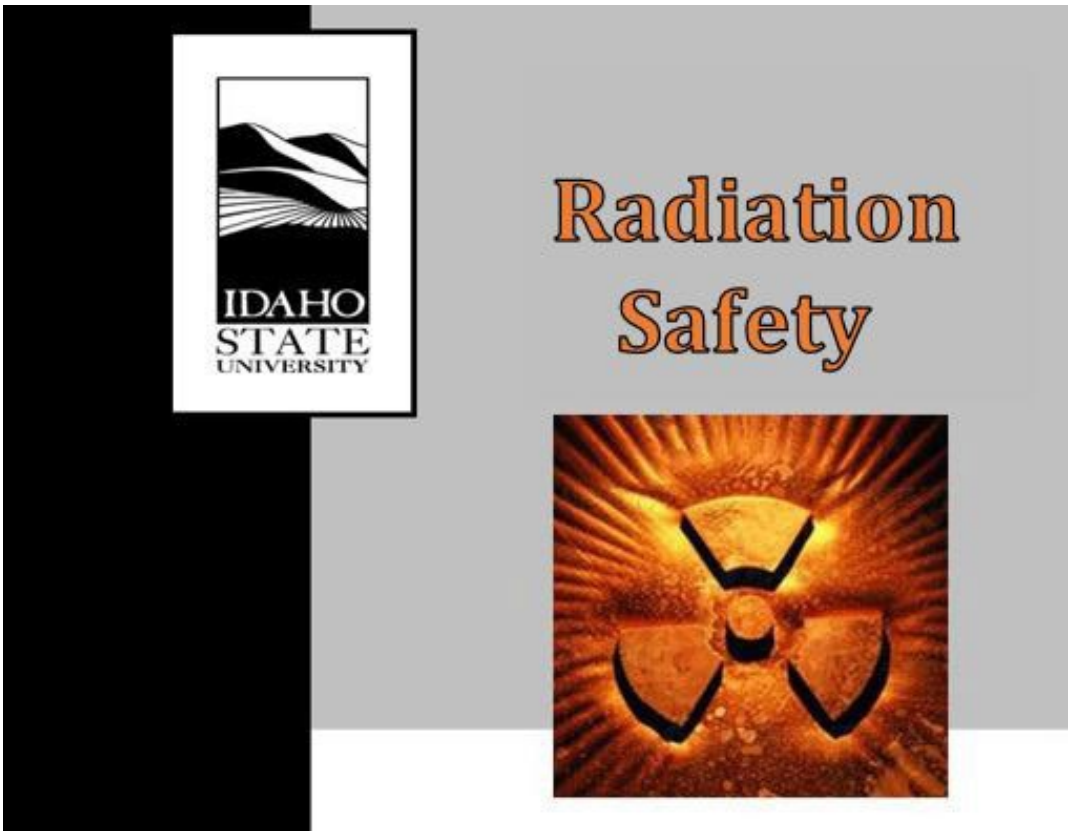

RADIATION PROCEDURES MANUAL

Procedure Cover Sheet

Procedure Title:	Creation and Accountability of Accelerator Activated Materials
Procedure Number:	IAC-RP-101 Rev 1
Effective Date:	8/7/2023

Approved By: Radiation Safety Committee Date: 7/28/2023

Revision History

Revision Number	Author Name	Date	Approved by/date
IAC-RP-101.0	Mason Jaussi & John Longley	07/01/21	RSC-07/01/21
IAC-RP-101.1	Mason Jaussi & Jon Stoner	07/19/23	RSC-07/28/23

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1. INTRODUCTION

The requirements of 10 CFR 20.1801, and 1802 specify the licensee secure licensed materials from unauthorized removal or access and maintain constant surveillance of licensed materials when not in storage. These regulations also apply to accelerator produced radioactive material, regulated as by-product material. The Idaho State University Radiation Safety Manual (RSM) requires that each Authorized User (AU) maintain complete records of all acquisitions, uses, transfers and disposals of radioactive material. Materials, both stable and radioactive, may be made into new radioactive materials either deliberately or inadvertently, when using a particle accelerator (including the electron LINACS at the IAC). This procedure applies to the production and management of those materials.

2. PURPOSE

This general procedure supplies users and staff the methods they must follow when materials are made radioactive when using an accelerator at the Idaho Accelerator Center.

3. SCOPE

This general procedure applies to the following:

1). Incidentally or inadvertently produced radioactive materials

2). Experiments to deliberately create radioactive materials with exceptions noted below.

Experiments that meet any of the following criteria are not covered by this general procedure are required to have a specific procedure:

- Production of copper-67.
- Activation of any material with atomic number greater than 83.
- Production of a mixed waste as defined under EPA regulations or the State of Washington Administrative Code and requiring disposal by ISU. ISU must determine that disposal paths are available for mixed waste and disposal costs must be borne by the experimenter. If a target produces mixed materials, but, is shipped to a licensee other than ISU with responsibility by that licensee for the target, the target may not be considered waste.
- Activation of materials that may become readily dispersible (liquids, powders, gases) during or after activation (including during analysis).
- A target that creates a radiation area prior to activation.
- A target that will create a high radiation area outside the accelerator hall.

Specific procedures are developed in collaboration with the director of the IAC and the Radiation Safety Officer and approved by the Radiation Safety Committee. These specific procedures should address the topics listed in Appendix A of this procedure.

