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Safe Handling of Radioactive Sources

Several types of radioactive sources are used in the AN34 series of Experiments in Nuclear Science. The simple rules in this advisory are aimed at safe handling of the sources.

Never eat, drink or smoke in the laboratory counting area. Wash your hands at the end of each laboratory experiment. In experiment 22 (Measurements in Radiation Biology), liquid sources are used; therefore special, protective clothing and gloves should be worn.

Most of the gamma-ray sources employed are in sealed packaging, containing activities ≤1 μCi. With minimal risk, these sources can be handled with your fingers. However, it is good practice to always handle these sources by the edge of the disk.

The beta-ray sources used in the beta-spectrometry experiments have thin windows covering the active area of the source. It is important to avoid touching this window to avoid adding dirt or other contamination to the window. Handle the beta-ray sources by the outer diameter of the ring that surrounds the active area.

All of the alpha-particle sources employed in the AN34 series of experiments have no window protecting the active area of the source. The handling of these unsealed sources should be minimized and care should be used to avoid wiping any of the radioactive spot onto your hands, clothing or equipment. Grip the alpha-particle sources by the outer diameter of the ring that surrounds the active area. Any source that has an activity >10 μCi should be handled with tongs to maximize the distance from any body parts.

Several experiments utilize a 1 to 3 Curie neutron source. Such intense neutron sources can be very dangerous if improperly handled. Long tongs, or a 1-meter length of string should be used to manipulate the neutron source. When not safely locked in the shielded neutron howitzer, the neutron source should be locked in its shielded shipping container. The special techniques for handling neutron sources are usually included with the shipping container for the source.

Radiation survey meters should be readily available in the nuclear counting laboratory to monitor all source activities >5 μCi.

For a quick reference on handling sources of different types and various activities, see Table 1.

Table 1. Guidelines for Handling Radioactive Sources.

Type	Activity	Guidelines
Sealed gamma-ray sources	~1 μCi	May be handled with fingers.
Unsealed beta and alpha sources	~1 μCi	May be handled with fingers by the outer diameter of the disk. But, do not touch the active source spot.
Any higher activity sources (sealed or unsealed)	>10 μCi	Use tongs or other devices for adding distance. Do not handle directly.
Neutron sources	1 to 3 Ci	Use long tongs. Follow the instructions provided by the manufacturer, or those in the license application.

Measurements in Health Physics from a Practical Point of View

In order to use radioisotopes in a counting laboratory, it is necessary to understand and use good health physics practices. Most of the radioactive sources used in the AN34 series of experiments are sealed, low-activity sources, and present no significant health physics problems. In many industrial, medical and research laboratories, high-activity, unsealed sources are often used. If a liquid source is accidentally spilled, the procedures for determining the types of radiation and the activity of the smears taken from the area involve the same techniques taught in the AN34 experiments. For added safety, however, consult the local health-physics authorities for specific instructions.

If, in the course of research, it is necessary to employ a “hot” (high-activity) source, it is wise to minimize exposure by:

1. Minimizing the time spent in the vicinity of the source,

2. Maximizing your distance from the source, and

3. Utilizing appropriate protective shielding between yourself and the source.

With knowledge of the source activity and the type of radiation, together with a wise compromise among shielding, distance and exposure time, the risks can be minimized when working with the radioactive sources normally encountered in the laboratory environment.

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Specifications subject to change
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