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 should 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:

Although general guidelines are available in this SOP 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, training and type of evidence being examined.

The following reagents and powders are approved for use by the latent print section (see Appendix 1). Whenever possible premixed solutions or premixed kits will be purchased. When an examiner needs guidance as to the application of development techniques or the preparation of chemicals not purchased as premixed, the "Guidelines for the Application of Powders, Chemicals and Reagents" in Appendix 2 should be referenced.

If a chemical/reagent will be made at the Laboratory, the examiner should refer to the appropriate "Formula" information in Appendix 1 of this SOP.

Any new reagents or chemicals not listed in this document will first be validated after conferring with the Deputy Director of Identification Services and/or the Quality Manager.

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**

APPENDIX 1

Authorized Powders, Chemicals, Reagents & Formulas

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:

Adhesive Releaser:

The following methods may be used to break an adhesive bond to a substrate. These methods will not work with adhesive-to-adhesive bonds.

1. Liquid Nitrogen

This method is highly successful in separating duct tape through liquid nitrogen emersion. The item is quickly emersed in liquid nitrogen and the two different substrates are gently pulled apart.

2. Solvent Based Fluids (e.g. Undue or similar product)

Solvent based products such as undue are successful in removing labels and stamps. The label or stamp is moistened with a few drops of the solvent, this can be above or to the

underside of the adhesive bond. The label or stamp is gently removed in most cases with sterile tweezers.

3. Hair Dryer (warm air/heat method)

This method is also successful in removing larger labels where solvents may not be practical. Heat is applied to the corner a label or stamp; it is gently pulled up from one of its corners and progressively removed as heat is applied.

Acid Fuchsin/Hungarian Red (Aqueous & Water-based) [blood]

Acid Fuchsin is a water-based staining solution for traces in blood. It has a number of advantages compared to other staining solutions. It is safe (water-based), stains well, and can be lifted with a white gelatin lifter. A special characteristic of Hungarian Red is that the lifted traces fluoresce under green light, making it possible to visualize weak traces, even when they are present on a dark surface.

Guidelines for Application

1. The surface needed to be "fixed" with a solution of sulfacylic acid.
2. Once "fixed", stain with acid fuchsin/Hungarian Red
3. Stain is rinsed off after approximately 3-5 minutes with water.
4. Prints may be lifted with a gel lifter and recorded using an ALS (515-560nm) and a red filter on the camera lens.

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.) This chemical is stored at room temperature.

Guidelines for 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.
6. Forced air or blot dry.
7. Photograph any latent prints of value.

Developer & Rinse Solution Formula for Methanolic Solution

DEVELOPER SOLUTION:
1 2g Amido black dye
2 100 ml Glacial acetic acid
3 900 ml Methanol
4 (Combine and mix with a stirring device for 30 minutes.)

RINSE SOLUTION:
1 100 ml Glacial acetic acid
2 900 ml Methanol

FINAL RINSE:
1 use distilled water

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. This chemical is stored at room temperature.

Guidelines for 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.

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 range using red viewing goggles. This chemical is stored at room temperature.

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.

Guidelines for Application

1. Tray immersion for 1 to 2 minutes.
2. Cold tap water rinse - 30 seconds.
3. Photograph latent prints of value.

Cyanoacrylate (see Superglue)

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. This chemical is stored at room temperature.

Guidelines for 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 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. This chemical is stored at room temperature.

Guidelines for 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.

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. This chemical is stored at room temperature.

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.

Guidelines for 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 or use no heat or humidity
and wait up to 72hrs for development.

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

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

5. Photograph latent prints 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 range).. Optimum viewing and photographing is done with dark orange glasses/filters (cut on point 570-590 nm range). This technique is may prove more successful on multicolored porous materials. This chemical is stored at room temperature.

Guidelines for 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 additional humidity added.

4. View under a forensic light source:

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

For manila, brown paper bags,
cardboard items & craft paper ....

View @ 515 - 570 nm range 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. This chemical is stored at room temperature.

Guidelines for Application

1. Tray immersion 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. This chemical is stored at room temperature.

Guidelines for Application

1. Maleic Acid Pre-wash for 10 min
2. Working solution
   (approximately 20 minutes)
3. Rinse (5 minutes) w/Appropriate Solution
4. Rinse (5 minutes) w/Appropriate Solution
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. This chemical is stored at room temperature.

Guidelines for Application

1. Spray, dip, or use a squirt bottle
   to apply R.A.M. to the item then rinse w/water.
2. Examination under a UV light 365nm
   or Forensic Light Source at 415-530 nm range.
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 range utilizing the best contrasting barrier filter. This chemical is stored at room temperature.

