

# Standard Operating Procedures for

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## Beta Ray, Gamma Ray, Compton, and Rutherford Experiments

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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-241 sealed 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 the experiment. Rutherford locate where the source and measure activity
- Use gloves provided when handling the Radiation sources and remove gloves when touching anything else
- Place source inside the large yellow lead pigs while doing the experiment and remove when completed for the day.
- Do not leave sources inside the source Pig without any sign placed on the pig telling people that there is a source inside
- ***Except for Rutherford scattering where the source stays in the Alpha Gun. DO NOT Remove it.!!***
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### Section 2 – Hazardous Chemicals

No chemicals used in this experiment.

## Section 3 – Potential Hazards

- DO NOT Touch sources with your bare hand
- High Voltage is a potential hazard. Be careful that all power supplies are off before connecting or disconnecting any high voltage cables. ( PMT voltage).
- No eating around these experiments ONLY at benches marked with blue stripe.
- Always use gloves provided when handling the radioactive sources.
- Do not use gloves to handle the equipment.
- Where protective goggles provided

## 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

- All experiments using radioactive sources will have a dosimeter issued to personal
- All Radiation sources should be used according to safety standards to keep your dose As Low As Reasonably Achievable (ALARA). They are placed inside the lead Pigs while used in these experiments at all times, except **Rutherford** where the source always stays in the Alpha Gun.
- **Gamma**-After use the sources will be returned to the Gamma storage pig.
- **Compton**-When source is in use always have a sign placed on the outside of the big lead box stating source inside.
- Beta source is never removed from the chamber under vacuum.

## Section 7 – Personal Protective Equipment

- All experiments using radioactive sources will have a dosimeter issued to personal
- All experiments using radioactive sources will have a dosimeter issues to personal
- Disposable Gloves supplied at experiments
- Safety glasses
- Close-toed shoes, hazard from heavy Lead bricks on Gamma experiment

## 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

**Dry Waste:** Collect the dry waste in double clear plastic bags. Be sure to use strong plastic bags that won't rip. Place waste into a lead container for protection. Label the waste container with a caution radioactive materials label and indicate the radionuclide. Once your waste bag is full, log onto RSIS to initiate its disposal and to print out the waste label. Place this label between the two plastic bags and seal the top shut with tape.

**Liquid Waste:** No sewer disposal of liquid radioactive waste is permitted. Collect all liquid radioactive waste in the one gallon poly carboys provided by EH&S. When you are not actively adding waste to your carboy, it should be kept tightly capped. Do not overfill the carboys - leave approximately three inches of space at the top. Use a funnel for filling the carboy. Use a large volume transfer pipette if any of the waste transfer steps are too precarious. Keep the carboy in secondary containment (e.g., buckets or Nalgene wash tubs, etc.) that is large enough to contain all of the waste. Maintain the pH between 5 and 10 for your radioactive liquid wastes.

When the waste container is full you can request an EH&S pick-up through RSIS. Keep liquid waste carboys stored in secondary containment until the waste is picked up by EH&S (this process typically takes five business days).

## Section 12 - Decontamination

Clearly label contaminated glassware or equipment until it has been decontaminated.

Surface of contamination can be cleaned with paper towels and a decontamination solution. Start by wetting a paper towel with your decontamination solution and, working from the outer edge of the contaminated area, wipe the surface inward toward the center of the contaminated area. Discard the towels into a radioactive waste container after each pass. Do not re-use the paper towels or wipe the contaminated area in a circular fashion. Repeat this until the paper towels are no longer picking up removable contamination.