A. Purpose:

To list approved chemicals, reagents, powders and guidelines for their use.

B. Responsibility:

Latent Print Examiners

C. Safety:

1. When using chemicals, reagents and powders; lab coats, masks and gloves will be worn. Other items such as sleeves or splash protectors will be worn as needed based on case and/or personal protection requirements.
2. Eye protection will be worn whenever there is a possibility of injury to the eyes.
3. Fume Hoods and Down Flow Workstations will be utilized whenever possible.

D. Procedure:

The following reagents and powders are approved for use by the latent print section. Whenever possible premixed solutions or premixed kits will be purchased. Chemical formulas are listed for reagents that may be prepared at this laboratory. Any new reagents or chemicals not listed in this document will first be validated after conferring with the laboratory's quality control manager. Although general guidelines are available for the application of various powders, chemicals and reagents, it is ultimately the responsibility of the examiner to determine the best possible application or sequential applications of various techniques based on previous experience and training.

Guidelines For The Application Of Powders, Chemicals, And Reagents

Porous

- Visual Examination
- ALS (to be utilized sequentially as determined appropriate)
- Iodine
- DFO or Indandione
- Ninhydrin ***(examiner may go directly to this step after visual examination and stop)***
- Oil Red O
- Physical Developer

Non-porous

- Visual Examination
- ALS (to be utilized sequentially as determined appropriate)
- Cyanoacrylate Fuming or Powder ***(examiner may stop at this step)***
- Dye Staining
- Powder

Blood Stained-Porous

- Visual Examination
- ALS (to be utilized sequentially as determined appropriate)
- Ninhydrin / LCV / Amido Black ***(examiner may stop at this step)***
- Physical Developer

Blood Stained Non-Porous

- Visual Examination
- ALS (to be utilized sequentially as determined appropriate)

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- LCV / Amido Black / Acid Fuchsin / Fluorescein ***(examiner may stop at this step)***
- Cyanoacrylate Fuming
- Dye Staining
- Powder

Cardboard (non-glossy)

- Visual Examination
- ALS (to be utilized sequentially as determined appropriate)
- Ninhydrin ***(examiner may stop at this step)***
- Silver Nitrate

Rubber Gloves (special circumstance processing only)

- Visual Examination
- ALS (to be utilized sequentially as determined appropriate)
- Wetwop -or- Cyanoacrylate ***(examiner may stop at this step)***
- Magnetic Powder
- Dye Stain
- Ninhydrin
- Physical Developer

Tape Non-Adhesive Side (protect adhesive side prior to processing ie clean acetate)

- Visual Examination
- ALS (to be utilized sequentially as determined appropriate)
- Cyanoacrylate Fuming ***(examiner may stop at this step)***
- Dye Staining
- Powder

Adhesive Surfaces

- Wet Powder Processing –or– Gentian Violet ***(examiner may stop at this step)***

– OR –

- Cyanoacrylate
- Dye Stain

Glossy Paper

- Visual Examination
- ALS (to be utilized sequentially as determined appropriate)
- Cyanoacrylate Fuming ***(examiner may stop at this step)***
- Powder
- Ninhydrin
- Dye Stain

D. Authorized Powders, Chemicals and Reagents:

Fingerprint Powders:

Many types of powders are available for the development of latent prints. Powders will combine or adhere to friction ridge residue which can be of natural or foreign substances. Powders are available for both conventional and alternate light source documentation. Magnetic powders offer an advantage for processing porous materials such as paper. The following powders may be utilized by the latent print section; however this list is not all inclusive or limiting:

Standard Powders such as but not limited to: White, Gray or Black

Magnetic Powders

Bi Chromatic Powders

Fluorescent Powders

Chemicals & Reagents:

Amido Black (Aqueous & Methanolic) [blood]

Aqueous Amido Black solution can be used to enhance or develop friction ridge detail matrices containing blood. (Premixed rinse/destains may also be used.)

Procedure Of Application

1. Be certain that the blood is 'dried' prior to application.

2. Squirt, Spray bottle or Tray application - Apply Amido Black solution for 30 to 90 seconds

3. For Methanolic based formula only: Apply rinse solution for approximately 1 minute.

4. Apply a final distilled water rinse

5. Allow the item to air dry.

Cont. next page.