Guidelines for Application

1. Spray, dip, or use a squirt bottle to apply R.A.Y. then rinse w/water.

2. Examination under a laser or Forensic Light Source at 450 nm to 550 nm range.

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

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. This chemical is stored at room temperature.

Guidelines for Application

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

- or -

1b. Spray Bottle Method: Shake well and apply. Repeat as necessary to keep 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. This chemical is stored at room temperature.

Guidelines for Application

1. Tray immersion 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. Superglue can be stored at room temperature, refrigeration may be used to extend the usable viscosity of the liquid cyanoacrylate.

Guidelines for Application

1. Place item(s) into enclosed chamber.

2. Add glue to cover bottom of aluminum dish or other dispersion source. Glue may be heated to accelerate development.

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

4a. For Small Chamber
Fume at least 10 minutes or
until ridge development occurs,
monitor for development.

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

4c. For processing under vacuum
run vacuum pump for approx. 1min 30sec
and vapor is visible from pump exhaust portal.
Fume under vacuum for at least 30 minutes.

5. Photograph latent prints of value.

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

Wet Powders [adhesives surfaces]

Wet powders are applied to adhesive surfaces to develop latent impressions. This chemical is stored at room temperature.

Guidelines for 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.

APPENDIX 2

Guidelines For The Application Of Powders, Chemicals, And Reagents

Note: Below are the recommended processing sequences for various types of substrates. The case examiner has the final discretion to determine the best possible application or sequential processing techniques based on the evidence and the background substrate (*e.g. a fluorescent paper may not be suitable to be processed with indandione prior to ninhydrin*). If the examiner determines that an application or alternate sequence is the best due to the evidence type, they will review this with the Unit Supervisor prior to proceeding. The analyst will document the change and reason for the alternate sequence or different application. The Unit Supervisor will initial and date the note written by the analyst regarding the alternate sequence or application.

All substrates will start with a visual examination, analysis may stop at this point dependent on the condition of the item to be viewed.

The below guidance does not require all the listed chemicals to be used but rather indicates the best sequence. The steps do not need to be completely followed in sequence to the end. Analysis may be stopped upon development of ridge detail.

Porous (such as paper, unfinished wood, uncoated cardboard[1], etc)

- Visual Examination
- ALS or AARI (to be utilized sequentially as determined appropriate)
- Iodine (as determined appropriate)
- Indanedione
- Ninhydrin
- Oil Red O (optional)
- Physical Developer (optional)

Notes:

[1] Use of AARI Ridge Detection/AI Regions of Interest may not be suitable for glossy paper or cardboard

Non-porous (glass, metal, etc)

- Visual Examination
- ALS (to be utilized sequentially as determined appropriate)
- Cyanoacrylate Fuming or Powder
- Dye Staining
- Powder

Blood Stained-Porous

- Visual Examination
- ALS (to be utilized sequentially as determined appropriate)
- Ninhydrin or LCV or Amido Black
- Physical Developer (optional)

Blood Stained Non-Porous

- Visual Examination
- ALS (to be utilized sequentially as determined appropriate)
- LCV or Amido Black or Acid Fuchsin or Fluorescein
- Cyanoacrylate Fuming
- Dye Staining
- Powder

Rubber Gloves (special circumstance processing only)

- Visual Examination
- ALS (to be utilized sequentially as determined appropriate)
- Wetwop -or- Cyanoacrylate
- Magnetic Powder
- Dye Stain
- Ninhydrin
- Physical Developer (optional)

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
- Dye Staining
- Powder

Adhesive Surfaces

- Visual Examination
- ALS (to be utilized sequentially as determined appropriate)
- Wet Powder Processing or Gentian Violet

– OR –

- Cyanoacrylate
- Dye Stain

Glossy Paper (high gloss –magazine cover, glossy photograph, etc)

- Visual Examination
- ALS (to be utilized sequentially as determined appropriate)
- Cyanoacrylate Fuming
- Dye Stain
- Powder

Glossy Paper[1] (low gloss – magazine pages, catalog pages, etc)

- Visual Examination
- ALS or AARI (to be utilized sequentially as determined appropriate)
- Indanedione
- Ninhydrin
- Oil Red O (optional)
- Physical Developer (optional)

Notes:

[1] Use of AARI Ridge Detection/AI Regions of Interest may not be suitable for glossy paper

Note: ALS and AARI

ALS (Alternate Light Sources) are used to make latent prints visible after chemical processing by utilizing different wavelengths that react with either the latent print or the substrate. Documentation of these latents is conducted with digital imaging and is then exported following the digital image management SOP.

AARI (Amino Acid Rapid Imager) is a self-contained unit that can be used to visualize latent prints after chemical processing of flat porous items. This instrument contains various wavelengths and

automation to assist in the detection of ridge detail. Digital image documentation is self-contained in this instrument and is then exported following the digital image management SOP.