OSAC PROPOSED STANDARD 2023-N-0020
Standard for the On-Scene Collection and Preservation of Friction Ridge Impressions

Crime Scene Investigation & Reconstruction Subcommittee
Scene Examination Scientific Area Committee (SAC)
Organization of Scientific Area Committees (OSAC) for Forensic Science



OSAC Proposed Standard

OSAC 2023-N-0020
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Crime Scene Investigation & Reconstruction Subcommittee
Version: 2.0
December 2024

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Foreword

Proper collection and preservation of friction ridge impressions help ensure that the integrity of the evidence is maintained from the point of collection, through possible forensic examination, and to the presentation of the evidence in the courtroom. This document delineates standards and recommendations for collecting and preserving friction ridge impressions. The methods in this standard are intended to maintain the integrity of friction ridge impressions so that reliable, accurate, and relevant conclusions can be obtained.

This document should be utilized in conjunction with local regulations and any requirements set forth by entities examining collected evidence to inform or augment policies relating to collecting and preserving physical evidence.

This document has been drafted by the Crime Scene Investigation and Reconstruction Subcommittee of the Organization of Scientific Area Committees (OSAC) for Forensic Science through a consensus process.

This standard provides guidance on some safety issues but is not exhaustive. It is the responsibility of the appropriate agency to develop a full health and safety plan. All hyperlinks and web addresses shown in this document are current as of the publication date of this standard.

Keywords: *scene investigation, collection, preservation, detection, development, friction ridge impressions, latent impressions, patent impressions, plastic impressions, processing methods*

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Standard for the On-Scene Collection and Preservation of Friction Ridge Impressions

1 Scope

This document delineates recommendations for collecting, processing, and preserving friction ridge impressions. This document does not apply to the collection of known impressions or analysis. The intended purpose of this document is for the collection and preservation of latent impressions by scene investigators on the scene or for evidence collected from the scene and later processed by the scene investigator in a controlled setting.

2 Normative References

The following reference is indispensable for the application of the Standard. For dated references, only the edition cited applies. The latest edition of the referenced document (including any amendments) applies for undated references.

OSAC 2021-N-0015, *Guiding Principles for Scene Investigation and Reconstruction*

OSAC 2021-N-0018, *Standard for On-Scene Collection and Preservation of Physical Evidence (under development)*

See Annex B, (informative) Bibliography, for other references.

3 Terms and Definitions

For purposes of this document, the following definitions and acronyms apply:

NOTE: In a situation that involves a potentially criminal act, definitions in sections 3.1 through 3.17 would be preceded by "crime" (e.g., crime scene investigator).

3.1
contamination
The unintended introduction of a substance to an item at any point in the forensic process.

3.2
detection
The process of identifying the presence of friction ridge impressions.

3.3

development

The process of making a latent impression visible and, in most cases, is also the equivalent of locating the impression.

3.4

digital image

A photographic image that is represented by discrete numerical values organized in a two-dimensional array. (ASTM)

3.5

examination quality photograph

A photograph or digital image taken following a specific protocol for the purpose of conducting a comparative forensic examination.

3.6

friction ridge collection

The process of transitioning a developed friction ridge impression into a tangible form for transport and laboratory analysis. Collection may or may not be the same as preservation.

3.7

friction ridge impression

An impression from the palmar surfaces of the hands or fingers or from the plantar (sole) surfaces of the feet or toes. (OSAC Lexicon)

3.8

friction ridge processing (also development/processing method)

The procedure of performing a series of techniques to visualize the impression of the raised portion of the epidermis on a surface.

3.9

friction ridge preservation

The process of maintaining the impression in the best possible condition.

3.10

forensic light source (FLS)

A filtered light source that may be fixed or tunable to a variety of spectral ranges. (OSAC Lexicon)

3.11

latent impressions

An impression not readily visible to the naked eye.

3.12
patent impressions

An impression visible to the naked eye.