6. Forced air or blot dry.

7. Photograph any latent prints of value.

Rinse Solution Formula for Methanolic Solution

1. Combine the following:
   100ml Glacial Acetic Acid
   900ml Methanol

2. Final rinse of distilled water

Ardrox [CA dye stain]

Ardrox is a fluorescent liquid dye used to enhance the visualization of friction ridge detail which was processed with superglue fuming. ALS settings: 365nm, 450-480nm utilizing the best contrasting barrier filter.

Procedure Of Application

1. Tray immersion or squirt or spray bottle for 5 seconds.

2. Water rinse – using Squirt bottle or gently running stream of tap water for 10 seconds.

3. View under an Ultra-violet lamp 365nm range or Forensic Light Source in the 435 nm to 480 nm range.

4. Photograph latent prints of value using an appropriate filter.

Basic Yellow [CA dye stain]

Basic Yellow dye is designed to enhance latent fingerprints developed with cyanoacrylate on non-fluorescent, multi-colored surfaces. Prints fluoresce bright yellow/green between 365nm and 485nm with an alternate light source or a UV light.

Procedure Of Application

1. Tray immersion or spray to cover item for at least 5 seconds.

2. Water Rinse - Squirt bottle application or gently running stream for 10 seconds

3. View under an Ultra-Violet lamp 365 nm a Forensic Light Source in the 450 nm to 485 nm range.
4. Photograph with appropriate filter.

CyanoBlue [CA dye stain]

CyanoBlue is a non-flammable, water-based cyanoacrylate dye which bonds rapidly to cyanoacrylate fumed latent prints, providing a highly bright fluorescence. CyanoBlue works immediately upon contact with the print and does not require long-term exposure

Procedure Of Application

1. Tray immersion or spray to cover item for at least 5 seconds.

2. Water Rinse - Squirt bottle application or gently running stream for 10 seconds

3. View under an Ultra-Violet lamp 365 nm a Forensic Light Source in the 450 nm to 485 nm range.

4. Photograph latent prints of value ***Cont. next page.***

using an appropriate filter.

Crystal Violet [adhesives / oil]

Crystal Violet is a staining process using a water-based working solution. Used for non-porous evidence and the adhesive side of tape. The evidence is repeatedly stained and rinsed until optimum development occurs. The working solution may also be applied by brushing. Enhanced detail may be observed under a forensic light source at 505nm to 570nm using red viewing goggles.

Crystal Violet (Gentian Violet) Formula (A):

Stock Solution

1.5gm Crystal Violet
100ml Ethyl Alcohol

Working Solution

2ml Stock Solution
100ml Distilled Water

Crystal Violet (Gentian Violet) Formula (B):

Stock Solution

5gm Crystal Violet
10gm Phenol (caution hazardous)
50ml Ethyl Alcohol

Working Solution

1ml Stock Solution

Add distilled water constantly swirling the mixture until the gold film on the surface disappears.

Procedure Of Application

1. Pass the item through a Tray containing the reagent solution for 1 to 2 minutes.

Cont. next page.

2. Cold tap water rinse - 30 seconds.

3. Photograph latent prints of value.

Cyanoacrylate (see Superglue)

DFO [amino acid]

Reacts to amino acids present in latent print residue on porous surfaces. A fluorescence of the prints is obtained after baking the item in an oven at 50 to 100 degrees C (120 to 212F), then viewing under a forensic light source. A hair dryer or a DRY steam iron may be substituted for a baking oven, if necessary. Do not allow steam to contact the item. Strict control of the humidity is not required. View the item at 500 nm to 590 nm using red colored goggles to reduce background fluorescence, if necessary.

Procedure Of Application

1. Submerge or spray the item - 5 seconds.

2. Air-dry the item in a fume hood.

3. Process the item a second time &
   Air-dry the item in a fume hood.

4. Oven bake or hair dryer @ 120 to 212 degrees F
   for 10 to 20 minutes.

5. View under a forensic light source
   at 495 nm to 550 nm. Absorption Max
   is 514 nm.

6. Photograph latent prints of value
   using an appropriate filter.

Fluorescein [blood]

Fluorescein is a chemical mixture that causes a catalytic reaction to occur between the hemoglobin in blood and oxygen. The reaction results in a fluorescence that is visible under UV light.

Cont. next page.

