

Standard Operating Procedures for

Beta Ray, Gamma Ray, Compton, and Rutherford Experiments

Date: January 11, 2014

SOP Title: Cs-137 unsealed source in vacuum Beta Ray Experiment

SOP Title: Na-22, Co-60, Mn-54, Cs-137 all sealed Gamma Ray Experiment

SOP Title: Am-241sealed and Fe-55 sealed Compton Experiment

SOP Title: Am-241- unsealed source for Rutherford Scattering Experiment

RUA Number: 3271

Principal Investigator: Donald Orlando (510-642-5328)

Room and Building: 286 LeConte Hall

Lab Phone Number: 642-1937

Section 1 – Experimental Description and Process

- Survey the area with Geiger counter before removing any sources and starting your experiment. Notify Don Orlando immediately if any elevated readings are detected. For the Rutherford Scattering Experiment you should locate where the source is and measure the activity.
- **Always** wear the gloves provided when handling the Radiation sources and remove gloves before touching anything else. Survey gloves with Geiger counter and verify that they are free of contamination before disposing of them. Notify Don Orlando immediately if any contamination is detected.
- Place source inside the large yellow lead pigs while doing the experiment and remove when completed for the day.
- Place a sign which indicates the presence of a radioactive source by any pig that a source is left in.
- Do not leave sources inside the source pig without placing a sign on the pig informing others that there is a source inside.
- ***Except for Rutherford scattering where the source stays in the Alpha Gun. DO NOT Remove it!***

Section 2 – Hazardous Chemicals

No chemicals are used in these experiments

Section 3 – Potential Hazards

Radiation Hazards:

- Experiments involve radiation sources that emit Alpha, Gamma, and Beta radiation. The sources that you will be directly handling are gamma emitters of relatively low activity and of minimal hazard when handled for short periods of time.

High Voltage is a potential hazard:

- Be careful that all power supplies are off before connecting or disconnecting any high voltage cables and do so with one hand only. (PMT voltage).

The heavy lead bricks pose a potential crushing hazard:

- When handling bricks from the Gamma Ray Experiment be careful not to crush your fingers between bricks or to accidentally drop them on your feet or toes.

Section 4 – Approvals Required

All Users must go through Radiation on-line safety training and have completed the 111-Lab Pink sheet with printout of EH&S training certificate. These must be turned into the 111-Lab Staff.

Section 5 – Designated Area

Gamma Ray experiment located on the north-west wall of 286 LeConte Hall

Compton Scattering experiment located on the west wall of 286 LeConte Hall

Beta Ray located on the north wall in 286 LeConte

Rutherford scattering located on the north-east wall in 286 LeConte

Section 6 – Special Handling Procedures and Storage Requirements

- No eating around these experiments ONLY at benches marked with blue stripe.
- **DO NOT** touch radioactive sources with your bare hands, always wear gloves when handling radioactive sources. After handling radioactive sources, remove your gloves before handling any other equipment.
- Minimize the time spent handling radioactive sources to help keep your radiation dose **As Low As Reasonably Achievable (ALARA).**
- Where protective goggles provided
- All experiments using radioactive sources will have a dosimeter issued to personal. Personnel should wear their assigned dosimetry whenever handling the radioactive sources.
- All Radiation sources should be used according to these safety standards to keep your dose ALARA. Radiation sources must be kept inside the lead Pigs while used in these experiments at all times, except the **Rutherford Scattering Experiment** where the source always stays in the Alpha Gun.
- **Gamma Ray Experiment** – Only use gloves to handle radiation sources and remove gloves

before touching any equipment. After use, the sources will be returned to the Gamma storage pig.

- **Compton Scattering Experiment** – Only use glove to handle radiation sources and remove gloves before touching any equipment. When the source is in use, you should always have a sign placed on the outside of the big lead box stating that the source is inside.
- **Beta Ray Experiment** - The Radioactive source is **never** removed from the chamber under vacuum.
- **ALWAYS** wash your hands before eating, drinking, or leaving the laboratory.

Section 7 – Personal Protective Equipment

- All experiments using radioactive sources will have a dosimeter issued to personal. Dosimetry must be worn at all times while handling radioactive sources.
- Disposable Gloves must be worn at all times while handling radioactive sources.
- Wear protective goggles and/or safety glasses provided.
- Close-toed shoes must be worn at all times while working in the lab.

Section 8 – Security

- Physics 111-Lab will be closed after hours and no students will be working un-attended.
- Rooms containing radioactive material must be locked or under the control of RUA personnel such that measures can be effectively taken to prevent the unauthorized use or removal of the material.
- If non-RUA authorized users are permitted to be in the room where the radioactive materials are stored, then the radioactive material must be either under constant surveillance by RUA personnel or locked such that it cannot be used or removed by an unauthorized individual.
- The room in which our radioactive materials are stored is kept locked when users are not present. Users are trained to challenge unauthorized individuals when they enter the storage location. –Or- All radioactive materials must be kept in a locked storage
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Any loss or potential loss of radioactive material must be reported to EH&S (510-642-3073) as soon as possible after the loss is suspected.

Section 9 –Engineering, and Ventilation Controls

- N/A

Section 10 – Spill and Accident Procedures

Radiation Safety must be notified immediately of any of the following situations:

- A radioactive materials spill
- Skin contamination
- Ingestion of radioactive material
- Unexpected personnel exposure
- Airborne radioactivity
- Loss or theft of radioactive materials

In the event of a spill:

- Inform everyone in the immediate area and limit traffic near the spill.
- Use rad tape or signs to mark off the area of the spill.
- During business hours call the EH&S main line at 642-3073. After hours and on the weekends call UCPD at 642-3333. If you are in doubt as to whether the severity of a spill or other radiation incident warrants assistance from EH&S, call anyway. Where feasible, place absorbent materials on the spill area to minimize its spread.
- Do not allow lab personnel present to leave the area. Have them assemble nearby to be surveyed.
- Await further instructions from EH&S Radiation Safety on how to proceed.

In the event of skin contamination:

- Remove contaminated clothing and wash the contaminated skin area gently with mild soap and lukewarm water (never hot water!) Do not abrade the skin with rough scrubbing or excessive washing, and do not use solvents. Restrict movements, call Radiation Safety, and stay in the area until Radiation Safety arrives.

If the spill is significant, the RSO will help plan/coordinate the cleanup.

Section 11 – Waste Disposal

Waste disposal is not anticipated under normal work activities. EH&S will advise on proper waste management should the need arise.

Section 12 - Decontamination

Decontamination of personnel, work surfaces and/or equipment is not anticipated under normal work activities. EH&S will advise on proper decontamination techniques should the need arise.