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. 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. 120mL hydrochloric acid (HCl)

iii. 100mL distilled water (dH_2O)

b. Turner's Reagent (for ferrous material)

i. 2.5g $CuCl_2$

ii. 40mL HCl

iii. 25mL ethanol (C_2H_6O)

iv. 30mL dH_2O

c. Davis Reagent (for ferrous material)

i. 5g $CuCl_2$

ii. 50mL HCL

iii. 50mL dH_2O

d. 25% Nitric Acid (for non-ferrous material)
   i. 25mL nitric acid (HNO_3)
   ii. 75mL dH_2O
e. Acidic Ferric Chloride (for non-ferrous material)
   i. 25g ferric chloride ($FeCl_3$)
   ii. 25mL HCl
   iii. 100mL dH_2O
f. Ferric Chloride (for non-ferrous material)
   i. 25g $FeCl_3$
   ii. 100mL dH_2O
g. 10% Sodium Hydroxide (for non-ferrous material)
   i. 10g sodium hydroxide (NaOH)
   ii. 90mL dH_2O
h. Hubball Reagent (for non-ferrous material)
   i. 10g potassium dichromate ($K_2Cr_2O_7$)
   ii. 80mL concentrated HCl
   iii. 60mL dH_2O
   iv. 50mL C_2H_6O
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 H_3PO_4
   iv. 3mL concentrated 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 I-1 Safe Handling of Firearms
3. ATF Serial Number Structure Guide