Procedure Of Application

1. Spray suspect area with mixed reagent (A+B). Allow to Dry

2. Spray suspect area with part (C). Allow to Dry

3. View under UV Light (365nm) or ALS at around 450nm with orange or yellow filter.

4. Photograph latent prints of value using an appropriate filter.

Gentian Violet [adhesives / oil]

See crystal violet.

Iodine [grease / fats]

The iodine fuming method is used on surfaces that are generally impractical for dusting with fingerprint powder. On greasy surfaces the iodine fumes may be absorbed at different rates by different fatty or oily residues, and the latent impressions may be visible. Most paper surfaces, and especially hard smooth surfaces, may show high quality latent prints when fumed with iodine.

Procedure Of Application

1. Prepare the photographic set-up by pre-setting camera lighting, aperture and shutter speed.

2. Pass the fumes over the surface to be examined. Utilize container or pipette method.

   Note: Low temperature heat is required to sublimate the

Cont. next page.

iodine crystals into fumes.

3. Photograph any latent prints of value ***immediately***.

LCV (Leuco-Crystal Violet) [blood]

LCV is used to enhance blood through the catalytic oxidation of the dye, while simultaneously fixing and enhancing the blood impression. Other blood enhancement techniques such as Amido Black may be applied after this technique.

Procedure Of Application

1. Spray the blood impression or suspected using a fine-mist sprayer.

   Development should occur in 30 seconds.

2. Photograph latent prints of value.

Liqui-Drox [CA dye stain]

Liqui Drox is effective for dark-colored adhesive tapes, the Liqui-Drox method is a post-cyanoacrylate process involving brushing the reagent unto tape, rinsing, then viewing the result under long-wave ultra-violet light. This reagent is composed of a mixture of a fluorescent agent, a detergent and water. Liqui-Drox is prepared in the laboratory. See formula below:

Liqui-Drox Formula**:**

200 ml Ardrox P-133D
400 ml Liqui-Nox
400 ml distilled water

Combine and stir the chemicals thoroughly. A thick milky-yellow solution should result.

Cont. next page.

Procedure Of Application

1. Using a camel hair brush, apply the reagent onto both sides of the tape until a lather is produced.
2. Wait approximately 10 seconds.
3. Rinse under a gentle stream of cold tap water.
4. Allow the tape to air dry.
5. View under a Forensic Light Source or Ultra-Violet lamp able to produce a long-wave ultra-violet light output.
6. Photograph latent prints of value using an appropriate filter.

MBD 7-(PMethoxybenzlamino-4Nitrobenz-2-Oxa-1,3-Diazile) [CA dye stain]

MBD is a yellow fluorescent dye stain used to enhance the visualization of friction ridge detail which was processed with superglue fuming. ALS settings: Various wavelengths utilizing the best contrasting barrier filter.

PROCEDURE OF APPLICATION

1. Spray, immerse or use a squirt bottle to apply the M.B.D. solution to the item.
2. View under a Forensic Light Source: Absorption Max is should be around 450 nm.
3. Photograph latent prints of value using an appropriate filter.

Ninhydrin [amino acid]

Ninhydrin is a reagent for developing prints on porous materials like paper and cloth by reacting with amino acids contained in latent print residue. Various pre-mixtures are available including "HFE 7100" and "Thermal".

Ninhydrin Formula:

FORMULA #1:

12.5g Ninhydrin crystals
dissolved in 1L alcohol solvent.

FORMULA #2:

Use a magnetic stirring device.

5 g ninhydrin crystals
dissolve in 30 ml Methanol
add - 40 ml 2-Propanol
add - 930 ml Petroleum ether.

Procedure Of Application

1. a) Tray immersion of item
   - 5 seconds
   b) Brush solution onto item
   - until coated.
   c) Spray solution onto item
   - until coated.
2. Warning: Do not use heat or steam for Thermal Ninhydrin applications.

   Heat up to 80 degrees C
   & humidity exposure
   60% - 70% relative humidity.
   Monitor for development, or use
   a steam iron.

3. Photograph the developed detail using a green colored filter.

4. View under Forensic Light Source Generally at 450-590nm.

5. Photograph latent prints of value ***Cont. next page.***

using an appropriate filter.

