A. Purpose:

To describe the techniques that can be utilized to recover an obliterated serial number.

B. Responsibility:

Forensic Science Examiners or other employees assigned to the Unit.

C. Safety:

1. The analyst shall use appropriate PPE (eye protection, gloves, lab coat).
2. Serial number restorations shall be conducted in a fume hood.

D. Procedure:

- Operability testing shall be conducted prior to any serial number restoration attempts.
- The condition of the obliterated area(s) and any visible characters shall be documented in the notes by photographs and/or sketches prior to restoration attempts.
- The notes shall demonstrate the progression of the restoration attempt(s).
- During any stage of the restoration, a second analyst must verify the restored characters by initialing the appropriate space on the Serial Number Worksheet (QR FA-8, 8a).

1. Preparation
   a. Polishing
      i. Can be done with fine grit sand paper, emery cloth, or an electric polishing tool such as a Dremel.
      ii. Depending on the extent of the obliteration, continue polishing until the surface is mirror-like, removing the scratches. If the obliteration is severe, it may not be possible or desirable to remove all of the scratches.
      iii. Any characters that become visible shall be documented.
   b. If the serial number is not visible, or only a portion of the serial number is visible after polishing, chemical and/or magnetic processing may be conducted.
2. Magnetic Particle Inspection

Magnetic particle inspection is generally used on magnetic or ferrous metals, but can also be used on other types of metals. It is considered a non-destructive method of serial number restoration.

a. Spray the Magnaflux oil suspension (red or black) into a small cup or beaker.

b. Place the poles of the magnet on either side of the obliteration. Placement may be adjusted as needed. Press the power button.

c. Using a disposable pipette, drip the oil suspension onto the area of obliteration.

d. Document any characters that become visible.

e. This method may be used alone or in conjunction with chemical reagents.

3. Chemical Processing

a. Determine the most appropriate reagent for the type of metal.

b. Using a cotton swab, apply the reagent to the area of obliteration.

c. Document any characters that become visible.

d. Polishing may be used in between applications of the reagent.

e. When complete, flush the area with water to neutralize the chemicals. Then dry the area and apply oil to inhibit oxidation.

4. Electrolytic Method

Applying voltage to the chemical reagent process speeds up the reaction between the acid and the metal.

a. Using an alligator clamp, attach the positive terminal of the low voltage power supply to the frame or receiver of the firearm.

b. Hold the negative terminal of the low voltage power supply to a cotton swab moistened with the desired reagent.

c. Turn on the power supply to low.

d. Swab the obliterated area, taking care to not touch the frame/receiver with the negative terminal on the cotton swab.

e. Document any characters that become visible.

f. Polishing may be used in between applications of the reagent.

g. When complete, flush the area with water to neutralize the chemicals. Then dry the area and apply oil to inhibit oxidation.

5. Reporting Results

a. Unrestorable characters shall be represented by a "?"

b. Characters which could be multiple possibilities shall be represented by a "*" with the possibilities listed. e.g. *The "*" represents a character that could be a 3 or an 8.*

6. QC Check

a. Prior to using any chemical reagent, a quality control check shall be conducted and documented on the Serial Number Restoration Worksheet.

b. Two (2) pistol slides are located in the fume hood. One is a ferrous material, the other is non-ferrous. These will be used to perform the QC check.

c. Using a cotton swab moistened with the desired reagent, dab a small amount onto the appropriate slide.

d. The appearance of bubbles is a positive control which indicates that the reagents are working properly.

e. If the reagent does not bubble as expected, the reagent has failed the QC check. This should be documented in the Firearms Chemical Reagent Log.

f. The failing reagent should be disposed of properly and remade.

E. Available Reagents

Reagents that are prepared in the laboratory shall be logged in the reagent log book. Refer to GL-2 Safety Manual for proper labeling.

In general, Fry's Reagent, Turner's Reagent, and Davis Reagent are used on ferrous materials. 25% Nitric Acid, Acidic Ferric Chloride, Ferric Chloride, 10% Sodium Hydroxide, Hubball Reagent, and Phosphoric/Nitric Acid are used on non-ferrous materials.

a. Fry's Reagent (for ferrous material)
   i. 90g cupric chloride ($CuCl_2$)
   ii. 100mL distilled water (dH_2O)
   iii. 120mL hydrochloric acid (HCl)

b. Turner's Reagent (for ferrous material)
   i. 2.5g cupric chloride ($CuCl_2$)
   ii. 25mL ethanol (C_2H_6O)
   iii. 30mL distilled water (dH_2O)
   iv. 40mL HCl (Hydrochloric acid)

c. Davis Reagent (for ferrous material)
   i. 5g cupric chloride ($CuCl_2$)
   ii. 50mL distilled water (dH_2O)

iii. 50mL HCL (Hydrochloric acid)

d. 25% Nitric Acid (for non-ferrous material)
   i. 75mL distilled water (dH_2O)
   ii. 25mL nitric acid (HNO_3)

e. Acidic Ferric Chloride (for non-ferrous material)
   i. 25g ferric chloride ($FeCl_3$)
   ii. 100mL distilled water (dH_2O)
   iii. 25mL Hydrochloric acid (HCl)

f. Ferric Chloride (for non-ferrous material)
   i. 25g ferric chloride ($FeCl_3$)
   ii. 100mL distilled water (dH_2O)

g. 10% Sodium Hydroxide (for non-ferrous material)
   i. 10g sodium hydroxide (NaOH)
   ii. 90mL distilled water (dH_2O)

h. Hubball Reagent (for non-ferrous material)
   i. 10g potassium dichromate ($K_2Cr_2O_7$)
   ii. 60mL distilled water (dH_2O)
   iii. 50mL C_2H_6O (Ethanol)
   iv. 80mL concentrated HCL (Hydrochloric Acid)

   Directions: Measure the powder on a balance contained in a hood. Add the powder to a glass bottle and add the dH_2O, mixing well to dissolve the powder. In small amounts, add in the Ethanol stirring slowly. Once this step is completed, begin to slowly add in the Hydrochloric Acid to this mixture. This mixture will have an exothermic reaction and will need to cool overnight.

i. Phosphoric/Nitric Acid (for non-ferrous material)
   i. 98mL 85% phosphoric acid (H_3PO_4)

ii. 2mL concentrated nitric acid (HNO_3)

-or-

iii. 50mL concentrated phosphoric acid (H_3PO_4)

iv. 3mL concentrated nitric acid (HNO_3)

F. Equipment:

1. PPE
2. Fume hood
3. Polishing tools
4. Chemical reagents
5. Cotton swabs
6. MagnaFlux magnet and supplies
7. Low voltage direct current power supply

G. References:

1. GL 2 Safety Manual
2. FA SOP-02 General Firearms Safety
3. ATF Serial Number Structure Guide