreement or disagreement in the friction ridge details to make a definitive conclusion
   d. Reproducible conclusion

Consultations

I. Consultations are defined as significant interactions between examiners regarding an examination. Consultations are part of the scientific process and are encouraged. They may occur at any stage of the examination process. Examples of interactions that may be considered as consultations include, but are not limited to:
   A. Suitability determinations
   B. Sufficiency determinations during comparisons
   C. Interpreting distortions or other factors that affect image quality, such as contrast, focus, and background noise

II. Not all interactions and discussions rise to the level of consultation. However, if the interaction between the two examiners is deemed significant enough to be a consultation, it may be documented at the discretion of the case examiner.

III. Any documentation related to consultations must be done in the Illinois State Police ADAMS. Documented consultations must include the following, which can be written physically on the item, appear visually in the image, be contained in the electronic audit trail of the image, or be embedded in the metadata of the image file:
   A. Specific ridge impression(s) reviewed
   B. Result of the consultation

C. Initials of the consulting examiner
D. Date of consultation

Data Rejection

I. If/when a test result or observation is rejected, the reason(s), date, and individual taking the action shall be recorded. This includes rejection by the analyst, reviewer, or verifier.
II. Examples of rejected data include:
    A. Images that will not be used due to some issue rendering them unusable. Examples of this include but are not limited to:
        1. lack of a scale
        2. being out of focus
        3. under- or over-exposure
        4. not meeting digital image submission criteria
        5. See Command Directives ESH Appendix 25, Latent Prints Procedures Manual LP-APP-II, Minimum Standards & Controls, "Preservation of Images", and Latent Prints Procedures Manual VIII, Minimum Digital Imaging Standards and Controls.
    B. Database searches that were incorrectly entered and need to be re-run. Examples of this include but are not limited to:
        1. searching the wrong pattern type or finger numbers
        2. failing to flip the image when needed (as with gel lifts)
        3. re-running the search if the latent was entered under the wrong case number or latent number
        4. See Latent Prints Procedures Manual V, Minimum Biometric Database Standards and Controls.
    C. Database searches that are not used because a subsequent identification renders the search unnecessary. Examples of this include but are not limited to:
        1. When one latent print is searched in both ABIS and NGI at the same time. If one search results in an identification before the other search is complete, there is no need to view the candidate list of the second search.
        2. The latent print is subsequently identified to a listed subject (victim, elimination, suspect, or other) and usable standards are available.
        3. See Latent Prints Procedures Manual V, Minimum Biometric Database Standards and Controls.
III. Rejected data will be documented as follows:
    A. Photographs/Images
        1. When an image is rejected, the rejection will be documented in Adams Web. The documentation must be as follows:
            a) The Asset Name of the image will be renamed to include the word "rejected".

b) A detailed reason for the rejection will be documented in the Asset Description or Notes.
c) The analyst, tech reviewer, and/or verifier that rejected the image must include their initials and the date of the rejection along with the reason for the rejection. The audit trail in Adams Web will record the identity of the analyst making the change and the date the change occurred.

2. When a tech reviewer rejects an image, the reason for the rejection will be documented in the Tech Review Checklist comments. The audit trail in LIMS will record the identity of the tech reviewer and the date the rejection occurred.

B. Database Searches

1. When a database search is rejected, the examiner will use the "Kill" function in the NEC Job Queue to change the status of the search from Verify/Wait to Kill. The "Kill" status is the indication in NEC that the search has been rejected. Examiners are not allowed to use the "Purge" function but will instead leave all searches visible in the Job Queue.
2. When a database search is rejected, the rejection will be documented in the Database Search Results panel in LIMS. The documentation must include:
   a) A way to track which search was rejected. This can be either the TCN of the search from the Job Queue, or a description that includes the latent number as it was searched.
   b) A detailed reason for the rejection.
   c) The date the rejection was made.
   d) The LIMS audit trail will document the identity of the analyst.
   e) Every database search is saved in NEC and can be accessed through the NEC Integrated System Monitoring (ISM) website. The NEC audit trail in ISM will document the date the search was run and the analyst who entered the search.
3. When a tech reviewer rejects a database search, the reason for the rejection will be documented in the Tech Review Checklist comments. The audit trail in LIMS will record the identity of the tech reviewer and the date the rejection occurred.

IV. Examiners, technical reviewers, and verifiers are all responsible for ensuring that adequate documentation is provided for rejection of observations, data, or calculations.

ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

APPENDIX III: NON-ROUTINE PROCEDURES

Reviewed by:

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Forensic Scientist Katharine Mayland, Chairperson
Latent Prints Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

LOW TEMPERATURE LUMINESCENCE

INTRODUCTION

Zinc chloride, will chemically bond with ninhydrin developed latent impressions creating a color change and luminescence. Lower temperature luminescence can be an effective way to enhance faint zinc chloride revealed impressions, either to improve the brightness or increase contrast. While not suggested as a routine processing procedure, low temperature luminescence should be attempted when zinc chloride visualization results in ridge detail but the impression is unsuitable for comparison

Luminescence can be increased by lowering the temperature of the metal bonded ninhydrin developed impression. At temperatures below 100^{o} Kelvin, the efficiency of light absorption and emission becomes noticeably improved and reaches a maximum level near absolute zero. For laboratory application, the most practical means is the use of liquid nitrogen to produce a temperature of 77^{o} Kelvin.

OTHER RELATED PROCEDURES:

Ninhydrin
Zinc Chloride

SAFETY CONSIDERATIONS

Liquid Nitrogen
Forensic Light Sources - see General Instrumentation Appendix IV

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

NFPA LISTING				
CHEMICAL	HEALTH HAZARD	FLAMMABILITY HAZARD	REACTIVITY HAZARD	CONTACT HAZARD
Liquid Nitrogen	3	0	0	

Warning! Toxic! Can cause serious injury despite medical treatment! Liquid nitrogen can cause severe injury upon contact. Insulated gloves, protective clothing and a face shield must be worn when transferring this material. Metal objects should not be used with liquid nitrogen unless adequate insulation between skin and metal is worn. Tongs used to adjust examined items should be wooden or plastic. Remaining liquid nitrogen in the examination container should be allowed to vaporize. Adequate ventilation is advised to prevent excessive nitrogen levels.

PREPARATIONS

No specific preparation of liquid nitrogen is required.

INSTRUMENTATION

See Appendix IV - General Instrumentation.

Forensic Light Sources

Forensic light sources producing excitation light of an appropriate wavelength can be used to illuminate the evidence and produce the desired fluorescence.

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

MINIMUM STANDARDS & CONTROLS

The liquid nitrogen procedure is dependent on the zinc chloride procedure. Therefore, the Standards and Controls for zinc chloride will be followed. As with any fluorescence, photographic preservation is required.

The liquid nitrogen requires no specific set of minimum standards and controls.

PROCEDURE OR ANALYSIS

All applications should be done in a fume hood.

Low temperature luminescence requires a container which can withstand the cooling from liquid nitrogen. Polystyrene is recommended, although styrofoam containers offer satisfactory, if less durable, alternatives. The bottom surface of the container must be darkened to prevent excessive background luminescence that often occurs with styrofoam or polystyrene. Black paint is

acceptable, but will require occasional retouching. The most advantageous method is a tightly woven dark cloth or black construction paper weighted to prevent movement. Containers deeper than six inches will help prevent condensation and fogging problems.

A plate glass cover slightly larger in size than the top of the container is beneficial to reduce vaporization of the liquid nitrogen and subsequent coating of the camera lens. The item to be examined is placed in the container and weighted to minimize movement. Liquid nitrogen is poured into the container until the surface of the item is covered. Additional depth of liquid nitrogen does not improve luminescence and can interfere with focusing. Small, two liter dewars facilitate the transfer of the liquid nitrogen into the tray and are safer to use than larger, ten liter dewars. When the liquid nitrogen transfer is completed, the glass cover is positioned over the container so that a small vent is created along one side of one corner. This permits vapors to escape and reduces condensation. If fogging does occur, air movement across the glass cover using a hair dryer on cool or air only setting will remedy the situation.

Laser illumination through the glass upon the item should reveal increased luminescence. Photographic preservation procedures are the same. Depletion of the liquid nitrogen is readily observed by a decrease in fluorescence, but will be restored with additional liquid nitrogen.

MINIMUM QUALITY STANDARDS AND CONTROLS

See Appendix II.

REFERENCES

1. Menzel, E. Roland. *Fingerprint Detection with Lasers*; Marcel Dekker: NY, 1980.

2. Kobus, Hilton J.; Milutin Stoilovic; R. N. Warrener. "Luminescent Enhancement Procedures for the Detection of Latent Fingerprints"; Proceedings of the International Forensic Symposium on Latent Prints, FBI: Quantico, VA, 1987.

3. Stoilovic, Milutin; Hilton J. Kobus; Pierre A. J.; L. Margot; Ronald N. Warrener. "Improved Enhancement of Ninhydrin Developed Fingerprints by Cadmium Complexation Using Low Temperature Photoluminescence Techniques"; *Journal of Forensic Sciences*, 1986, 31, 2, 432-445.

