Department of Nuclear Science and Engineering

HP Survey Laboratory

Report from a laboratory experiment conducted on February 8, 2017
as part of NSE 115 - Experimental Methods

February 14, 2017

Abstract:

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1. Introduction and Background

2. Theory

Knowing the shielding material of each element is important to help us choose which material should be used to prevent the targeted radiation. In order to measure this we consider the thickness of a material used to prevent the radiation to effect the source. When the radiation interact with the absorber the beam of the used radiation decreases. This can be quantized using the equation of intensity:

$$I = I_o \cdot e^{-\mu x}$$

Where Io and I stands for the initial and final intensity respectively, x is the thickness of the absorber and (mu) is a constant which is the linear attenuation coefficient.

Since we are trying to achieve half the intensity then we can do that by using the half thickness and equating the previous equation to half. the half value is defined as the thickness of absorber that will cut the intensity in half and by plugging the two equations. the x will change to x(1/2) which would drive us to:

$$\ln(I/I_o) = -\mu x$$

$$\ln(I/I_o) = 0.5$$

$$\ln(0.5) = -\mu x_{1/2}$$

$$x_{1/2} \cong 0.693/\mu \qquad \mu \cong 0.693/x_{1/2}$$

3. Description of Experimental Setup

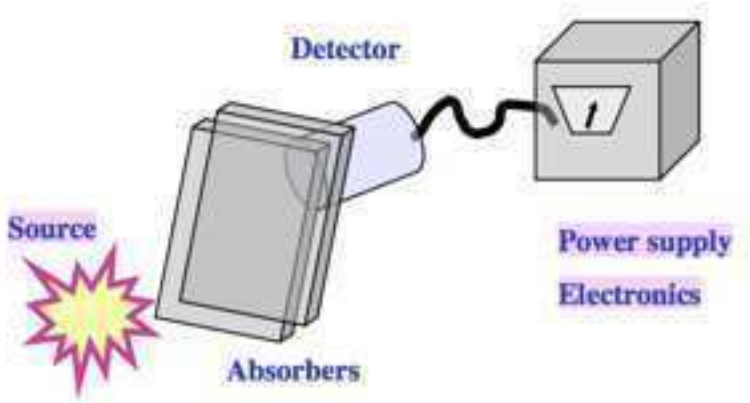

Figure 1: Sketch of Experimental Setup

The experiment was taken in the radiation center at Oregon state University on February 8th 2017 at 1 pm. The equipment was provided prior to the student's arrival. I worked with a group of 3 other members the equipment was set up on the table but we placed a wooden box below the detector to insure that it maintains a constant distance from the source and does not fluctuate and we made sure everything is ready in order to begin the experiment.

4. List of Equipment Used

1. Gieger Counter Bicron surveyor detector (12/5/2016)
2. A source of Thorium Mantle
3. Power supply electronics
4. Aluminum
5. Paper
6. Cupper
7. Wood

5. Procedure

Step 1: the detector and power supply was set up.

Step 2: The geiger counter detector was turned on.

Step 3: The background count rate was measured and and collected for later calculations.

Step 4: A box was used to place the detector above it to sustain a constant distance of ~ cm form the source.

Step 5: The reading on the detector was noted recorded after the detector stabilized.

Step 6: A sheet of aluminum was placed between the source and the detector. keeping the distance between them constant.

Step 7: The reading on the detecter was recorded after it stabilized.

Step 8: The number of sheets increased until 50% of the initial value was achieved.

Step 9: The net count rate data was plotted on a semi-log paper.

Step 10: Calculations were made to find X(1/2).

Step 11: Step 1-10 were repeated using a 0.1 mm papers.

6. Data

Background radiation: 30 cpm

No shielding gross: 650 cpm

No shielding net: 620 cpm

Barometric pressure at start of experiment: 29.80 inches of mercury

7. Analysis of Data

7.1. List of Variables:

7.2. Data Reduction Equations

7.3. Calculated Results

7.4. Uncertainty Analysis

8. Discussion of Results

9. Conclusions

10. References