

**Appendix**  
**Shoewear/Tiretrack SOP**

**Reagent Formulas**

**1. Amido black**

**Synonym: Naphthalene black**

**Blood Impressions/Non-porous surfaces**

Reagents (three solutions): Dye solution: Amido black 0.2 g  
Glacial acetic acid 10 ml  
Methanol 90 ml

Rinse solution 1: Glacial acetic acid 10 ml  
Methanol 90 ml

Rinse solution 2: Glacial acetic acid 5 ml  
Methanol 98 ml

**Safety:** For complete information consult the applicable MSDS. **Methanol:** The vapor mixes well with air, explosive mixtures are easily formed. **Amido black** is not a known carcinogen as of 5/2003. **Glacial acetic acid:** flammable liquid and vapor; health rating 3 (severe).

**Application:** Fix the impression with 5-sulfosalicylic acid.  
Apply the dye solution, allow to react for about 2 minutes.  
Apply rinse solutions, about 1 minute.

**Theory:** This is a protein stain that reacts with blood.

**Quality assurance:** Test against known blood.

**2. Ammonium thiocyanate 2%**

**Note:** Ammonium thiocyanate is a hazardous material. In contact with strong acid it generates cyanide gas.

**Use:** residue impressions (trace amounts of iron).

Prepare and use the reagent in a hood.

*For safety, do not store or use in a closed container/sprayer.*

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**Safety:** For complete information consult the applicable MSDS. **Ammonium thiocyanate:** MSDS lists it as incompatible with nitric acid. Reacts with acid to liberate hydrogen cyanide. Harmful if absorbed thru skin. Not a known carcinogen as of 2/2004.

**Nitric acid:** Corrosive! Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Health rating: 4 (Poison).

**Acetone:** Extremely flammable; flash point -4° F (-20° C). Not a known carcinogen as of 5/04.

The following procedure produces a reagent that works well:

Mix 40 ml of acetone and 10 ml nitric acid. The mixture should be warm to the gloved hand but not hot. Allow time for cooling.

Dissolve 2 g ammonium thiocyanate in 50 ml of acetone.

Slowly add the ammonium thiocyanate/acetone mixture to the acetone/nitric acid; mix.

There may be a few bubbles formed; when these have cleared the reagent is ready for use.

There is no shelf life for this mixture; prepare just before use and discard.

**Application:** Spray with an open sprayer (not air tight). Use a fine mist or spray. The reaction product is water-soluble; great care required with non-absorbent surfaces.

**Theory:** Soluble deep red product with Fe<sup>+++</sup> ions.

**Quality assurance:** Spray a known mark made with iron salts. Red reaction indicates a positive result.

### 3. 7,8-benzoflavone 0.2%

**Synonym:** alpha-naphthoflavone  
**Iodine enhancement reagent**

**Safety:** For complete information consult the applicable MSDS. **Iodine:** Corrosive, toxic. Health rating (3) severe. Causes burns to areas of contact. Not a known carcinogen. **7,8-benzoflavone:** Irritant; not a known carcinogen as of 3/03. Mutagenic in experimental animals. **Chloroform:** Health rating 3 (poison). Investigated as a tumorigen, mutagen, and reproductive effector. Carcinogen.

Dissolve 0.2 g 7,8-benzoflavone in 2 to 3 ml chloroform. Make up to 100 ml with petroleum ether.

**Application:** An enhancement for iodine fuming. First fume the item with iodine crystals in a sealed tank. Follow with a 10-second dip in the benzoflavone reagent, or spray.

**Theory:** Absorbed by a range of organic materials.

**Quality assurance:** Spray a known mark in starch. Positive result is a purple color.

4. **Cyanoacrylate  
(Super Glue)  
Wet origin impressions**

Place the impression in an enclosed space with humidity. The "super glue" may be placed on a mild heat source such as a coffee cup warmer, low wattage light bulb. Do not exceed 100° C for safety. Excess temperatures increase toxicity, and above 200° C cyanoacrylate generates hydrogen cyanide. Consult the references for exact methodology.

