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August 12, 1968

Mr. Howard L. Roffman
8829 Blue Grass Road
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Dear Mr. Roffman:

Thank you for your letter of May 10, which was not received until June 12. My apologies for not answering sooner -- your letter became buried and overlooked.

Our work related to the Oswald case is reported on pages 7 and 9-11 of General Atomic Report GA-6152 to the U. S. Atomic Energy Commission. Copies of these pages are enclosed.

Very truly yours,

Vincent P. Guinn

Vincent P. Guinn
Manger & Technical Director
Activation Analysis Program

VPG:mm
Enclosures

Jim Roffman

of 1.8×10^{12} n/cm^2-sec. The induced Ba^{139} and Sb^{122} activities were then separated radiochemically and counted. The results are shown in Tables 2 and 3.

In the case where the gun was wiped clean before each firing, moderately reproducible results were obtained. The standard deviations of the Ba and Sb values were ±43% and ±45%, respectively. Only one cast, the last in this series, showed unusually high values.

When the gun was not wiped clean after each firing, the results were quite scattered and covered a wide range, except for the Sb values in the second set. The standard deviations in the Ba and Sb values for the first set of casts (gun not wiped) were ±74% and ±75%, respectively. For the second set of casts, the standard deviations of Ba and Sb were ±77% and ±30%, respectively. In every case, the Ba and Sb values seem to parallel each other, either being both high or both low in each individual firing. In virtually all cases, the Ba and Sb values were well above the levels found on the hands of persons who had not recently fired a gun (see Table 1).

This particular type of experiment, where several paraffin casts are made of the same hand, is complicated in that each successive cast becomes harder to remove than the previous one. This may be due to the removal of natural skin oils from the hand, and may have had some effect on the results that were obtained.

Rifle Studies

A study of the deposition of Ba and Sb on the hands and faces of persons who had recently fired a rifle was made. Previously, only revolvers and automatic pistols had been investigated in this study. The weapon used in these tests was a used 6.5 mm Mannlicher-Carcano rifle, of exactly the same type as the one used in the assassination of President Kennedy. The test firing and hand samplings were performed in a manner such that the conditions of the assassination were duplicated as nearly as possible. All of the persons who fired the rifle were right-handed, and the firings were performed in a room that had a door open to the outside; only a slight breeze was blowing at the time. The exact wind conditions at the time of the assassination were not known to us. The rifle had to be fired horizontally instead of at a slightly downward angle as in the assassination. The hands and cheeks of the persons doing the firings were not sampled until three to four hours after they had fired the rifle. During this time, they went about their normal activities, but they did not wash their hands or face. This was to duplicate, approximately, the time between the assassination and the obtaining by the Dallas police of paraffin casts from the hands and right cheek of Lee Harvey Oswald, the suspected assassin.

Two sets of casts were obtained. One set was first treated with diphenylamine solution, which is the old chemical test for gunpowder residues, and was the method used by the Dallas police on the Oswald casts. After chemical testing, the reagents were washed off the casts with distilled water. The other set of casts was not treated with diphenylamine. In each series, casts were made after one shot had been fired, and after three shots had been fired in rapid succession.

When obtaining casts to be used for the diphenylamine test, gauze is added to the cast to give it strength. Before analyzing these casts, a sample of the gauze used was irradiated in the reactor for 30 min at a thermal-neutron flux of 1.8×10^{12} n/cm^2-sec, and treated in the same manner as irradiated casts. Although the gauze did not dissolve during the post-irradiation radiochemical separation, appreciable amounts of Ba and Sb were detected. Levels corresponding to 0.46 ppm Ba and 0.044 ppm Sb in the gauze were obtained. Thus, since the weight of the gauze in each cast could not be determined, a blank correction could not be made and it was necessary to separate the paraffin from the gauze before irradiation. A clean spatula was used to cut the gauze from the paraffin which had contacted the skin.

The casts were irradiated for 2 hr in a thermal-neutron flux of 1.8×10^{12} n/cm^2-sec, and the Ba^{139} and Sb^{122} activities were separated radiochemically and counted. The results are shown in Tables 4 and 5.

The results of the analyses of the casts on which the diphenylamine test was not performed seem to indicate that detectable gunshot residues are deposited on both hands and both cheeks of persons firing this rifle. The levels of Ba and Sb found are all above the average on normal hands (see Table 1). The amounts of these elements present after three shots were fired were generally appreciably greater than those detected after only one firing. After three firings, the amounts of Ba and Sb found were above even the maximum values (0.48 μg Ba and 0.06 μg Sb) found on normal hands, the Ba value on the left cheek being the only exception. After one firing, only the Ba on the right hand and the Sb on the left cheek were above these maxima.

