A. Purpose:

The Sodium Rhodizonate test is a chromophoric (color-producing) test for the presence of lead in gunshot residues. This test can be used to identify lead residues on an item that may have been present during the discharge of a weapon. Sodium rhodizonate is a direct application to a surface to test for the presence of lead residue.

B. Responsibility:

Analysts assigned to the Firearms Unit or analysts competent in distance determination

C. Safety:

Analysts shall use PPE such as gloves, eye protection, and lab coats when preparing these chemicals and using this test.

Listings				
Chemical	**Health Hazard**	**Flammability Hazard**	**Reactivity Hazard**	**Specific Hazard**
Sodium Rhodizonate	0	0	0	
Sodium Bitartrate	0	0	0	
Tartaric Acid	2	0	0	
Hydrochloric acid	3	0	0	

D. Procedure:

1. Reagent Preparation
   a. Sodium rhodizonate solution
      i. Fill a small beaker with distilled H_2O.
      ii. Add a small amount of sodium rhodizonate and mix until the powder is dissolved. The solution should be the color of strong tea.
      iii. Continue adding small amounts of sodium rhodizonate until the solution is saturated (small amount of powder remains on the bottom of the beaker after mixing).
      iv. Prepare only enough solution for immediate use. This solution is not suitable for long-term storage.
   b. 2.8 pH buffer solution
      i. Using a hot plate and a magnetic stirrer, dissolve 1.9 grams (29.32 grains) of sodium bitartrate in 100mL of distilled H_2O.

ii. Store this solution in a clean, uncontaminated bottle and label appropriately. The shelf life of this solution is one year; however, it may be discarded earlier if cloudiness is observed.

c. 5% hydrochloric acid solution

i. Add 5mL of hydrochloric acid to 95mL of distilled H_2O.

ii. Store in a sealed bottle and label appropriately. The shelf life of this solution is one year from the date of preparation.

2. Testing Procedure

a. Reagent control check

i. Create a faint mark by rubbing a lead bullet in a discrete spot on the evidence (away from any suspect bullet holes) and on the testing material (such as the cotton twill jean). This can also be done on a piece of filter paper. The unmarked areas of fabric will be used as a negative control.

ii. Spray the area in the following order: 1—sodium rhodizonate. 2—buffer solution. 3—5% HCl. A blue-violet color should only appear in the area of the rubbed bullet. Blue-violet indicates a positive control. No purple in the surrounding area indicates the negative control worked properly.

b. Direct application

i. Transfer adequate amounts of sodium rhodizonate, 2.8pH buffer, and 5% HCl solutions each to individual labeled spray bottles.

ii. With the item laid out flat, spray the questioned area with the sodium rhodizonate solution. This will turn the item a yellow-orange color.

iii. Spray the same area with the buffer solution. This eliminates the yellow color and adjusts the pH to 2.8. If there are heavy metals present, some of the area will turn pink.

iv. Spray the area with 5% HCl. The pink color will fade, and a blue-violet will develop in the presence of lead (particulate and/or vaporous, or bullet wipe).

v. Document results quickly, as the blue-violet color fades quickly.

vi. Allow the evidence and test shots to dry completely.

c. Bashinski Transfer Method

The Bashinski Transfer Method is recommended for dark colored items on which the blue-violet color development may be masked.

i. Place a piece of filter paper over the questioned area of the evidence item. Use a pencil to index the filter paper relative to the garment, using seams, holes, buttons, pockets, etc.

ii. Uniformly dampen the filter paper with the 15% glacial acetic acid while it is lying on the questioned area.

iii. Cover the dampened filter paper with several layers of dry filter paper. Apply a hot iron and press until all layers of filter paper are dry.

iv. Separate the filter paper that was in direct contact with the evidence, and process it with the direct application method listed above.

v. Any test shots must also be processed with the Bashinski Transfer Method.

vi. Allow tests and evidence to dry completely.

E. Other Considerations:

Environmental lead may also produce a positive result. The analyst should consider the resulting patterns when interpreting the products of this testing.

F. References:

1. Anon., (1970). "Gunshot Residues and Shot Pattern Test", F.B.I. Law Enforcement Bulletin, Vol. 39, No. 9, p. 7.
2. Dillon, John, H., "A Protocol for Gunshot Residue Examinations in Muzzle-To-Target Distance Determinations", AFTE Journal, 1990. Vol. 22, No. 3, p. 32.
3. Dillon, John, H., "The Sodium Rhodizonate Test: A Chemically Specific Chromophoric Test for Lead in Gunshot Residues", FBI – Gunpowder and Gunshot Residue Manual, p. 57.