ILLINOIS STATE POLICE

LATENT PRINTS
PROCEDURES MANUAL

APPENDIX IV: GENERAL INSTRUMENTATION

Reviewed by:

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Latent Prints Command Advisory Board

Approved by:

_____
Brian Mayland
Patterned Evidence Program Manager

APPENDIX IV

INSTRUMENTATION

GENERAL PROCESSING EQUIPMENT

Latent print examination equipment utilizes an enlarging array of items which include those specifically designed for residue detection and those modified or adapted for the specialized needs of evidence processing. Some equipment and commodities are of such limited availability, the examiner has little discretion regarding their use. Other items are prevalent, and examiners can choose individual items that produce the best results. Equipment and supplies within the scope of the latent print discipline are the tools of procedures. Such tools are dependent upon the skill and purpose of the examiner using them.

POWDERS AND PARTICULATE APPLICATION

Description:

Application of dry powders to a nonporous surface is a critical balance of sufficient coloring agent to adhere to the residue without obliterating the development of the friction ridge formations. This process is commonly called dusting and employs a brush or wand. Heat-generated particulate or suspension-deposited particles need no applicator. Selection of dry powder applicator is based upon the properties of materials used in the construction of the applicator and the damage potential of those materials. Brushes are used for standard powders while ferrous metal powders are normally applied with a magnetic wand. Atomizers or other spray devices using dry powders are not a practical form of application for latent print residue.

Properties of all brush construction materials are utilized toward the movement of powder particles with the least possible damage to the latent print residue. A brush must deliver powder to the surface and remove excessive particles with extremely light drag and bristle stiffness. Natural bristle brushes composed generally of squirrel hair (labeled camel hair) are, in initial condition, very soft and pliable. Feather brushes offer naturally delicate applicators at the tips of the barbs and the usual presence of some down. Fiberglass brushes use collections of very fine glass strands while carbon filament brushes are composed of almost pure carbon strands. Magnetic wands are constructed of a permanent magnet attached to a movable rod inside an aluminum housing. The tip of the housing is very thin to permit magnetic attraction when the rod is depressed but thick enough to block attraction when the magnet is raised.

Method:
Initial characteristics of brush material is often negated upon use. Contact with the surface processed brings contamination. Natural materials, animal hair and feathers, will absorb contaminants readily.

Cleaning is difficult and seldom returns the brush to initial condition. Continued use causes bristles or barbs to bind together and lose pliancy. Once this process begins, the evidence damage potential increases immediately to an unacceptable level.

Synthetic materials tend to resist surface contamination, and because foreign material is not absorbed, can be satisfactorily cleaned with mild detergent and water. Continued use creates a splintering effect to individual bristles, forming strands of softer and lighter contact. Carbon filament splinters tend to snap off, while fiberglass splinters tend to remain affixed to the main strand.

Results:

For nearly all routine, nonporous surface powder applications, fiberglass brushes are superior. Carbon filament brushes perform quite well but do not improve in desired qualities to the extent of fiberglass. Squirrel hair brushes must be monitored carefully and discarded at the first sign of bristle contamination. Feather brushes are impractical and have no real value since the development of the fiberglass brush. All magnetic wands are essentially the same, provided attraction is present and the magnet remains movable.

LIFTING MATERIAL

Description:

Powder and particulate-developed latent prints should be preserved. Photographic preservation is the first and most important method, and once accomplished, may serve as the only preservation technique. Latent print residue visualized by powders or particulate is more fragile and susceptible to damage than undeveloped deposits. Accidental contact with any other surface, even packaging, may obliterate or completely remove the developed impression. A second form of preservation exists which preserves the actual evidence, the use of lifting material.

Lifting materials provide a means of capturing the particles adhering to the developed latent print, either to affect a transfer preservation or to protect the visualized latent on the surface. Such lifting material is manufactured with an even coating of adhesive to provide specific degrees of tack or utilizes substances which possess an inherent adhesive quality. Lifting material is divided into transparent and opaque devices with each type designed for prescribed applications.

Opaque lifting material is generally restricted to products which are classified as rubber lifters. This type of lifter utilizes a natural low-tack quality of the synthetic rubber which attracts the particles of a developed latent impression upon contact. While the tack is sufficient to successfully remove the particles in the arrangement of the residue outline, the removed particles can be disturbed on the rubber surface. Rubber lifters are supplied with an acetate cover which is applied to the rubber surface after transfer to protect the lifted impression. Rubber lifters are available in white and black

in various precut sizes. Generally, larger sections are purchased and cut into smaller sections as required.

Transparent lifting material is more widely used and is available in many variations of the same basic principle: a clear, thin film with an even coating of adhesive designed to be free of defects. The simplest and most effective form is pressure wound tape produced in rolls and available in widths ranging from one to four inches. One and one-half or two-inch wide tapes are most popular and will provide satisfactory lifting capability for most latent impressions. The acetate film of lifting tapes can be either; clear and glossy, or frosted. Regardless of type, lifting tapes generally provide versatile and effective means to transfer powder or particulate-developed impressions to another surface specifically selected for the purpose of preservation.

Method:

After photographic preservation, transparent lifting materials are generally used in routine lift preservation, while opaque lifting materials are restricted to developed impressions on curved surfaces or visible impressions created by the touching of a dusty surface. Transparent materials preserve impressions in the correct position of contact, while opaque lifters produce a position reversed image. Such position reversal complicates a comparison to inked impression which most often requires a photographic intermediate procedure to return to true position. However, the high degree of flexibility inherent in the rubber material of opaque lifters permit successful transfer from irregular-shaped surfaces such as light bulbs and other round objects when acetate films will fail.

Opaque lifters are used by cutting out a section slightly larger than the area of the developed impression from the available sheet. The protective cover is removed, and the exposed rubber section is placed gently but firmly onto the surface bearing the impressions. On round items, initial contact between the lifter and the surface is made at the approximate center of the impression, then the rubber material is gently shaped toward the edges. This is a difficult procedure which requires considerable practice to obtain uniform contact without lifter slippage and should only be attempted if photographic preservation is complete and secondary preservation is essential. On curved surfaces, the lifter can be rolled from one side of the impression to the other in one slow, continuous motion. Once the lift is accomplished, the plastic cover is replaced over the lifter.

Transparent lifting tapes are used in the same manner regardless of the type of tape selected. Frosted tape is more flexible than clear and will retain ink or pencil markings. The glossy surface of clear tape produces considerable glare reflection which can present some inconvenience during examinations or subsequent photographic preservation. The adhesive qualities of frosted tape are sufficient to remove the particles of a developed latent impression but have less of a tendency to attract loose or flaking substrate material. The main advantage, however, is a property of the acetate which serves as an indicator of complete surface contact. The natural appearance of the tape is translucent. When placed on a surface and pressed with the fingertip or rubbed with the thumbnail, the areas of thorough contact become transparent. When all portions of the developed latent

impression can be observed distinctly, the examiner is assured of total powder or particulate adhesion. Since a major cause of inadequate lifts is incomplete contact between tape adhesive and particles imbedded in surface irregularities, this indicator property is extremely beneficial.

With minimum practice, lifting tapes can be easily and effectively used. A small section of the tape end is folded over onto itself, adhesive to adhesive, to form a tab. The tape is then unrolled to a length slightly longer than the area to be lifted. The tape is placed on the item surface at a spot adjacent to the impression and then the fingertip is run down the center of the tape toward the tab end. From this center anchor, the tape is rubbed toward the edges until the entire section of tape has thorough contact. The tape is removed by pulling the tab slowly from the item. Once disengaged from the item surface, the tape is placed on an appropriate backing in the same manner.

Larger impressions may require wider tape or the use of overlapping strips. Several sections of tape may be applied with each section placed to create a slight overlap of the one next to it. When the impression is completely covered, the overlapped sections can be removed as one by grasping all tapes simultaneously. With care, the entire impression will be preserved with no missing areas.

Two-layer devices are seldom used in laboratory examinations, although they have a certain degree of popularity with some crime scene investigators. Designed for simplicity in operation and the convenience of a lifter and backing unit, they generally yield less productive results than tapes or opaque lifters. Two general types are available, those with solid backing material and those with transparent backings. Because all are precut, a variety of sizes are available and are usually required in routine processing occasions. The end result is a collection of lifted latent impressions of no uniform dimensions, some quite small and easily lost. Those in which the lifter portion is improperly repositioned to the backing present exposed adhesive which can stick to other lifters or to containers.

Solid back lifters reveal the latent impression in true position. However, transparent lifters require a marking to denote the positive side. Transparent lifts can be photographically preserved using back lighting, either from a light box or an enlarger.

Two-layer units are used to lift impressions in the same manner as tapes except one edge is prepared to serve as a tab. The acetate film is usually less flexible than tapes and therefore, if used, are restricted to flat surfaces or those with slight, regular curvature.

Use of any lifting material during low humidity conditions is sometimes hampered by a static electricity build-up on the acetate covers or tapes. This charge can create an attraction between lifting material and surface which may make control of the material prior to positioning over the developed impression very difficult. Contact of the non-adhesive side of the lifting material with a conductive metal immediately before positioning will dissipate the static charge.