**Safety: For complete information consult the applicable MSDS.** Skin contact may cause burns. Prolonged skin contact may result in dermatitis in sensitive persons. Will irritate eyes on contact. Generates hydrogen cyanide at temperatures above 200° C. Not a known carcinogen (2002).

5. **Dental stone  
Casting material**

The amount of water to be added to the dry powder is indicated by the manufacturer as ml water/100 g powder. Our pre-weighed bags of dental stone contain approximately 700 g powder. If no information is readily available, start with 26 ml water/100 g powder, mix for 3 minutes. If the mixture is still too thick for easy pouring, add 15ml additional water.

**Safety: For complete information consult the applicable MSDS.** Causes irritation to skin, eyes and respiratory tract. May be harmful if swallowed. Health Rating: 1 – Slight. Flammability Rating: 0 – None. Contact Rating: 1 – Slight.

6. **Fingerprint Powders  
Smooth, waxed, polished, non-porous surfaces  
Not suitable for porous or textured surfaces**

**Safety: For complete information consult the applicable MSDS.**

**Carbon black powder:** Carbon black is designated a nuisance dust.

**Black magnetic powder:** Designated a nuisance dust. Neither carbon black nor black magnetic are listed as carcinogens (2003).

**Fluorescent powders:** Irritants. Consult the appropriate MSDS.

Conventional powders

Fluorescent powders, applied while using ALS/UV light.

## 7. 8-Hydroxyquinoline

**Synonym:** 8-Quinolinol

Dissolve 0.5 g 8-hydroxyquinoline with stirring in 100 ml 90:10 v/v acetone: water.

**Safety:** For complete information consult the applicable MSDS. **Hydroxyquinoline:** Health Rating: 1 – Slight/Contact Rating: 1 – Slight. **Acetone:** Health Rating: 2 - Moderate Flammability Rating: 3 - Severe (Flammable)/Contact Rating: 3 – Severe.

**Application:** View in 254 to 365 nm UV light.

**Theory:** fluorescent chelates formed with certain metal ions such as  $Mg^{++}$  and  $Ca^{++}$ .

**Quality assurance:** Test with known marks made with chalk dust. A purple fluorescence within the chalk indicates positive reaction.

## 8. Iodine

Place iodine crystals in airtight chamber, along with the item to be fumed. A source of heat, approximately 37° C, and humidity must be included. The reaction should occur within a few minutes. Photograph the developed impression to preserve the enhancement.

**Safety:** For complete information consult the applicable MSDS. **Iodine:** Health Rating: 3 - Severe (Life)/Reactivity Rating: 2 – Moderate (oxidizer)/Contact Rating: 3 - Severe (Corrosive) Causes burns to areas of contact.

**References:**

## 9. Leuco Crystal Violet

- A. 10 g 5-sulfosalicylic acid in 500 ml 3% hydrogen peroxide. Use the bottle in which the hydrogen peroxide is purchased.
- B. 1.1 g leucocrystal violet in a 60 ml bottle.
- C. 4.4 g sodium acetate in a 60 ml bottle.

**Safety:** For complete information consult the applicable MSDS. **Sulfosalicylic acid:** Health Rating: 1 - Slight/Contact Rating: 1 – Slight. **Hydrogen peroxide 3%:** Health Rating: 2 – Moderate/Contact Rating: 2 – Moderate. **Leucocrystal violet:** May cause respiratory and digestive tract irritation. May cause eye and skin irritation. Light sensitive. Air sensitive. The toxicological properties of this material have not been fully investigated. **Sodium acetate:** Health Rating: 1 – Slight/Contact Rating: 1 – Slight.

Working solution: Add approximately 30 ml of **A** to bottle **B**; mix. Pour the contents back into bottle **A**. Then add approximately 30 ml of **A** to bottle **C**; mix. Pour contents back into bottle **A**. Shake bottle **A** thoroughly. This is the working solution which will last approximately three months if refrigerated.

Alternate method: 10 g 5-sulfosalicylic acid in 500 ml 3% hydrogen peroxide  
Add 3.7 g sodium acetate  
Add 1 g leucocrystal violet

Application: spray, soak impression, flood surface.