The Ba and Sb values obtained from the casts on which the diphenylamine test was performed are quite scattered. The Ba values are low, the only apparent exception being for the right hand of the person who fired three shots. This cast is the only one that gave a positive diphenylamine test (a test for nitrates). However, the levels of Sb on the casts were still well above normal levels, even after the casts were treated by the chemical test. It appears, therefore, that performing the diphenylamine test on the paraffin casts removes the Ba fairly completely but does not remove significant amounts of Sb.

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Table 4

RESULTS OF RIFLE FIRINGS WHERE DIPHENYLAMINE TEST WAS NOT PERFORMED
(Element Values in μg Net)

Sample	Ba	Sb
Dan Miller (three firings)		
Left hand	0.511	0.083
Right hand	0.529	0.157
Left cheek	0.399	0.079
Right cheek	0.492	0.095
Ed Miller (one firing)		
Left hand	0.215	0.022
Right hand	0.596	0.028
Left cheek	0.300	0.104
Right cheek	0.144	0.037

NOTE: Subjects fired at 12:30 pm. Dan Miller casts were made at 3:30 pm. Ed Miller casts were made at 4:00 pm.

Table 5

RESULTS OF RIFLE FIRING WHERE DIPHENYLAMINE TEST WAS PERFORMED
(Element Values in μg Net)

Sample	Ba	Sb
Bingle (one firing)		
Left hand	0.144	0.088
Right hand	0.094	0.064
Left cheek	0.186	0.019
Right cheek	0.084	0.020
Howe (three firings)		
Left hand	0.075	0.095
Right hand[a]	0.341	0.051
Left cheek	0.148	0.066
Right cheek	0.091	0.028

NOTE: Subjects fired at 2:00 pm. Bingle casts taken at 4:30 pm. Howe casts taken at 4:45 pm.

[a]Only positive diphenylamine test.

As a result of these studies, the paraffin casts of the hands and right cheek of Lee Harvey Oswald were analyzed by neutron-activation analysis for Ba and Sb by the Federal Bureau of Investigation at Oak Ridge National Laboratory. The casts had been previously treated with diphenylamine by the Dallas police. As reported by the Warren Commission, the results were inconclusive--not because of failure of the activation analysis technique (which worked well), but rather because of earlier contamination of the casts, presumably by excessive handling.

The important casts in rifle studies are those of the cheeks. Large amounts of Ba and Sb on the cheeks would indicate that a rifle had been fired, as these elements would not be expected to be deposited on the cheeks when a revolver or pistol was fired, unless the revolver or pistol was held very close to the face, which is unlikely. The Kennedy assassination is an example of a case where unaltered casts of the cheeks (i.e., not chemically treated and not mishandled) would have been extremely important. It was alleged that the suspect, after firing the rifle, also fired a revolver (there were witnesses to the revolver firing by Oswald, which resulted in the death of Officer Tippett). Casts of the hands alone would indicate that a gun had been fired, but it could not be determined whether it was a rifle or a hand weapon. High levels of Ba and Sb on the cheeks would indicate that a rifle had been fired, regardless of whether a hand weapon had also been fired. The normal levels of Ba and Sb on the cheeks have not been determined, but there is no reason to suspect they should be higher than the normal levels on the hands.

Suicides

Paraffin casts from the left and right hands of a number of victims of gunshot suicides were analyzed for Ba and Sb. These casts were obtained through the cooperation of the Coroner's Offices of Los Angeles, San Diego, Orange, and San Mateo Counties (all in California). The purpose of this study was to evaluate this method of gunshot-residue detection in actual known cases which were uncontrolled, as opposed to controlled test firings in the laboratory, and to provide a basis for the interpretation of the results from unknown shooting cases (possible suicides or possible murders).

A total of seventeen cases were studied. Of these, two were not suicide victims, but were victims murdered by one of the suicides, and the remaining fifteen were known suicides. The results of the analyses are shown in Table 6.

By comparison of these results with the normal hand blanks (see Table 1), it is found that only one (No. 1) of the known suicides had both Ba and Sb above the normal maximum on one hand (the left hand) and below the normal maximum on the other hand. The values for both Ba and Sb