4. ROLES AND RESPONSIBILITIES

- The Authorized User (AU) is responsible for the tracking and management of all radioactive material possessed, stored, acquired, or produced under his or her radiation safety program or license at the IAC.
- The Radiation Safety Officer is responsible for maintaining compliance with the limits established for the Radiation Safety Programs and Idaho State University's NRC licenses.
- The Radiation Safety Staff (RSS) and the Accelerator Operations Staff will assist the AU by performing tasks related to activated material accountability in accordance with this procedure.
- Experimenters must complete the General Activation Form and follow the instructions specified in this procedure.

5. REQUIRED MATERIAL(S)

- General Activation Form (Procedure IAC-RP-102)
- Dosimetry

6. REQUIRED TRAINING(S)

None.

7. PROCEDURE

The following sections outline the steps taken by the experimenters, radiation safety staff, and the accelerator operators to ensure safe and compliant accountability of activated materials.

7.1. Procedures for Deliberate Activation of Materials

7.1.1. Complete the General Activation Form as specified in IAC-RP-102, Section 6.4.

7.1.2. Obtain a target number from the RSS and enter the form.

7.1.3. Complete a description of the target on the General Activation Form.

7.1.4. Describe all materials including witness foils (e.g., nickel) and pure chemicals. If pure chemicals or RCRA metals (As, Ba, Cd, Cr, Pb, Hq, Se, Ag) are present, contact the AU or RSS to evaluate for possible mixed waste issues. Add discussion of sub parts (witness foils, etc). Subparts will be tracked as target number -001, -002, etc. Use additional pages as necessary to fully describe the target.

7.1.5. Enter the expected radionuclides that will be produced and expected activity of each. This should include the nuclides expected for research and impurity nuclides if possible.

7.1.6. Enter the irradiation date, start time, stop time, and elapsed irradiation time on the form.

7.1.7. Enter the beam parameters on the form.

7.1.8. Enter your name and the name of the accelerator operator on the form.

7.1.9. The accelerator operator will perform the irradiation in accordance with procedure IAC- RP-102.

7.1.10. After irradiation is complete, experimenter will obtain dose rate information from the accelerator operator and enter on the form.

7.1.11. Transfer the form to the RSS.

7.1.12. The RSS will enter the target information in the activated target log.

7.1.13. The experimenter will perform gamma spec measurements on the source and report measured activity to the RSS. Computations and/or computer codes may be used in place of gamma spectroscopy.

7.1.14. The RSS will update the activation log with the final activity.

7.1.15. The IAC will store the target for 30 days to allow the experimenter to perform necessary measurements.

7.1.16. At 30 days the experimenter will accept possession of the target and ship it to themselves or the RSS will transfer the target to radioactive waste. If transferred to radioactive waste, the waste tag number will be entered for storage location in the activated target log.

7.1.17. The RSS will maintain waste tags by calendar year. One waste tag will include items that are pure NARM (Ra-226 and accelerator produced). Separate waste tags will be created for other radioactive materials (U, Th, Np, etc.). Waste addition logs will be maintained for the NARM waste tags and will include all target numbers placed in the waste tag.

7.2. Procedure for Tracking of Incidentally or Inadvertently Produced Radioactive Materials

7.2.1. Accelerator components or experimental apparatus may become activated during routine operations when the electron beam energy exceeds 8-10 MeV. These components may be fixed to the accelerator and generally remain in the accelerator hall or may be instruments monitoring experiments that are not intended to be activated. If these components or instruments must be removed from the accelerator hall they must be screened/measured for the presence of radioactivity, labeled if the activity exceeds the labeling criteria in 10 CFR 20 Appendix C, inventoried if the activity exceeds the exempt quantity limits specified in 10 CFR 30 Schedule B, and stored in an appropriate container for reuse, decay in storage, or shipment. Instruments belonging to experimenters may be stored at the IAC or shipped to the experimenter if the experimenter's license allows it. See the RSO for all questions regarding inadvertently activated materials and shipment requirements.

8. LIST OF FORMS

General Activation Form (Procedure IAC-RP-102)

9. REFERENCES

None.

10. CHANGE HISTORY

Revision #	Changes
1	Revision 1 expanded the scope of the procedure to include general activation experiment criteria, which are covered by this procedure, and those that require specific procedures approved by the Radiation Safety Committee. An appendix was added to provide guidance for developing specific procedures. This revision also included the addition of Section 7.2, Procedure for Tracking of Incidentally or Inadvertently Produced Radioactive Materials.

11. APPENDICES

Appendix A – Requirements for Specific Activation Procedures

APPENDIX A – Specific Activation Procedure Criteria

Specific activation procedures should include the following sections:

- Introduction
  - Brief Summary of the project with goals
  - Potential hazards that might be encountered
  - Frequency of the experiment in a calendar year
  - Mention lessons learned if similar experiment was performed in the past
- Targets design and containment
  - Target specifications (weight, physical/chemical form, etc)
  - Target assembly or containment configuration (Diagrams/figures if any)
- Activation Conditions and Monitoring
  - The quantities of radioactive material(s), both intentionally and incidentally, to be produced (may attached calculated/estimated data as an appendix)
  - Estimated irradiation time in hours
  - Irradiation configuration and parameters
  - Instructions for personnel monitoring for radiation exposure from handling or breaching the target assembly
  - Engineering and administrative controls for keeping radiation exposures ALARA
  - Instructions for monitoring of the target for any leakage
  - Instructions for coolant water sampling to determine if contamination is present
  - Instructions on when to stop the experiment, if unusual event occurred
- Instructions for Loading, Unloading, and Packaging
  - Step by step instructions on loading, unloading, and packaging of the irradiated target
  - Instructions if lapel filters are required when transferring the target into the shipment container
  - Instructions on the transportation and storage of the target materials as necessary