3.13
plastic impressions

A plastic print is created when the substrate is pliable enough at the time of contact to record the three-dimensional aspects of the friction skin. (Fingerprint Sourcebook)

3.14
scene

A place or object that is subject to and/or requires forensic examination. (ISO/FDIS 21043-1:2018)

NOTE A crime scene is a common description of a scene where a presumed crime has been committed. The scene can also be a person or an animal.

3.15
scene investigation

The act of identifying, documenting, preserving, and collecting physical evidence from a scene.

3.16
scene investigator

An individual, however, named, who is responsible for performing elements of a scene investigation that may or may not involve a potentially criminal act.

3.17
technique

The method for carrying out a particular task.

4 General Collection and Preservation of Friction Ridge Impressions

Friction ridge impressions are chance impressions that can be left on a surface in the form of fingerprints, phalanx (joint) impressions, palm prints, or plantar (foot) impressions. When friction ridge skin comes into contact with a surface, an impression or a portion thereof may be left behind that may be compared to a specific source. Friction ridge impressions may be visible to the naked eye or may need various development and processing methods in order to be observed and collected. The three categories of friction ridge impressions are latent, patent, and plastic.

There are several factors involved in the deposition and development of friction ridge impressions, which include, but are not limited to: skin conditions, environmental factors, type of residue being deposited, handling of the evidence at the time of collection, and the manner in which the evidence is packaged. Residue can be secreted through eccrine or sebaceous components. Other residues can be deposited on friction ridge skin, such as blood, paint, etc.

These processing methods often depend upon the impression's composition and the surface on which it is deposited. Reagents and developmental techniques for friction ridge impressions are generally intended to be used in combination and in sequential order. Adherence to correct processing methods increases the probability of developing the best quality friction ridge impression and minimizes the potential of destroying impressions and/or evidence upon which they were deposited. The collection method employed for a friction ridge impression will be dependent on the development method utilized. The investigator should consider the preservation of additional evidence collection, such as DNA and trace evidence, before selecting a friction ridge processing method. In some circumstances, it may be better to collect an item for more extensive friction ridge processing in a controlled laboratory environment rather than attempting to process the item on scene. Additionally, the crime scene investigator must consider whether other types of testing could be performed and whether the type of processing being utilized will compromise other testing.

OSAC 2021-N-0015, *Guiding Principles for Scene Investigation and Reconstruction*, and OSAC 2021-N-0018, *Standard for On-Scene Collection and Preservation of Physical Evidence*, shall be used in conjunction with this document because OSAC 2021-N-0015 and OSAC 2021-N-0018 provide the foundational principles upon which additional specific requirements, such as this document, will be based.

4.1 Preservation of Friction Ridge Impressions

4.1.1 Friction ridge impressions shall be handled, collected, packaged, and preserved in a manner that prevents contamination, tampering, alteration, or loss of evidence.

NOTE: The use of gloves does not always prevent the transfer of friction ridge detail from the scene investigator to the evidence.

4.1.2 Examination quality photographs should be taken of any visible friction ridge impressions prior to preservation or processing attempts.

4.1.3 To prevent damage to friction ridge impressions, items should be handled in areas not normally touched or on surfaces incapable of yielding legible ridge detail (e.g., the textured surfaces of handguns).

4.1.4 If damage to friction ridge impressions is a concern prior to processing, the scene investigator can consult with a latent print specialist or take examination-quality photographs.

5 Development and Processing of Friction Ridge Impressions

It is important to note that not all processes are used in every situation. Discretion in the choice of development and processing techniques will remain with individual agencies and practitioners both at the scene and in the laboratory.

The following are examples of factors that can influence the choice of development techniques:

- Type of friction ridge medium suspected (e.g., blood, oil, sweat)
- Type of substrate
- Texture of surface
- Condition of surface (e.g., clean, dirty, tacky, sticky, greasy)
- Environmental conditions during and following friction ridge deposition
- Location of processing
- Length of time since the evidence was handled
- Consequences of destructive processing methods
- Anticipated subsequent forensic examinations (e.g., DNA or chemical analysis)
- Sequential ordering of reagents

5.1 Development Techniques

5.1.1 Friction ridge impression development can be achieved with a wide array of optical, physical, and chemical processes. If viable ridge detail is visibly present, documentation should be completed before additional developmental techniques are implemented. Friction Ridge Impressions should be documented at each stage of processing.