Results:

Lifting materials, especially tapes and opaque lifters, provide an excellent means of evidence preservation. Generally, this is secondary to photographic preservation. However, on occasion, the experienced examiner may elect to use lifting as the primary form of preserving powder or particulate-developed latent impressions due to practical considerations concerning type of evidence, quantity of items, and time involved in photography. Such decisions must be based upon the confidence of the examiner that lifting will produce the desired results of proper and effective preservation. Any deviation from the procedure of photographic preservation followed by lifting must be based upon sound and prudent reasoning. Any destruction of evidence by the lifting method without prior photography must be considered improper and inadequate procedure.

BACKING MATERIAL

Description:

Single layer transparent lifting materials used to remove a developed latent impression from the surface of deposit must be affixed to another surface for preservation. The type of preservation surface, commonly called backing material or lift cards, greatly affects the final condition and appearance of the completed lift. Generally, only two colors of backing material are required, white for dark powder-developed impressions and black for light powders. However, those examiners restricting powder usage to black and gray will need only white backing material.

While any white material may be used as a lift backing for some occasions, specific surface properties of the backing can add desired clarity and contrast. Absence of noticeable fibers or other defects, uniformity in color and high surface gloss will greatly aid in the observation of characteristics and facilitate evaluations and comparisons. Two such materials provide the best backing surface properties: photographic paper and commercially prepared backings.

Photographic paper designed for cold tone, general purpose printing provides a very good lift backing surface. Resin-coated papers are especially well suited for this purpose. Photographic paper is fixed and washed without exposure to produce high gloss white backings, or totally exposed, fixed, and washed to yield a high gloss black backing. Medium or double weight papers provide additional substance which increases the durability of the backing. The only disadvantage to photographic papers is the brittleness of the emulsion. When photographic paper is folded as required for side-by-side comparisons, a fracture of the emulsion may occur. While not generally harmful to the preservation of the lifted latent, the fracture may result in some minute flaking and produce a highly visible line along the location of the fold. Repeated bending may even create a tear in the paper leaving the affixed tape susceptible to potential damage. Examiners who regularly compare latent to inked impressions side-by-side beneath one magnifier should avoid using photographic paper backings.

Commercial lift cards provide the most desired characteristics of a lift backing. Available in both white and black, the backing surface is an opaque coating of resinous material that possess high gloss, flexibility and strength. Manufactured with superb quality control, these lift cards provide a background surface that offers the ultimate contrast to the developed powder or particulate impression.

Results:

Properly developed and lifted latent impressions placed on appropriate backing material can provide excellent conditions for impression evaluation and comparison. The use of recommended backing materials will produce the required contrast, clarity, and permanence for subsequent examination procedures.

IMAGE PROCESSING EQUIPMENT

Image processing requires a combination of input, processing and output devices. It functions best when all components are integrated and tested as an end to end system. Some common components include forensic image workstation, software, storage media, digital camera, flatbed scanner, and high resolution printing device. When properly integrated, the system is simple to use; however, it is highly specialized for forensic applications and requires advanced training, knowledge and skill.

FORENSIC IMAGE WORKSTATION

Description:

A forensic image workstation is a computer or laptop with a fast high end processor. The workstation requires large amounts of physical memory and a separate non-integrated video card. Separate physical memory and video memory allows the system to perform at peak efficiency without sharing resources. Shared resources increase the risk of conflicts and other hardware errors. The workstation also has one or two high end computer monitors. When work space is a consideration, one monitor can be used provided it is large enough to display multiple images for comparison work. When space permits, dual monitors are preferred. Images can be displayed with other applications running simultaneously which facilities note taking. The workstation has image processing software appropriate for forensic use. The software used in processing and analyzing digital images produces consistent results, tracks changes, and allows competent examiners to achieve comparable results. Other applications can run on the forensic image workstation such as e-mail, word processing, and laboratory information system provided the system is tested with these applications running and there are no errors.

Method:

Image enhancement is any process intended to improve the visual appearance of an image. Many digital imaging processing techniques have roots in traditional photography and/or mathematics. Some of the more common techniques include brightness and contrast, cropping, dodge and burn, hue and saturation, color adjustments and invert. More advanced techniques include sharpening, noise removal and pattern removal. These techniques are applied to larger portion of an image and not at the pixel level. They are documented in an audit trail. Techniques that change the image content such as cut and paste or clone are strictly prohibited.

The trained forensic scientist applies various processing techniques to improve the visual quality of the impression or to remove background interference which obscures detail. The first step is to save the original image prior to any processing. A working copy is created for processing. While processing, each step is documented in work notes or audit trail. The working copy is saved as a separate image and stored in a secure manner.

DIGITAL CAMERA

A digital camera used for latent print work is a professional style single lens reflex (SLR) camera or scan back. It can use CCD or CMOS technology. Typical professional SLR cameras exceed 12 megapixels and have a sensor capable of capturing an area of 4 1/4 inches by 2 13/16 inches while maintaining the necessary image quality for latent print work. Scan back cameras can significantly increase that capture area. Other unique features of the SLR and scan back cameras is that they can accommodate a variety of standard and macro lenses, have adjustable apertures and shutter speeds, can accommodate a variety of light sources including lasers and alternate light sources. SLR cameras can be used on a copy stand or are easily detached and portable for larger subjects.

Method:

The digital camera with macro lens is attached to a copy stand. Prior to use, establish the camera to subject distance to obtain 1000 pixels per inch (ppi) resolution. Set the camera settings for the highest quality, no compression and RAW or TIFF file format. Set white balance based on the lighting source. Illuminate the subject with the proper lighting source. Frame the subject in the view finder or live preview window. Set the camera to subject distance to maintain or exceed 1000 ppi. Focus the camera. Take the picture and transfer it to the forensic image workstation. The camera can be attached to a forensic image workstation for live viewing and storage, or not. When the camera is not attached to a workstation, images can be stored on removable media and transported to a card reader on a forensic image workstation.

FLATBED SCANNER

A digital flatbed scanner is used for images that are flat such as paper. They can make high resolution scans over larger areas (varies depending on the size of the scanner). The light source is contained in the scanner so the object is uniformly illuminated. Flatbed scanners must be connected to a forensic image workstation. Flatbed scanners can have transparency adapters which are used as a source of transmitted light for scanning negatives, transparent lifters and plastic bags. Flatbed scanners have adjustable resolutions. The resolution data is typically added to the metadata in the image file. Some imaging programs will read this meta data so there is no need to set the resolution in the image software. Scanners have TWAIN interfaces which allow direct scanning into the imaging application. Also, scanners can scan to a file.

Method:

Prior to scan, determine the optical resolution of the bed and the transparency adapter. Verify the scanner settings. Set the scanner for the optical resolution of the scanner. (Note: lower resolutions can be used but they should be reduced by factors of two. Example: 4800 ppi can be reduced to 2400 ppi or 1200 ppi). Resolutions under 1000 ppi for latent prints should be avoided. Turn off any enhancement features such as sharpen. Make a preview scan. Select the final scan area. Make the final scan.

HIGH RESOLUTION PRINTER

Description:

A high resolution printer is used to reproduce the finest detail in a latent print. Resolution is rated in dots per inch (dpi). A higher dots per inch value, will resolve finer detail. The number of dots per inch is not the only factor when printing a quality image. The size, pattern and color of the dots all have influence on the quality of the image. This makes inkjet technology a good choice. Some printers use combinations of cyan, yellow, magenta, and black (CMYK) to simulate shades of gray and color. Some inkjet printers have additional colors and grey inks beyond CMYK. Printer drivers can be developed to change the size and patterns of the ink dots. The Noritsu printer company has developed the Super Shamone driver which was developed specifically for printing latent prints.

Method:

See the manufacturer's recommendations for paper and ink type. Verify printer settings. The highest quality may not necessarily be the best setting. (Example: Epson printers have a "Vivid" color mode. This mode increases the droplet size and may obscure fine detail. Standard mode is the preferred color setting). Set paper size. Print picture.

MAGNIFIERS

Description:

Optical fingerprint magnifiers provide between 4 and 5 power enlargement of impressions with 4.5X the most commonly available instrument. Generally, the optics consist of several elements, often coated, to magnify the viewed object with a minimum of distortion. Field of view is usually sufficient to observe characteristic relationships without repositioning the magnifier. A magnifier designed to produce a larger field of view with a slight reduction of magnification is manufactured by Police Science Industry, Ltd., Tokyo, Japan.

Method:

Horseshoe base magnifiers are equipped with a screw adjustment to permit proper object-to-lens distance for the examiner's particular vision. An optional lock ring will hold the settings during the extensive handling of the magnifier. Column type magnifiers are adjusted up or down the pedestal until correct focus is obtained and held in position by a set screw.

Utilizing a good light source, the examiner can readily evaluate most impressions with the 4.5x magnification. For comparisons, some examiners prefer two magnifiers, one placed over the latent and the other positioned over the comparable area of the inked print. This normally requires shifting the head back and forth to view each area. Needle-type pointers are essential to maintain a reliable reference of friction ridge characteristics. While this method can be quite effective for those individuals trained to compare two separate fields of view, many examiners prefer a single magnifier approach in which the latent impression and the inked impression are placed side by side. A simple fold of the latent print lift or photograph will permit comparable area positioning. This method forms a split image beneath the magnifier which facilitates characteristic comparison by eliminating alternate field inspections.