Quality control: Test with known blood.

Theory: Hemoglobin, hemoglobin derivatives cause formation of crystal violet, a violet colored dye.

## 10. Physical developer

**Porous surfaces, especially paper**

**May be used after iodine or ninhydrin processing**

Reagent: May be mixed in the laboratory, see Bodziak, 2<sup>nd</sup> edition, or purchased commercially from Lightning<sup>®</sup> Powder Company.

**Safety:** For complete information consult the applicable MSDS. **Maleic acid:** Causes severe eye irritation and possible burns. Contact Rating: 3 - Severe (Corrosive). Causes skin and respiratory tract irritation. May be harmful if swallowed or absorbed through the skin. May cause kidney damage. Not a known carcinogen. **Ferric nitrate:** Health Rating: 2 - Moderate  
Reactivity Rating: 3 - Severe (Oxidizer) Contact Rating: 2 - Moderate. Contact with other material may cause fire. Harmful if swallowed or inhaled. Causes irritation to skin, eyes and respiratory tract. Affects the liver. Not a known carcinogen (2003). **Ferrous ammonium sulfate:** Health Rating: 1 - Slight. Reactivity Rating: 0 - None. Contact Rating: 1 - Slight. Causes irritation to skin, eyes and respiratory tract. Harmful if swallowed or inhaled. Not a known carcinogen (2004). **Citric acid:** Health Rating: 1 - Slight Flammability Rating: 1 - Slight. Reactivity Rating: 2 - Moderate. Contact Rating: 3 - Severe. Causes severe eye irritation. Causes irritation to skin and respiratory tract. Not a known carcinogen (2004). **Silver nitrate:** Health Rating: 3 - Severe (Poison). Reactivity Rating: 3 - Severe (Oxidizer). Contact Rating: 3 - Severe (Corrosive). Poison! Corrosive. Causes burns to any area of contact. May be fatal if swallowed. Harmful if inhaled. Strong oxidizer. Contact with other material may cause fire. Not a known carcinogen (2004). **N-dodecylamine acetate:** May cause skin irritation and/or dermatitis. May cause allergic skin reaction. May cause irritation of respiratory tract. Not a known carcinogen (2004). **Synperonic N:** (ethoxylated nonylphenol). Severe eye irritant; may cause tissue destruction. Inhalation of mists may cause respiratory tract irritation. Avoid open flame, strong oxidizers and reducing agents. Not considered carcinogenic (2002).

Application: Metal forceps, rubber gloves, or bare fingers may leave deposits on the item; handle with non-serrated plastic forceps or gloves.

Theory: Reacts with fats, oils, waxes present in the impression.

#### 11. 5-Sulfosalicylic acid for fixing bloody impressions

Reagent: 20 g 5-sulfosalicylic acid in 1 liter water.

**Safety: For complete information consult the applicable MSDS. Sulfosalicylic acid:**  
Health Rating: 1 - Slight/Contact Rating: 1 - Slight.

Application: Immerse the item in the solution for 10 minutes; then immerse in distilled water for 5 minutes. Large areas such as floors may be sprayed.

Theory: Chemical fixing ensures the bloody impression is not washed away during chemical enhancement.

#### References:

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**Idaho State Police  
Forensic Services  
Trace Section**

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**History Page  
Footwear & Tire Track Impression SOP  
Appendix: Reagent Formulas**

<b>Revision #</b>	<b>Issue Date</b>	<b>History</b>
1	3/29/02	Current methodology used by ISPFs
2	3/04	Slight modification of ammonium thiocyanate methodology.
3	5/04	Further modification of ammonium thiocyanate methodology.
4	6/05	Added safety information to reagent formulas. Deleted leucomalachite green procedure. Added leucocrystal violet procedure.

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**Approval:**

**Technical Leader:** \_\_\_\_\_ **Date:** \_\_\_\_\_  
Dave Laycock

**Issuance:**

**QC Manager:** \_\_\_\_\_ **Date:** \_\_\_\_\_  
Rick D. Groff