5.2 Processing Order

5.2.1 Processing should generally begin with the least destructive technique. Visual inspection and the least intrusive methods should be utilized prior to the use of any methods that can alter the impression or substrate. Visualization of friction ridge impressions through the use of optical or lighting methods is considered non-destructive and should be attempted prior to each subsequent processing method. Refer to Appendix B for an outline of processing methods.

NOTE: Forensic Light Sources, particularly short-wave UV, can damage DNA.

5.3 Friction Ridge Processing Methods

a. Friction Ridge Processing can encompass dusting and other processing methods.

b. Friction Ridge Processing is used to develop friction ridge impressions through a chemical reaction that occurs between the impression residue components and the selected reagent.
    i. Reagent checks should be performed and documented based on agency policies prior to the use of evidence.

ii. Adherence to recommended friction ridge processing techniques ensures the best opportunity to develop all friction ridge detail on an object and minimizes the chance of destroying the friction ridge impressions.

6 Latent Impressions

A latent impression (i.e., impression) is one where the ridge detail is not visible to the unaided eye and requires additional processing to observe and collect ridge detail.

6.1 Detection

6.1.1 Locations and evidence should be examined as soon as feasible with appropriate optical (i.e., lighting techniques such as the forensic light source (FLS)), physical, or chemical processes designed to enhance the contrast of friction ridge impressions.

Some latent impressions are fragile and can be altered by environmental conditions, therefore detection should be prioritized.

6.2 Documentation

6.2.1 Latent impressions should be documented at each stage of processing and before collection. Notes shall be taken outlining the location, substrate, medium (if known), and orientation of any discovered impressions. (e.g., location (kitchen), substrate (tiled floor), medium (black powder), and orientation (north)).

6.2.2 The scene investigator shall document the technique(s) used to capture the impression to aid the examiner in determining if the digital image is reversed.

6.3 Processing

6.3.1 Most latent impressions can be enhanced using physical and chemical processes. If the item is processed at the scene, the scene investigator should apply the appropriate development technique.

NOTE: See the Friction Ridge Processing Methods section below.

6.4 Collection

6.4.1 If possible and applicable, the scene investigator should collect the item, and the item should be processed in a controlled environment. If the item is processed at the scene, the ridge detail should be collected using appropriate methods, such as a photograph and/or lift.

7 Patent Impressions

A patent impression is one where the ridge detail is partially or wholly visible to the unaided eye. Examples include but are not limited to an impression in blood, paint, ink, mud, or dust.

7.1 Detection

7.1.1 Locations and evidence should be examined for patent impressions as soon as feasible. Some visible impressions are fragile and can be altered by environmental conditions. A variety of lighting techniques may assist in the visualization and may enhance the contrast of the friction ridge impressions.

7.2 Documentation

7.2.1 Patent impressions shall be documented through photography. Notes shall be taken outlining the location, substrate, medium, and orientation of any discovered impressions.

7.3 Processing

7.3.1 Most patent impressions can be enhanced using similar processing methods to those of latent impressions.

NOTE: See Friction Ridge Methods section below.

7.4 Collection

7.4.1 An item containing a patent impression shall be photographed before collection.

a. After photography, if possible, the complete item should be collected.

b. If collection of the complete item is not possible, the relevant section of the item containing the impression should be collected.

7.5 Techniques and Enhancements for Patent Blood Impressions

7.5.1 Universal precautions should be employed when handling items with suspected biological pathogens, such as blood or other potentially infectious material.

7.5.2 Friction ridge impressions in blood and other biological substances should be enhanced in a manner that minimizes the possibility of contaminating a DNA profile. Where such a possibility exists, a scene investigator should consider consulting with a DNA analyst before determining if DNA samples should be collected before proceeding with friction ridge development.