Results:

High quality magnifiers are the essential tool for latent print evaluations and comparisons. While occasionally photographic enlargements or image enhancement may be required to reach conclusions of impression suitability or identity, the use of standard fingerprint magnifiers will produce satisfactory results in routine examination procedures.

SPECIALIZED PROCESSING EQUIPMENT

In addition to basic equipment needs related to routine evidence processing, certain specialized apparatus can facilitate portions of various techniques, improve the consistency of results or enable examinations to a greater depth of analysis. Some are employed so infrequently that they cannot be defined as mandatory pieces of equipment while others have adequate, if more complicated,

procedural alternatives. No one listing can supply a complete catalog of specialized equipment which may have some application to evidence processing on some occasion.

REFRIGERATORS AND FREEZERS

Refrigerators and freezers that are used for evidence, reagent, or chemical storage must adhere to the following standards:

1. Refrigerators must be kept between 2°C and 10°C (between 36°F and 50°F).
2. Freezers must be kept between -18°C and -1°C (between 0°F and 30°F).
3. Analysts are to ensure the above temperature ranges are sufficient for any newly purchased reagents with temperature control requirements. Any differences will be discussed with a supervisor.

A performance check will be completed monthly for refrigerators and freezers.

1. Record the temperature of the refrigerator or freezer using a NIST traceable thermometer. Adjust the temperature dial if necessary and recheck. Record the results in the LAM.
2. If the temperature cannot be maintained within the specified tolerance window listed above for a period of 24 hours, all contents will be relocated to an appropriate working refrigeration unit. The refrigerator or freezer that was out of the acceptable temperature range will be placed out-of-service until it can be repaired or replaced.

THERMOMETERS

Only thermometers with ISO/IEC 17025 Certificate of Calibrations may be used. These thermometers must be traceable to national or international standards (e.g. NIST). The calibration certificate for each thermometer will be entered in the LAM. The vendor's calibration is the performance check. The thermometer may be placed into use immediately and used until the expiration date on its certificate.

HEAT/HUMIDITY CHAMBERS

Description:

Environmental chambers or cabinets which permit adjustment of temperature and relative humidity are required to assure the maximum potential from selected processing procedures. Optimum heat and humidity levels can be maintained for post treatment development during ninhydrin processing and pretreatment of items to be processed with amido black.

Environmental chambers are available in various sizes, qualities, and prices. Basic design consists of an insulated cabinet containing heating and cooling elements combined with humidifying/ dehumidifying devices. Cost is related to construction quality and tolerances of temperature/ humidity settings. Latent print processing benefits from environmental control occur within a

relatively broad range of temperatures and humidity fluctuations so that precise maintenance levels are not critical. Changes of +/-10ºF or +/-5% RH do not appear to affect the reliability of reactions except in terms of time requirements.

Adequate storage space and construction quality are important factors. Unreliable components and excessive condensation may present conditions in which evidence is damaged by the chamber. Unfortunately, large volume and component integrity are associated with high cost.

Method:

The need for humidity to produce effective ninhydrin-amino acids chemical reaction must be balanced with the solubility of the amino acids in water. Heat/humidity chambers should function at 70% RH in a temperature range from ambient to 80ºC. Higher temperature operation should not produce condensation which can diffuse amino acids. Dry, processed articles are placed in the prepared chamber. Slightly better results are obtained from exposing the items to a temperature of ambient or a little above with a relative humidity of 70%. An acceptable alternative is exposure to a temperature of 50º to 80ºC at 70% relative humidity for five minutes.

Results:

Heat and humidity at the prescribed ranges will produce uniformly consistent ninhydrin-amino acids chemical reactions with minimal residue diffusion and background discoloration. Developed suitable latent impressions require photographic preservation.

FORENSIC LIGHT SOURCES

Description:

Routine examination and photographic requirements usually can be accomplished with the aid of incandescent lamps, such as photo flood lights, or quartz lamps especially designed for camera illumination. These sources provide white light saturation ample for most tasks, although they generate heat which may be detrimental to some types of sensitive evidence. Other light sources may provide convenience when photographing particular articles of evidence or may yield additional or superior evidence when applied toward photographic preservation. These include fluorescent light boxes, fiber optic illuminators, fluorescent light sources, ultraviolet and infrared viewing systems, alternate light sources, lasers, and Reflected Ultraviolet Imaging Systems (RUVIS).

Method:

Fluorescent light boxes with frosted glass or plastic diffusers provide an excellent back lighting source. Transparent or translucent items placed on the light box may reveal better detail and permit easier and more complete photographic recording than with reflected light. Light boxes are also

beneficial in the evaluation of negatives and the preparation of photographic enlargements for courtroom displays.

Fiber optic illuminators provide a highly controlled, maneuverable light source which can easily be positioned to provide directed illumination with irregularly shaped surfaces. Latent impressions located in recesses, may be successfully illuminated when conventional lighting techniques would create masking shadows. Most fiber optic illuminators have irises which permit control of light intensity and have heat absorbing filters which permit illumination of sensitive materials. A fiber optics beam directed into the edge of some plastics produces an effect similar to fluorescence with latent print residue.

Fluorescent illuminators, such as those that are used in microscopic examinations, provide for a softer more diffuse light source. This type of light has been found to be very beneficial when photographing highly reflective surfaces such as chrome, plastics or metal plated objects. In addition, visual impressions found on firearms, either blued or nickel plated surfaces, are often more easily captured using this type of lighting. This type of lighting is very versatile in its applications and produces a very sharp, detailed image on the negative.

Ultraviolet and infrared viewing systems may be useful in reducing the interference of certain inks used in cancellation stamps on checks. Ultraviolet illumination may be utilized to create background fluorescence on surfaces such as cardboard or cloth to enhance chemically developed latent impressions. When used with Ardrox staining, ultraviolet illumination, particularly from high intensity light sources, is highly productive.

Alternate light sources have vastly improved over the years and the intensity that can be delivered by these sources has also improved. Lasers are still superior in the amount of watts that can be delivered to illuminate a surface for fluorescent examinations. However, the advent of continuously tunable filtration in alternate light source systems shows great potential. This allows the examiner to fine tune the wavelength of light so that the impression fluoresces while any background fluorescence is minimized. This can improve the contrast with impressions that may show a weak fluorescence, and may be obliterated by background fluorescence, such as with some zinc chloride developed impressions. This ability to continuously fine tune the filtration provides an aspect not available with lasers.

Additionally, these alternate light sources can be used multi-wavelength fiber optic illuminator. Using the alternate light sources in this fashion is beneficial in that some substrate or residues may show more contrast using specifically filtered wavelengths of light as opposed to the broader spectrum of a basic fiber optic illuminator. This may provide a contrast that makes the photographic preservation simpler or may produce a contrast that could not be achieved by other means.

Lasers may be used in a similar manner to fiber optics illuminators, especially where high intensity, oblique lighting is required. Since the beam is applied as a light source rather than a means of

luminescence excitation, no wide band pass filter is necessary. Utilization of specialized light sources generally improves the quality of photographic preservation of latent print impressions. Occasionally, attempts to record the best evidence reveal information not previously observed or removes interference which prohibited full visualization of suspected deposits. Application of specialized lighting when conventional illumination is unsuccessful often produces satisfactory preservation results.

There are several references one can refer to for additional information about lasers. To locate information about the use of lasers to visualize fingerprints, including information on photoluminescence, chemical treatments, the mechanics of lasers, and wavelengths of light, see the book *Fingerprint Detection with Lasers* by E. Roland Menzel (Marcel Dekker: NY 1980). Information concerning the mechanics of specific laser systems can be found in each laser's user's manual.

Reflected Ultraviolet Imaging Systems (RUVIS) are non-destructive intensifying devices that best reveal unprocessed and processed latent friction ridge skin impressions on smooth, non-porous surfaces that have reflective properties. Different components work together to visualize impressions: a shortwave (254nm) UV light source, a digital camera, and computer software to view and capture images. When shortwave UV light hits the substrate at certain angles, the light reflects off of the substrate at the angle of incidence. Any irregularities on the surface, such as raised ink, textured areas, or fingerprint impressions, will cause the shortwave UV light to scatter at different angles. The RUVIS camera detects this scattered light, and the RUVIS software allows the examiner to view and capture images of friction ridge impressions on difficult to photograph substrates.

CYANOACRYLATE FUMING CABINETS

Typically, cyanoacrylate fuming chambers are enclosures that can be sealed in order to contain the cyanoacrylate fumes and provide the appropriate environment for processing the evidence. Most often these are containers such as aquariums with plexiglass lids or some other type of enclosure that has been manufactured by the user to accommodate the evidence to be processed. Humidity is usually provided for by placing a warm container of water in the enclosure. Heat for the volatilization of the cyanoacrylate ester is provided for by light bulbs, hot plates or other devices that produce appropriate levels of heat.