Ninhydrin Analogs [amino acid]

Indanedione does not produce strong-colored prints. They are typically pale pink in color, but prints do fluoresce strongly when examined by an alternate light source. Prints developed with 1,2-indanedione will fluoresce under green light (optimum about 530 nm), similar to DFO. Optimum viewing and photographing is done with dark orange glasses/filters (cut on point 570-590 nm). This technique is may prove more successful on multicolored porous materials.

Procedure Of Application

1. Dip, spray or wash the item in the reagent.

2. Air-dry the item (3 minutes).

3. Oven bake at 100 degrees C for 10 - 20 minutes at 60% relative humidity or with no added humidity.

4. View under a forensic light source:

   For most papers ......
   View @ 515 nm (green light)
   with orange barrier filter.

   For manila, brown paper bags, cardboard items & craft paper ....
   View @ 515 - 570 nm with orange or red barrier filters.

5. Photograph latent prints of value using an appropriate filter.

Oil Red O [lipids]

A lipid-specific dye stain technique for use on porous items; and porous items which have become wet. Oil Red O may be used after ninhydrin processed items or in lieu of, or as a precursor to, Physical Developer.

Procedure Of Application

1. Immerse the item in stain solution and soak completely. It is optional to agitate the solution on a shaker platform.

   - Ridge detail should begin to develop in 5 min.
   - Weak fingerprints (poor lipidic content) may require 60 to 90 minutes of development time.

2. Remove & drain item - immerse in the buffer solution.

3. Remove item from buffer solution - rinse in distilled water.

4. Dry item at room temperature - or heat in an oven at 50 degrees C or use a hair dryer.

5. Photograph latent prints of value.

Physical Developer [lipids]

Physical Developer is a silver-based liquid reagent which reacts with lipids, fats, oils and waxes present in fingerprint residue. Paper items should be treated with Ninhydrin, and then Physical Developer.

Procedure Of Application

1. Maleic Acid Pre-wash for 10 min

2. Working solution (20 minutes)

3. Rinse (5 minutes) w/Appropriate Solution

4. Rinse (5 minutes) w/Appropriate Solution ***Cont. next page.***

5. Photograph latent prints of value.

RAM (Rhodamine 6G, Ardrox, MBD) [CA dye stain]

RAM is a combination of Rhodamine 6G, Ardrox and MBD. It is a fluorescent liquid dye used to enhance the visualization of friction ridge detail which was processed with superglue fuming. ALS settings: Various wavelengths utilizing the best contrasting barrier filter.

Procedure Of Application

1. Spray, dip, or use a squirt bottle to apply R.A.M. to the item.
2. Examination under a UV light 365nm or Forensic Light Source at 415-530 nm.
3. Photograph latent prints of value using an appropriate filter.

RAY (Rhodamine 6G, Ardrox, Basic Yellow) [CA dye stain]

RAY is a combination of Rhodamine 6G, Ardrox and Basic Yellow. It is a fluorescent liquid dye used to enhance the visualization of friction ridge detail which was processed with superglue fuming. ALS settings: 450-550nm utilizing the best contrasting barrier filter.

Procedure Of Application

1. Spray, dip, or use a squirt bottle to apply R.A.Y.
2. Examination under a laser or Forensic Light Source at 450 nm to 550 nm.
3. Photograph latent prints of value using an appropriate filter.

Rhodamine 6G [CA dye stain]

Rhodamine 6G is a fluorescent liquid dye used to enhance the visualization of friction ridge detail which was processed with superglue fuming. ALS settings: 495-540nm utilizing the best contrasting barrier filter (generally orange or red).

Procedure Of Application

1. Spray, dip, or use a squirt bottle to apply the Rhodamine solution to the item.

2. Allow the item to air dry.

3. Examination under a laser or Forensic Light Source at 495 nm to 540 nm. Absorption Max is at 525 nm. Use orange or red colored goggles.

4. Photograph latent prints of value using an appropriate filter.

Silver Nitrate [Salts]

Silver Nitrate is typically used on porous materials after Ninhydrin processing to produce a dark brown color. Silver Nitrate reacts to the chlorides present in latent prints, and requires exposure to sunlight or ultraviolet light in order to develop.

Procedure Of Application

1a. Tray immersion of item for 5 seconds.

1b. Reagent solution brushed onto item until coated.