7.5.3 Forensic light source (FLS) can be used for creating sharper background contrast and enhancing ridge detail visualization and are considered the least destructive method of development. Chemicals using stains, tests, and protein dyes, such as Amido Black and Leucocrystal Violet, can also be used to further visualize blood and blood-based ridge detail.

NOTE: Some chemicals, such as luminol, can potentially damage the friction ridge detail and are not recommended for the processing of friction ridge impressions in blood.

8 Plastic Impressions

A plastic impression is formed when the substrate is pliable enough at the time of contact to record the three-dimensional aspects of the friction skin.

8.1 Detection

8.1.1 Locations and evidence should be examined for plastic impressions as soon as feasible. Some visible impressions are fragile and can be altered by environmental conditions. Oblique lighting may be needed to detect ridge detail. Some plastic impressions are fragile and are subject to temporary or environmental conditions.

8.2 Documentation

8.2.1 Plastic impressions shall be documented through photography. The investigator shall document the technique(s) used to capture the impression to aid the examiner in determining if the digital image is reversed.

8.3 Processing

8.3.1 Various lighting techniques can be used to visualize the ridge detail of plastic impressions.

8.4 Collection

8.4.1 An item containing a plastic impression shall be photographed prior to collection. The use of a silicone casting material can be used to collect plastic impressions if the item is unable to be collected.

9 Friction Ridge Processing Methods

The processing method will be determined based on the surface upon which the friction ridge impression is located. Surfaces can be separated into three classes: Non-Porous, Porous, or Semi-Porous.

Many items of evidence consist of more than one physical property (e.g., a porous envelope with a glassine window). In those situations, the scene investigator should apply the processing

methods, generally selecting the least intrusive to the most intrusive method, using sequences appropriate for the relevant areas in a manner that does not negatively impact other areas of the evidence.

9.1 Surfaces

9.1.1 Non-porous surfaces typically are non-absorbent and repel moisture. Non-porous surfaces may also appear polished. Examples include rubber, glass, metal, and lacquered or painted wood.

9.1.2 Porous surfaces typically are absorbent and do not repel moisture. Examples include paper, cardboard, and wood.

9.1.3 Semi- porous surfaces are typically characterized by the ability to both repel and absorb moisture depending on the absorbency of the surface. Examples include glossy cardboard, glossy magazine covers, cellophane, latex gloves, and some finished wood.

9.2 Methods

9.2.1 Non-porous, Porous, and Semi-porous surfaces containing ridge detail can be further processed using a variety of physical and chemical processes. NOTE: This document discusses common processing methods on a scene but does not include a discussion on all processing methods.

9.2.2 Processing methods that will be discussed are powder, cyanoacrylate processing, dye stains, small particle reagent, adhesive-side powder, 1,8-Diazafluoren-9-one (DFO), ninhydrin, and 1,2 indanedione.

NOTE: Refer to Appendix B for sequential processing chart.

a. A positive control shall be utilized to ensure the functionality of any chemical processes used.

b. The scene investigator should consider digitally preserving items before and after the application of the processing methods to record changes resulting from the processing methods.

c. If background interference is a concern when selecting a physical or chemical processing method, an area of the surface away from the friction ridge impression shall be tested.

d. An FLS can assist in visualizing impressions that are not visible with other processing methods.

e. The FLS may be used on any surface in which a fluorescing reagent/process has been used and needs to be visualized, such as fluorescent powders and dye stains. The FLS should not be used without viewing through the proper filters/goggles, as the scene investigator

may not be able to visualize the fluorescence, and eye injury may occur. The FLS should be used with the proper filters/goggles to avoid eye injury.