If properly sealed with an adequate amount of cyanoacrylate ester and humidity any container can be used to produce the desired results. Manufacturers of fingerprint supplies have produced several chambers that all can produce satisfactory results. One such unit produced by DPA Manufacturing not only provides for a sealed enclosure but also controls heat and humidity levels. This control allows the examiner to achieve a consistent environment in which to process evidence. The unit controls the temperature at which the cyanoacrylate ester is volatilized, 140 degrees Celsius is recommended, and also the amount of water needed to precisely control the humidity in the chamber. Superglue is added in specific amounts (0.6 to 1.0 grams) and the unit controls the processing from

volatilization through evacuation of the fumes through a water filtration system. The examiner must still monitor the evidence to insure that items are not over exposed to the cyanoacrylate fumes. If one cycle provides insufficient polymerization on the evidence the examiner can run a second cycle.

IODINE FUMING CABINET

Iodine fuming cabinets, once a staple of latent print processing areas, have practically disappeared in most laboratories. The ineffectiveness of iodine vapor to visualize impressions more than ten days after deposit and the effectiveness of ninhydrin to develop older latent impressions resulted in an almost total abandonment of iodine fuming. However, with the discovery of 7,8-benzoflavone enhancement of iodine-visualized impressions and the very low destructive potential of iodine, iodine fuming cabinets may be considered as a viable addition to latent print processing equipment.

Commercially manufactured cabinets are available which use an electric heater to speed the iodine crystal sublimation. These cabinets work well but have two drawbacks which can limit their operation life. First, the top lid is hinged and does not fit snugly. Vapors can escape unless a weight is used. The plastic hinges are not corroded by the iodine vapors but will break after heavy usage. Second, the cabinet is constructed of vinyl-coated metal. Any scratch or removal of the vinyl exposes the metal to iodine vapors that will eventually destroy the cabinet.

An iodine fuming cabinet can be constructed using wood and glass which will function well without danger of corrosion. A diagram is included in this appendix that provides the general construction guidelines. Modifications may be preferred, especially in the heat source and baseboard, to avoid safety and health risks. An electric bulb can be used in lieu of the alcohol burner, and that removes the need for asbestos. The essential design features are a sealed chamber with a well-fitting lid, at least one glass viewing window, and supports for a moveable device to hold items suspended in the vapor atmosphere.

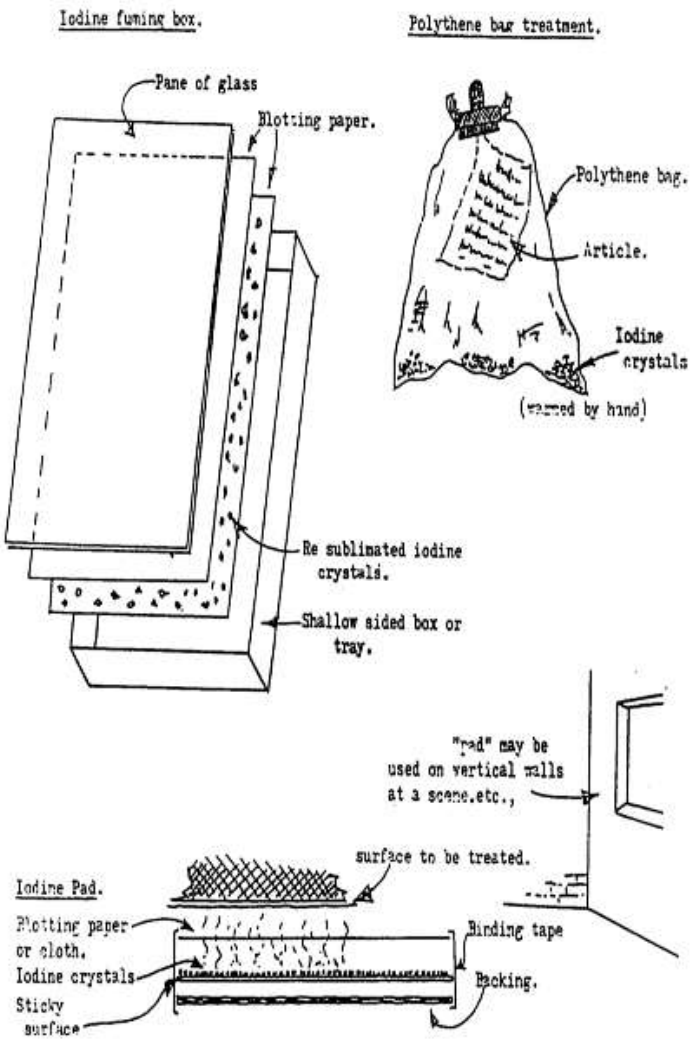
IODINE FUMING GUN

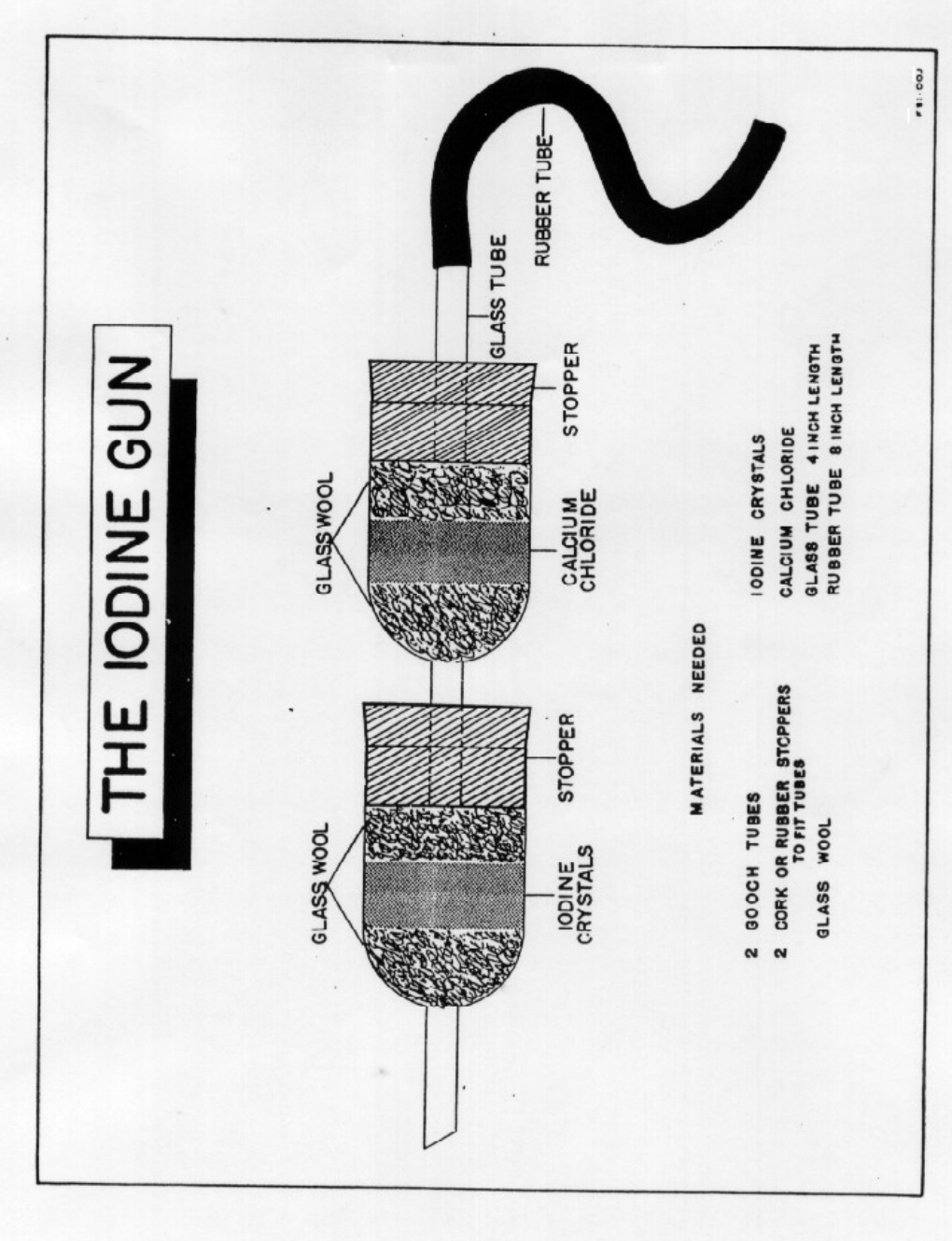
A handheld enclosure which permits directed dispersal of sublimated iodine fumes is called an iodine fuming "gun." The device is a glass tube which holds the iodine crystals through which air is passed. One method requires blowing into the tube through rubber tubing where the heat from the breath combined with the heat from the hand increase the sublimation rate of the iodine crystals. However, since moisture mixed with the iodine vapors can react with starch sizing in paper to cause a permanent blue discoloration, calcium chloride is used as a desiccant. Commercially available iodine fuming guns generally are a single tube arrangement with the iodine and calcium chloride separated by glass wool or cotton. As the calcium chloride absorbs water from the breath, it hardens, and unless the tube is cleaned thoroughly after every use, the device may be rendered inoperable. An alternative design uses two tubes as illustrated in the appendix diagram. The separate calcium chloride tube must be cleaned after use, but if neglected, a substitute tube is easily fashioned. The two tube gun also permits easier replacement of iodine crystals during lengthy examination.