2. Air dry for 20 minutes.

3. Expose item to Sunlight or U.V. Light 365 nm for ten to sixty minutes.

4. Continuously monitor for development. ***Cont. next page.***

5. Photograph latent prints of value.

Wet Powders [adhesives surfaces]

Wet powders are applied to adhesive surfaces to develop latent impressions.

Procedure Of Application

1. With a camel hair style brush apply wet powder to the adhesive surface side of item being processed.

2. Rinse under mild stream of tepid to cool tap water.

3. Allow item to dry (adhesive side up).

4. Photograph latent prints of value.

Small Particle Reagent [wet surfaces / oil / fats]

Small Particle Reagent (SPR) is also known as Molybdenum Disulfide (MoS2). Small Particle Reagent is composed of finely ground particles suspended in a detergent solution. These particles adhere to the fatty constituents of latent fingerprints to form a visible deposit. Small Particle Reagent is typically used to develop latent prints on wet surfaces, such as vehicles wet with rain or recovered from bodies of water. Latent prints developed using this method may be lifted using standard lifting mediums.

Procedure Of Application

1a. Tray Immersion Method:
keep Stationary for 1 minute.

- or -

1b. Spray Bottle Method:
Shake well and apply.
Repeat as necessary to keep

Cont. next page.

wet for about 1 minute.

2a. Tray Immersion Method:
Rinse excess reagent in
tap water for 15 seconds.

- or -

2b. Spray Bottle Method:
Rinse under running tap
water for 15 seconds.

3. Allow the item to dry
at room temperature.

4. Photograph latent prints of value

5. Lifts may be taken after latent prints
of value are photographed.

Sudan Black [grease / wax]

Sudan Black is best used for processing smooth or rough non-porous surfaces contaminated with greasy or sticky substances. Works best on greasy or waxy non-porous surfaces such as glass, metal, milk cartons, interiors of gloves, and candles.

Procedure Of Application

1. Immerse in Working solution
for 2 minutes.

2. Cold Tap water rinse -
remove excess dye.

3. Dry item at room temperature.

4. Photograph latent prints of value.

Superglue (cyanoacrylate) [hard non-porous surfaces]

Superglue vapor polymerizes with friction ridge residue to form a white deposit which will visualize a latent print. The superglue technique is most effective on non-porous materials.

Procedure Of Application

1. Place item(s) into enclosed chamber.

2. Add glue to cover bottom of aluminum dish or other dispersion source.

3. Humidify w/cup of warm water (except under vacuum)

4a. For Small Chamber
Fume at least 10 minutes,
Monitor often for development.

4b. For Automated Chambers follow manufacturer's instructions.

5. Photograph latent prints of value.

6. Continue processing with powder or Dye-stain if necessary.

Zinc Chloride [ninhydrin treatment]

Zinc chloride is applied as post-ninhydrin , post 1,2-Indandione & post 5-MTN treatments in order to improve the strength of the fluorescence of the ridge detail for viewing and photography. View @ 515 - 570 nm with orange or red 600(BP 35) barrier filters.

Zinc Chloride Formula #1:

30 g Zinc chloride dissolved in
500 ml methyl-tert-butylether (MTBE)
20 ml of anhydrous Ethanol.

Use magnetic stirrer until completely dissolved. Dissolution may be slow.
Add 10 ml Glacial acetic acid.
Dilute with 500 ml Petroleum ether.

Cont. next page.

Zinc Chloride Formula #2:

*** ZINC CHLORIDE **STOCK SOLUTION** ***

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

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

*** ZINC CHLORIDE **WORKING SOLUTION** ***

6 ml Zinc chloride stock solution
100 ml Petroleum ether or Pentane or Heptane
(cont. next page)

Procedure Of Application

1. Spray the item lightly.
2. Air-dry the item.
3. Process & dry a second time.
4. Oven bake at 80-100 degrees C at 65% humidity for 40 minutes.
5. View under a forensic light source around 490nm to 515nm.
6. Photograph latent prints of value using an appropriate filter.

E. References:

1. **FBI Latent Print Operations Manual**
2. **Home Office Handbook of Fingerprint Development Techniques**
3. **http://www.cbdiai.org/Reagents/main.html**
4. **Ron Smith & Associates Appendix B - Approved Processing Methods 6/11/13 Rev.7**