9.2.3 Powder Processing

a. Powder Processing is a physical method in which powder particles adhere to residues in the friction ridge impression.

b. A variety of powder processing methods can be utilized, such as magnetic or non-magnetic, both available in a variety of colors (including fluorescent).

c. The scene investigator should choose a brush (e.g., magnetic, such as a wand, or non-magnetic such as fiberglass, feather, camel hair, etc.) based on the type of powder (magnetic or non-magnetic powder) being used and the surface of the object. Disposable brushes and powders should be used in cases where cross-contamination of DNA is a concern.

d. The scene investigator should dispense the powder into a secondary container and apply the powder with a brush or wand to the surface of the object.

e. Apply the powder in a circular motion, with only the brush or wand touching the surface. As friction ridges begin to develop, brush in the direction of the ridge flow.
   i. When using the magnetic wand, engage the magnet to adhere powder to the end of the wand and apply the powder to the surface for ridge development without allowing the magnetic wand to make contact with the surface. When the magnet is disengaged, the powder is released from the wand. The scene investigator should not use magnetic powder on iron-containing surfaces.

   ii. When using a non-magnetic brush, the scene investigator should avoid placing the brush directly into the original powder container to not contaminate the powder.

f. After documenting the friction ridge impressions with photography, the scene investigator should use a lifter (e.g., hinge lifter, gel lifter, tape, etc.) to remove the developed ridge detail from the surface.

g. The lift backing shall be uniquely identified. The scene investigator may also include the case number, the date the impression was lifted, the scene investigator who lifted it, and the description, location, and orientation of where the impression was lifted.

   NOTE: This information can be outlined on the lift backing, evidence packaging, or in the scene investigator's notes.

h. If the ridge detail is unable to be lifted, the scene investigator should photograph the ridge detail and collect the item or cut a section from the surface.

9.2.4 Cyanoacrylate Processing

Cyanoacrylate, also known as superglue fuming, is a preservation technique sensitive to components of friction ridge impressions. Basic equipment includes an enclosure, humidifier, aluminum dish, a heat source, and cyanoacrylate. Proper ventilation is required for containment and to minimize the risk of exposure.

a. Preparation
   i. Place the items for development in the enclosure in a manner that will allow for the free flow of air around the item.

   ii. Place liquid cyanoacrylate in the aluminum dish.

   iii. Place the aluminum dish on a heating surface in the enclosure and add a positive control (i.e., test print) for visualization into the chamber.

   iv. Activate your heating element, and if a humidified enclosure is available, set the humidity between 70% and 80% for best results.

   v. Secure or seal the enclosure and fume the items.

b. Timing
   i. Fuming time varies depending on the size of the enclosure, the item, and your equipment. The scene investigator should visually monitor impression development through positive controls to ensure the item is not over-processed.

   ii. After the fuming cycle is complete, the scene investigator should ensure adequate ventilation of the vapors before removing items from the enclosure.

   iii. Items should then be removed from the enclosure and viewed for possible ridge detail.

   iv. If necessary, the fuming process can be repeated.

c. The developed friction ridge detail can be collected and preserved by photography.
   i. Different lighting techniques can be utilized, including oblique, reflected, and transmitted lighting techniques, to enhance visualization.

   ii. Powders and dye stains may be applied to enhance the contrast between the friction ridge and the surface. Refer to Appendix B for the Sequential Processing Chart.

9.2.5 Dye Stains

Dye stains are effective for enhancing ridge detail developed with cyanoacrylate. Dye stains can be applied through various methods and aid the scene investigator in further visualizing ridge detail. Dye stains include, but are not limited to, Basic Yellow 40, Rhodamine 6G (R6G), Ardrox, and RAM (Rhodamine 6G, Ardrox, MBD).

a. The scene investigator should select the dye stain that best reacts to the medium and the substrate, and which will create the greatest ridge contrast with the background surface.

b. Impressions that are inherently fluorescent or have been processed with a fluorescent powder or dye stain should be photographed using light from the forensic light source (no ambient light) and an appropriate filter on the camera. If using UV light, a barrier filter would not be needed.

9.2.6 Small Particle Reagent (SPR)

SPR can be used for the development of friction ridge detail on wet, non-porous surfaces and adhesive tape surfaces. SPR can also be effective on liquid accelerant-soaked surfaces. SPR can be applied through a spray method or a dish method. SPR may also be used for post-cyanoacrylate processing.

a. Ridge detail developed with SPR can be lifted or photographed for collection purposes. The scene investigator should immediately photograph the results of SPR processing, regardless of the collection method, due to the fragile nature of the solution. After photography, the developed ridge detail can be preserved with lifters.