The calcium chloride tube can be omitted if a squeeze-type air bulb is used. An air bulb also prevents any possible mishap resulting from accidental inhalation when using the gun requiring breath. Air bulbs with metal valves, however, may be corroded with prolonged usage and become inoperable. Rubber valve air bulbs do not present these problems.

Iodine fuming guns are used by heating the iodine crystals with the hand or placing the gun near a burning light bulb until purple vapor can be seen in the glass wool. The exit port of the tube is placed near the area to be examined and air is passed into the tube. Because the vapors are not contained, reactions may fade quickly, so prolonged exposure is usually required.

Diagrams of simple iodine fuming methods.





ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

APPENDIX V: MINIMUM BIOMETRIC DATABASE STANDARDS AND CONTROLS

Reviewed by:

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Approved by:

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Kellen Hunter
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MINIMUM BIOMETRIC DATABASE STANDARDS AND CONTROLS

INTRODUCTION

ABIS (Automated Biometric Identification System) is a statewide system that performs searches of latent prints or unknown deceased prints against a database maintained by the Bureau of Identification (BOI). The search results in a candidate list along with the corresponding Tenprint images for initial comparison. Fingerprint and/or palmprint standards of a subject, from which an identification may be made, can be obtained via the Digital Archive System (DAS). A latent print that does not "hit" may be registered in the Unsolved Latent Database (ULD), and subsequently new arrest cards submitted to the BOI are searched against the registered latent prints. Further information in the use and application of this equipment is contained in the ABIS User Guides provided by NEC.

NGI (Next Generation Identification) is a national system that performs many of the same functions as ABIS; however, the database is significantly larger and is maintained by the FBI.

I. CASE PHILOSOPHY FOR BIOMETRIC DATABASE SEARCHES

A. For all cases, all unidentified database suitable latent prints will be searched in ABIS and NGI. Exceptions will be made for the following:
   1. A previous probative identification has already been made in the case.
   2. Deferrals listed under section I.C.
   3. Case specific circumstances. The type of offense cannot be used as a "case specific circumstance" to justify deferring or not conducting database searches.

B. Elimination standards must be submitted before database searches will be conducted. Exceptions may be made on a case-by-case basis at the examiner's discretion or as outlined in CD TCH 5, III.A.5

C. Deferrals
   1. Database-Only Examinations
      a. Examiners have the option to analyze the latent prints in a case for database suitability only.
      b. When a database-only examination is performed, a deferral statement indicating no other work was performed must be documented in the examiner's work notes and on the report.
   2. Examiners may defer database examination due to the following circumstances:
      a. Lack of elimination standards
      b. Inconclusive comparison result to the submitted standards. Additional standards should be requested.
      c. Evidence is found on the person.

d. The size of the latent print indicates that it was deposited by a small child (younger than 10 years old).
e. Deferrals due to any of the above circumstances will be documented in the examiner's work notes and on the report. When case specific circumstances indicate that ABIS and/or NGI searches will not add value to the case, those circumstances and justifications must be documented in the examiner's case notes.

3. Examiners have the option to search 5 database suitable latent prints per exhibit, with a maximum of 15 prints per case, and defer additional database analysis. The deferral will be documented in the examiner's work notes and on the report. In the event that additional prints need to be searched in the databases:
   a. Contact the agency to request additional elimination prints.
   b. Enter a mutually agreed upon number of prints and defer the database suitable prints that were not searched. Document the deferral in the work notes and on the report.
4. For cases with database searches that resulted in an identification, the examiner may compare any additional suitable latent prints to the standards obtained as a result of the identification. Examiners may also choose to defer all additional comparisons.

II. TECHNICAL BIOMETRIC DATABASE REQUIREMENTS – DATABASE SUITABILITY

A. Only latent prints and unknown deceased standards that meet the following technical requirements should be searched in the biometric databases. Not all cases will have latent prints suitable for database processing.
   1. Fingerprints
      a. Minutia Number - A database suitable fingerprint should contain a minimum of 8 clear minutiae points (bifurcations and/or ending ridges).
      b. Core/Axis - A database suitable fingerprint should have a discernable core and axis.
      c. Searching Multiple Fingerprints from a Single Case.
         i. When multiple fingerprints appear to have been made by the same finger, only one print needs to be searched.
         ii. When an examiner determines multiple latents are simultaneous, at least two impressions will be searched unless one impression is identified.
      d. Latent fingerprints that do not meet these criteria may be searched at the examiner's discretion.
   2. Palm and Joint Prints
      a. Minutia Number: Database suitable palmprints and joints should contain a minimum of 12 clear minutiae points (bifurcations and/or ending ridges) inside a 1 inch by 1 inch area. Larger palmprint and joint areas may be searched in NGI at the examiner's discretion.

b. Orientation: Database suitable palmprints and joints should have a known orientation.
c. Latent prints designated as fragments may be searched at the examiner's discretion.

B. Required Documentation
1. The results of the analysis for database suitability will be recorded in the case notes.

III. PREPARATIONS OF LATENT PRINTS FOR BIOMETRIC DATABASE SEARCHES
A. Prints will be submitted to the biometric databases by one of the following methods:
1. Electronic image files
a. Prints will be brought into ABIS and ULW as electronic image files.
b. A reproducible analytical quality image of the print from which minutiae was extracted must be maintained.
c. Images brought into ABIS and ULW for searches must be at a resolution of 500 ppi or 1000 ppi.
d. Images brought into ABIS and ULW for searches must be in grayscale.
2. LFFS (Latent File Feature Search) File
a. Out of State Agencies: Any agency outside of Illinois that also has NEC software may submit LFFS files of latent prints for direct, non-altered entry.

IV. SEARCHING PRINTS IN ABIS
A. NEC ABIS software must be used to search ABIS. The Web Portal will not be used to search ABIS. Results are reviewed on the computer using the ABIS software program.
B. The following fields are mandatory when creating a new case in ABIS:
1. Case Number
2. Crime Code
3. Date of Crime
4. The Auto-Delete box will be checked when available
C. Types of Searches
1. Auto-LI/Auto-LIP (Auto-Latent Inquiry/Auto-Latent Inquiry Palm): Should be used as an initial cursory search of the system.
2. LI/LIP (Latent Inquiry/Latent Inquiry Palm):Required for prints that do not hit as an Auto-LI or for lower quality prints that were not searched as an Auto-LI.
3. L/LI (Latent to Latent Inquiry): Required for all prints searched in ABIS.
4. Remote-LI/Remote-LIP (Remote-Latent Inquiry/Remote-Latent Inquiry Palm): Used for searching NGI. See V. Searching Prints in NGI.
5. Latent Combo: May be used to run the LI/LIP, L/LI, Remote-LI/Remote-LIP, and LR (Latent Registration) in ABIS and/or NGI.
D. For fingerprints, all finger numbers will be searched unless an identification is made as a result of a previous search.

E. Pattern types for fingerprints should be selected as a parameter of the search. If the pattern is indiscernible, with no obvious patterns or references, the latent print should be searched as a scar.
F. Search Finger Types will be set to "Both."
G. Examiners may run multiple searches to edit core/axis, minutiae, orientation, and zoning if necessary.
H. Palmprints and joints can only be searched in 1 inch by 1 inch areas. If the palmprint or joint is larger than 1 inch by 1 inch, the examiner should choose the clearest area that contains a minimum of 12 minutiae points to submit for ABIS processing. Additional 1 inch by 1 inch areas may be searched at the examiner's discretion.
I. ABIS will be set to send back a response with 10 candidates. All 10 candidates will be viewed unless an identification is made or unless the system returns less than 10 candidates.
J. Tenprint to Latent (T/LI) or Tenprint Substitution to Latent (T/LI2) searches initiated at the Bureau of Identification will be reviewed by the original case examiner. If the original case examiner is no longer available, another examiner will be designated to review the T/LIs and T/LI2s.

V. SEARCHING PRINTS IN NGI

A. NEC ABIS or ULW (Universal Latent Workstation) software must be used to search NGI. Results are reviewed on the computer using one of these software programs.
   1. ABIS software may be used to search fingerprints and 1 inch by 1 inch areas of palmprints and joints.
      a. At a minimum, an examiner is required to search the same 1 inch by 1 inch area of a palmprint or joint in both databases unless an identification is made as a result of a previous search. An examiner may meet this requirement by searching the 1 inch by 1 inch palmprint or joint area in NGI using ABIS software (Remote-LIP), by searching the 1 inch by 1 inch area directly through ULW software, or by searching a larger area of the palmprint or joint directly through ULW software.
   2. ULW software may be used to search NGI via the Web Portal. The following fields are mandatory when creating a new case in ULW through the Web Portal:
      a. Case Prefix (must be the examiner's user ID)
      b. Case ID (ISP case number)
      c. Priority
B. All prints searched in NGI will be searched against the Criminal Master File Records and the Civil Records Files.
C. All states will be searched unless an identification is made as a result of a previous search.
D. For fingerprints, all finger numbers will be searched unless an identification is made as a result of a previous search.

E. Pattern types for fingerprints should be selected as a parameter of the search. If the pattern is indiscernible, with no obvious patterns or references, the latent print should be searched as a scar.

