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Per Letter Instructions Of

Per H. T. Gray, Supervisor
Laboratory Records Dept.

DATE July 29, 1948

SUBJECT Single Source Lanthanum Test -
AHRUU Program.

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[redacted] RIDGE NATIONAL LABORATORY
Division of
Carbide and Carbon Chemicals Corporation
Oak Ridge, Tennessee

Subject: Single Source Lanthanum Test - AHRUU Program.

The experiment was conducted in a large field near the X-10 area by members of the Health Physics Division of Oak Ridge National Laboratory under the supervision of Dr. John H. Roberson.

The general outline of the test was given in appendix A of a memorandum from Walter J. Williams to J. C. Franklin, dated July 2, 1948. The outline was as follows:

1. The source should be as near the ground as possible and still maintain an unobstructed straight line between source and detector.

2. Measurements should be made for each source distance at heights of 3, 6 and 12 feet from the ground.

3. It is desirable to have measurements made at points with lateral distances between source and counter of 10, 20, 50, 100, 200, 400, 750 and 1,000 feet. Data taken at greater distances from the source would be useful if cleared area and source strength will permit.

4. It is believed that the strength of the source should be of the order of 1,000 curies. (A memorandum from Walter J. Williams to J. C. Franklin, dated June 29, 1948, covers authorization for the preparation of a source of radio-lanthanum for this purpose.)

The barium separation was finished at 8:00 a.m. on July 12, 1948, by the Operations Division under L. B. Emlet, Director. An analytical measure of the total material gave 1,400 curies, which was divided into three sources of about 1,280, 100 and 20 curies. The sources were used on July 17, when the amount of lanthanum was a maximum.

A strip 10 feet wide and 1,900 feet long was cleared of vegetation and graded by the Engineering and Maintenance Division, Mr. J. C. Stewart, Director. The strip was leveled to within an estimated 1 foot tolerance, except for a dip between 1,300 and 1,700 feet, where the point of minimum elevation was about 6 feet below the source level. Distances from the zero point were measured and staked by a surveying crew.

The source carrier was placed in a hole at the zero point, so that the top of the carrier was at a ground level. The source was raised from the carrier to a height 9 inches above ground level, by means of a [redacted] and pulley on an overhead frame.

Measurements were made at 3, 6 and 12 feet from the ground. The electroscope was used in preference to a Geiger-Muller counter because of its greater accuracy in measuring roentgens. Lauritsen electroscopes were used, the chamber of which was surrounded by 1/4 inch plywood. Distances from source to electroscope are shown on Figure 1, together with the results of the measurements.

The ordinates in Figure 1 were computed by multiplying the reciprocal of the time of discharge of the electroscope by the square of the distance from source to instrument. The values are corrected for background, which was 1/5 of the total intensity at 1,900 feet. The segment of the curve taken with the medium source was fitted to the large source curve at 500 feet. The data on the smallest source was fitted to the medium source at 100 feet.

A large portion of the drop in the measured value of intensity times distance squared, apparent for all three sources at small distances, is undoubtedly due to non-saturation in the electroscope chamber in high-intensity fields. Time does not permit further investigation of this result.

The readings at 3, 6 and 12 feet do not differ appreciably at great distances, except at the 1,600 foot position, where the 3 and 6 foot elevations were below the ground level and shielded from the direct beam. At near distances any variation would have been obscured because of the high radiation intensity of the direct beam.

At the 600 foot distance a reading was made beside the truck, and another with the truck moved back to 700 feet. The two readings differed by less than 1% so the scattering from the truck did not introduce a serious error in these measurements.

Each measured value is the average of three readings whose internal consistency was better than 3%. The extrapolated value may be low by as much as 10%, though this is doubtful because of the good agreement between the small and medium source values at 200 and 100 feet.

Experimental Results

The half thickness of the straight portion of the curve is 450 feet (130 meters) corresponding to a coefficient of absorption of 5.3×10^{-5} cm^{-1} of air or a relaxation distance of 650 feet (190 meters).

K. Z. Morgan
Director, Health Physics Division

C. N. Rucker
Executive Director

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JHRoberson:mco

—Fig. 1—

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