9.2.7 Adhesive Side Powder

a. The scene investigator should consider the color of the adhesive side of the surface before selecting a processing technique to obtain the greatest contrast. Dark-colored adhesive surfaces may include but are not limited to masking, duct, or electrical tape. Light-colored adhesive surfaces may include but are not limited to packing tape, surgical tape, or painter's tape.

b. The scene investigator should visually examine the adhesive surface with a light. After visual examination, the scene investigator should determine which color sticky side powder to be used.

c. The sticky side powder is painted on the adhesive surface of the tape with a camel-hair brush. The scene investigator should allow the sticky side powder to settle for 30 to 60 seconds before rinsing it off with a slow stream of cold tap water. Allow the item to dry. The procedure can be repeated if needed.

d. Ridge detail developed with sticky side powder should be photographed for collection and preservation. The scene investigator should submit the adhesive surface containing the ridge detail for evaluation. The scene investigator should consider processing techniques for the surface of the non-adhesive side of the tape to determine proper sequencing.

9.2.8 DFO, 1,2-Indandione, and Ninhydrin

a. DFO, 1,2-Indandione, and Ninhydrin are reagents that react with amino acids. Friction ridge impressions may be created by the deposition of sweat when friction ridge skin comes into contact with a surface. Sweat contains amino acids, and when friction ridge skin comes into contact with porous or semi-porous items, amino acids are absorbed into the surface. Amino acids are deposited on porous or semi-porous surfaces, such as paper, checks, letters, cardboard, etc.

b. The scene investigator should visually examine the porous or semi-porous item to determine which reagent should be used.

c. Ridge detail developed with these reagents should be photographed for collection and preservation.

d. The scene investigator should submit the porous or semi-porous surface containing the ridge detail for evaluation.

e. The scene investigator should consider the destruction of any inks on the surface of the items prior to applying the reagents.

10 Friction Ridge Collection and Preservation

10.1 Photography

10.1.1 Friction ridge impressions should be photographed before they are collected because they can be damaged or destroyed when lifted.

a. Photographs should be taken in a non-compressed file format, such as a RAW or TIFF format.

b. Location and orientation photographs should be taken of the friction ridge impression prior to close-up photographs.

c. A stabilizing body such as a tripod or copy stand should be used.

d. In close-up photographs, the film/digital sensor plane should be parallel to the friction ridge impression.

e. A scale should be placed next to the impression, and both the scale and the impression should fill the frame of the photograph.

f. Uneven or curved surfaces require greater depth of field (and/or focus stacking techniques).

g. A variety of lighting techniques should be utilized to capture the best friction ridge detail, including oblique, reflected, transmitted, and FLS.

h. Impressions that are inherently fluorescent or have been processed with a fluorescent powder or dye stain should be photographed using light from the forensic light source (no ambient light) and an appropriate filter on the camera. If using UV light, a barrier filter would not be needed.

10.2 Lifting

10.2.1 Depending on the development process utilized, friction ridge impressions can be lifted from surfaces after photography using a variety of different methods to make a permanent record which can be used for comparison to known impressions or entered into AFIS. Substances that can be lifted include but are not limited to, powder, dust, and pollen.

a. To collect friction ridge impressions, the scene investigator should use a lifting medium, such as clear tape, hinge, or lifters.

b. For best results, the scene investigator shall wear gloves and anchor one side of the tape or lifter onto the surface next to the ridge detail and then slowly roll the tape or lifter onto the surface using even pressure to ensure that it adheres fully to the surface.

c. For curved surfaces, it may be best to place the tape or lifter on the center of the ridge detail and smooth outward.

d. The tape or lifter should be removed in a smooth motion to prevent start/stop lines from appearing on it. The tape or lifter should then adhere to a suitable lift backing.

e. The lift backing should be labeled with, at a minimum, the case number, the date the impression was lifted, the scene investigator who lifted it, an identifying number, and the location, description, and orientation of where the impression was lifted.

f. The lift backing shall be labeled according to agency protocol, which may include the case number, the date the impression was lifted, the scene investigator who lifted it, an identifying number, and the location, description, and orientation of where the impression was lifted.