F. NGI will be set to send back a response with 20 candidates. All 20 candidates will be viewed unless an identification is made or unless the system returns less than 20 candidates.

VI. REQUIRED DOCUMENTATION FOR ABIS AND NGI SEARCHES

A. Analysts shall retain all database searches. If a search is rejected, the rejection shall be documented according to the requirements in the Latent Prints Procedures Manual LP-APP-II, "Minimum Standards & Controls", Data Rejection.

B. The following information will be saved for all searches performed in ABIS and NGI. These documents will not be printed or saved in the examiner's case notes, but will be maintained in either the NEC Archive for searches generated through ABIS software or the Web Portal for searches generated through ULW:

1. For image searches, the image used for conducting the image search.
2. For feature searches, the Minutia/Core/Axis/Zone encoding used for conducting the feature search.
3. Candidate lists.
    a. In order to create a candidate list in ABIS, at least one saved decision must be made.
    b. If an Auto-LI is run and the transaction goes into Edit Required, a candidate list will not be generated and is therefore not required.
4. For searches generated in ULW, no relevant search jobs will be deleted/purged from the job queue in the Web Portal.

VII. DATABASE IDENTIFICATIONS

A. Examiners must compare the actual latent print image (from photograph, lift or electronic image file) to an actual standard obtained from the Bureau of Identification or the Federal Bureau of Investigation.

1. No identifications will be made or verified by another examiner from the preview screen. Database-generated split screen images, tracing images, or other ABIS and/or ULW generated documents will not be utilized to make a positive identification.

B. Examiners should request that a new standard of the identified subject be submitted by the agency.

C. Database Identifications resulting from a tenprint to latent inquiry (T/LI) or ULM (Unsolved Latent Match Response).

1. T/LI: If a potential identification is generated from a tenprint to latent inquiry, the original examiner will be notified.

2. ULM: If a potential identification is generated from the ULF, the original examiner will be sent a ULM.
3. If a T/LI or ULM identification is made, the examiner will compare all additional prints from that case that are registered in ABIS and NGI to that subject. The examiner will delete any subsequently identified prints that were registered in the databases.

D. Database Identifications resulting from a latent to latent inquiry (L/LI).
1. If a potential L/LI identification is made, the latent print examiner conducting the search will contact the latent print examiner of the other case and advise them of the potential identification.
   a. Each examiner will make a copy of the original latent print and the original work notes for documentation in the corresponding examiner's work notes. The documents will be retained and marked appropriately.
   b. Both latent print examiners will conduct a comparison with the images of the latent prints from each case.
2. If an L/LI identification is made, the examiner's case work notes will be marked that an identification was made to a latent print from another case.
   a. The case numbers and exhibit numbers will be recorded in the work notes for each case.
   b. Reports will be prepared by the original examiner of each case, advising the submitting agency/agencies that the same unknown subject's latent prints were obtained from an additional crime scene.
   c. Identifications must be documented and verified as being from the same unknown subject.
3. The above protocol should also be applied when the L/LI identification is made in conjunction with a T/LI identification.

E. Required Documentation
1. The following information will be maintained in the case file for any identifications resulting from searches in ABIS and/or NGI:
   a. An analytical quality copy of any known standards used to make an identification.
   b. Once a hit has been designated in the Verify screen (ABIS), an Unsolved Latent-Tenprint Search Confirmation report is generated. This document will not be printed or saved in the examiner's case notes, but will be maintained in the NEC Archive.
2. Examiners will document the identification according to protocol set forth in the Latent Prints Procedures Manual Appendix II, Minimum Standards and Controls.
3. Identifications will be verified as set forth in the Command Directives TCH 4 and the Latent Print Procedures Manual Appendix II, Minimum Standards and Controls.

VIII. REGISTERING LATENT PRINTS IN BIOMETRIC DATABASES

A. For all cases, all unidentified latent prints that meet the above Technical Biometric Database Requirements will be registered in the ABIS unsolved latent database for future search against new tenprint/palmprint records.
   1. All registered latent fingerprints must be registered as all fingers.
   2. Any Latent Deletions (LD) affecting prints registered in the ABIS unsolved latent database must be documented unless the LD is performed as the result of the expiration of the Statute of Limitations.

B. For homicide, attempted homicide, and sexual assault cases, all unidentified latent prints that meet the above Technical Biometric Database Requirements will be added to the NGI Unsolved Latent File (ULF) for future search against new tenprint/palmprint records. Registering unidentified latent prints in NGI for all other offenses is optional and may be done at the examiner's discretion.

   1. Registration in NGI will be limited to one registration per latent print. If multiple searches are conducted, the search parameters in which the examiner feels most confident will be used for the registration.

C. Latent prints searched as exceptions to the above Technical Biometric Database Requirements may be registered in the ABIS unsolved latent database and/or the NGI ULF at the discretion of the examiner.

D. Required Documentation
   1. Prints registered in ABIS and/or NGI will be documented utilizing the check boxes in the Database Search Results Panel in the LIMS.
   2. The "Unidentified Latent Registered" remark will be added to the report when at least one print is registered in a database. The remark is found in LIMS under the Latent Print Remarks panel. It can be slightly modified to correct for singular or plural usage.

IX. DELETION OF LATENT PRINTS FROM BIOMETRIC DATABASES

A. In this section, the term "deletion" refers to removing registered prints from an unsolved latent database.

B. Specific latent prints will be deleted in the following circumstances:
   1. When database processing results in one or more registered latent prints being identified.
   2. Upon request by the submitting agency.
   3. After the applicable Statue of Limitations has expired (automatic deletion).
   4. When an excessive number of T/LI or ULM candidates is generated over a 30-day period as a result of the latent print containing a common minutiae area.
      a. Examiners must obtain the approval of the laboratory director or an appropriate supervisor before a print is removed due to excessive T/LI or ULM candidates.

b. Examiners will perform and document database searches of all prints that are removed under this provision at least quarterly.

B. Required Documentation
   1. When a case examiner deletes prints from a database, the deletion will be documented utilizing the check boxes in the Database Search Results Panel in the LIMS.

X. SPECIAL CIRCUMSTANCES

A. Unknown Deceased Searches
   1. When available, two or more of the highest quality standards from the deceased subject will be prepared for database processing.
   2. All database searches and any identifications will follow the above guidelines.

B. Out of State Agency Requests for Illinois ABIS Searches
   1. Must adhere to policy as written in CD TCH 5.
   2. Latent prints must meet the same technical requirements as above.
   3. Elimination work and a search of the submitting agency's system is assumed.
   4. Latents may be registered in the ABIS unsolved latent database at the request of the submitting agency or at the examiner's discretion.

ILLINOIS STATE POLICE

LATENT PRINTS PROCEDURES MANUAL

APPENDIX VI: CLEAN TECHNIQUE PROCEDURE FOR NON-DNA PERSONNEL

Reviewed by:

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Forensic Scientist Katharine Mayland, Chairperson
Latent Prints Command Advisory Board

Approved by:

_____

Brian Mayland
Patterned Evidence Program Manager

APPENDIX VI

CLEAN TECHNIQUE PROCEDURE FOR NON-DNA PERSONNEL

INTRODUCTION

To minimize contact by analysts in other disciplines with potential DNA evidence, agencies will be required to inform the laboratory at the time of submission of the case if the case requires DNA analysis. This Clean Technique Procedure must be followed by any forensic scientist or evidence technician when handling evidence that has been designated for DNA analysis, but the evidence has not yet been to the DNA section for analysis. This situation will occur routinely due to things such as safety issues (like clearing a firearm) or preservation of evidence (micro/trace evidence critical as in EVH26). Good communication with the submitting agency should help ensure that evidence needing DNA analysis goes to the DNA section first, so that non-routine situations requiring non-DNA scientists to handle DNA evidence is minimal (per TCH21). If, however, you open an Item which did not have a reasonable potential for DNA evidence and you see a potential body fluid stain that could be significant, immediately stop work and contact a DNA analyst for advice and assistance.

1. The analyst must wear a mask, lab coat with disposable sleeve covers or disposable lab coat and gloves while examining any potential DNA evidence.

   A. The gloves must either be sterile or the gloves must be bleached and then dried with a paper towel after the gloves are put on. Gloves must be changed between Items. Gloves must also be changed after handling non-evidence items prior to returning to casework. These non-evidence items may include but are not limited to, refrigerators/freezers, biohazard waste bins, equipment, computers and telephones. Gloves should be changed following common sense and clean technique.

   B. The face mask must be worn over the nose and mouth to prevent the transfer of aerosols from both the nose and mouth of the analyst to the evidence. Whenever the mask is removed from the face it must be disposed of and a new mask used. For example, if an analyst removes the mask to talk on the phone, the mask must be disposed of, not hung around the neck or placed on the counter and reused.

   C. Lab coats must be fully buttoned or snapped.

2. First decontaminate the surface on which samples are to be processed with a 10% bleach solution. Wet the surface (counter top, lab bench, etc.) that will be utilized to examine evidence thoroughly with 10% bleach solution. Spread the 10% bleach across entire surface with a paper

towel. Ensure surface is dry before examining evidence. Don't store bleach solutions in open containers. Replace the bleach solution daily with a fresh bleach solution.

3. All instruments which will be used to process forensic samples (e.g., forceps, scissors, scalpel/razor blades, pipetters and metal probes) must be decontaminated by autoclaving or rinsing with a 10% bleach solution. Caution: some surfaces may resist wetting and will require addition of a detergent. In addition, these items may also be placed under an ultraviolet light source for at least 15 minutes. Note: UV light will not destroy DNA on surfaces that are not directly exposed to the light.

4. Place evidence samples in clean containers or on clean surfaces for processing. Large glassine weighing papers are suggested.

5. Use a 10% bleach solution to rinse or wipe instruments between samples. Instruments may be rinsed with distilled water. After rinsing with a 10% bleach solution, use kimwipes to wipe the instrument. Use a new kimwipe each time.

f. Items will be processed one at a time. Put away the previous Item before opening the next Item. Clean instruments and fresh paper must be used for each Item.

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LATENT PRINTS PROCEDURES MANUAL

APPENDIX VIII: MINIMUM DIGITAL IMAGING STANDARDS AND CONTROLS

Reviewed by:

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Forensic Scientist Jamie Lynn Edwards, Chairperson
Latent Prints Command Advisory Board

Approved by:

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Kellen Hunter
Acting Patterned Evidence Program Manager

MINIMUM DIGITAL IMAGING STANDARDS & CONTROLS

I. Category One Images – Images made for documentation purposes that will not be used for future scientific analysis, including record shots.

A. File formats are not restricted for Category One images.
    1. Compression is allowed provided the necessary image quality is achieved.
B. Category One images may have a resolution of less than 1000 ppi.

II. Category Two Images – Images from which scientific analysis will be conducted.

A. Any uncompressed or lossless file formats are acceptable, including TIFF, BMP, PNG, and the proprietary language of the camera (raw format).
B. Category Two images must be at a minimum resolution of 1000 ppi.
    1. Known standards downloaded from an ABIS or NGI repository may be at their original resolution of 500 ppi or higher.
    2. Any deviation from this minimum criterion shall be documented on a case-by-case basis.
    3. Compression is not allowed.

III. Original Image Requirements

A. Original Images must be acquired into the Illinois State Police Foray Authenticated Digital Asset Management System (ADAMS).
B. The original image must include a scale or be associated with a scale shot. Specific scale requirements for original images can be found in the Latent Prints Procedures Manual, Appendix II, Minimum Standards & Controls.

IV. Processed Image Requirements

A. Image processing and annotating will be performed in Photoshop on a working copy of the image through the Illinois State Police Foray ADAMS.
    1. If needed, the image must be calibrated in Photoshop. Images may not be calibrated using the Foray calibration tool.
    2. Steps used in processing of the image shall be documented in the metadata of the image.

3. All processed images depicting a suitable latent impression must be associated with the case number, item number, suitable impression designation, date of image capture, and examiner identification. The suitable impression designation may:
    a. Appear visually in the image.
    b. Appear in a text layer of the image.
    c. Appear in the asset name.
4. All processed images that do not contain suitable latent impressions or that have not been analyzed for suitability must be associated with the case number, item number, date of image capture, and examiner identification. This information may:
    a. Appear visually in the image.
    b. Appear in the asset name.
    c. Be embedded in the file name or digital data of the image.

V. Digital Image Naming Requirements

A. Digital images that have been annotated and are going to be exported for entry into the LIMS must be named in the following format:

1. Images depicting a latent print annotated for analysis:
    a. Latent Designator, Analysis
    Example: 1-1-1 Analysis
2. Images depicting a latent print annotated for comparison:
    a. Latent Designator, Comparison
    Example: 1-1-1 Comparison
3. Images depicting a standard identified to a latent print that has been annotated for comparison:
    a. Latent Designator to which the standard was identified, Standard
    Example: 1-1-1 Standard

VI. Image Retention

A. Analysts shall retain all images taken in the laboratory on the secure server.

B. Images submitted by an agency that are uploaded on the secure server shall be retained.

C. If images retained on the secure server are rejected, the rejection shall be documented according to the requirements in the Latent Prints Procedures Manual

LP-APP-II, Minimum Standards & Controls, Data Rejection.

REFERENCES

1. Scientific Working Group on Imaging Technology (SWGIT). Section 5 – "Guidelines for Image Processing", Version 2.1 2010.01.15.

2. SWGIT. Section 11 – "Best Practices for Documenting Image Enhancement", Version 1.3 2010.01.15.

3. Scientific Working Group on Friction Ridge Analysis, Study and Technology (SWGFAST). "Standard for Friction Ridge Digital Imaging (Latent/Tenprint)", Version 2.0.

4. International Association for Identification (IAI). Resolution 97-9, Recognizes that electronic/digital imaging is a scientifically valid and proven technology. 1997.

5. Witzke, David. "Advanced Forensic Digital Imaging Processing", Foray Technologies. 2010. On-line User Manual version 2.0 Foray Technologies' Authenticated Digital Asset Management System (ADAMS). 2008.

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APPENDIX IX: PROCESSING GUIDE

Reviewed by:

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Latent Prints Command Advisory Board

Approved by:

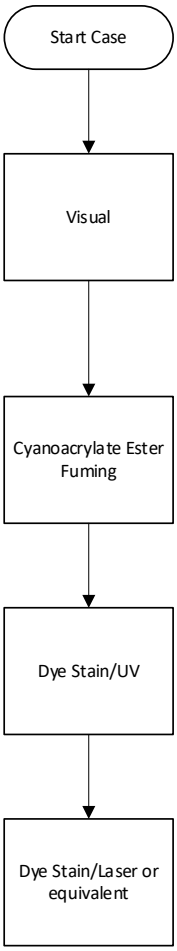
Brian Mayland
Patterned Evidence Program Manager

Processing Guide

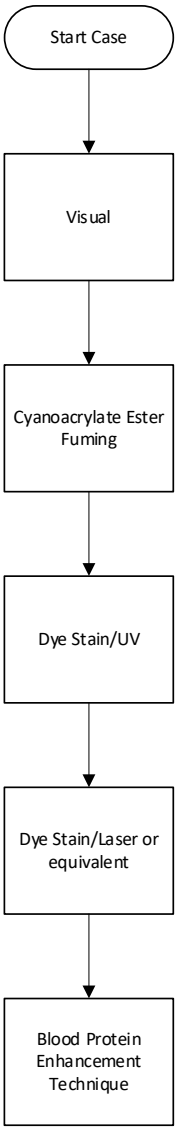
The following pages of this appendix contain charts outlining the general work flow for processing evidence. No single technique for recovering latent prints has universal application under all circumstances. Many factors other than the nature of the surface to be examined must also be considered when determining the best technique to use on a specific item of evidence. The procedures mentioned in this document are designed to accommodate the majority of the evidence encountered. Specialized processing techniques for specific types of evidence not covered in this document can be found in the appropriate sections of the Procedures Manual.

Examiners must indicate any deviations from the workflows listed in this appendix in their notes.

Latent Prints Processing
Non-Porous

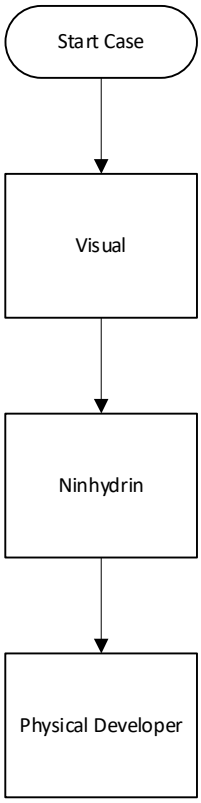


Latent Prints Processing
Blood (Non-Porous)

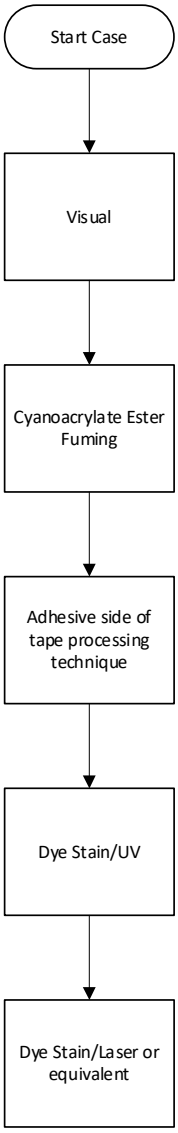


*Case-specific circumstances will determine the order in which the above processed are performed. Powder is considered a routine procedure and may be used at the examiner's discretion.

Latent Prints Processing
Porous with or without Blood



Latent Prints Processing
Tape



*Case-specific circumstances will determine the order in which the above processes are performed. Powder is considered a routine procedure and may be used at the examiner's discretion.

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APPENDIX X: DEFERRAL POLICIES

Reviewed by:

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_____
Brian Mayland
Patterned Evidence Program Manager

Deferral Policies

This appendix contains a chart outlining the available deferral policies for casework. These deferral policies are designed to accommodate the majority of cases; however, case-specific circumstances will dictate whether or not the use of any deferral policy is appropriate and may result in variations in their application.