NOTE: This information can be outlined on the lift backing or in the scene investigator's notes.

10.3 Difficult Surfaces

10.3.1 Silicone-based casting materials may be used to lift friction ridge impressions from difficult surfaces, such as textured or curved surfaces, to obtain a three-dimensional, permanent flexible mold. The scene investigator should refer to the manufacturer's instructions for the

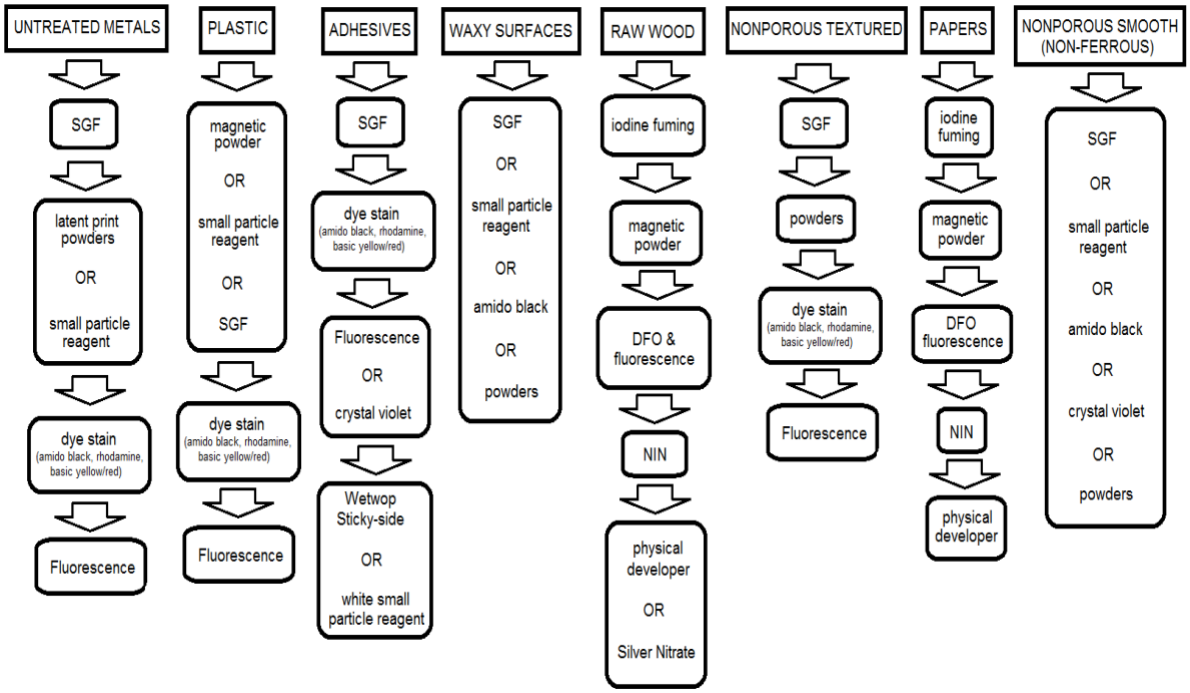
application technique. The recovered lift should be placed into a properly labeled evidence envelope for preservation.

Annex A

Sequential Processing Chart

*SGF=Superglue Fuming (Cyanoacrylate)

NOTE: Guidance related to the application, formulation, and optimization of specific processing techniques can be found in the *Fingerprint Source Book.*



Annex B

(informative)

Bibliography

This is not meant to be an all-inclusive list, as the group recognizes other publications on this subject may exist. When this document was drafted, these were some of the publications available for reference. Also, any mention of a particular software tool or vendor as part of this bibliography is purely incidental, and any inclusion does not mean that the authors of this document are endorsing it.

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