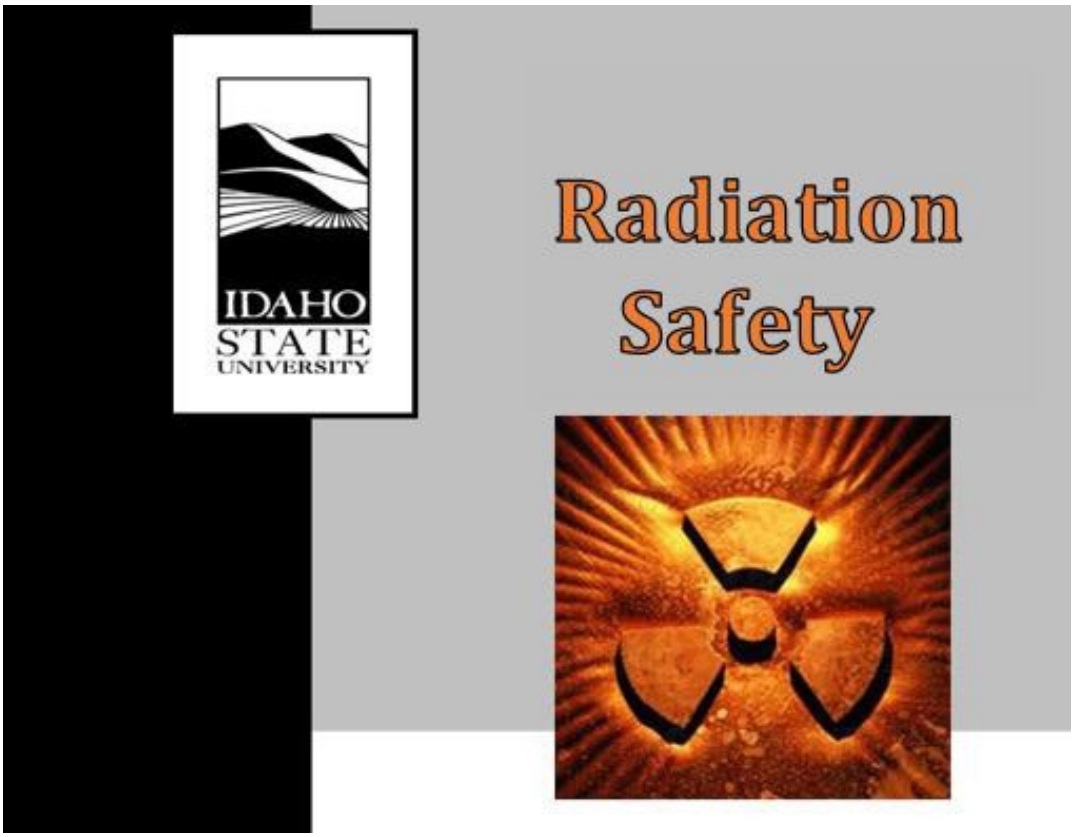

RADIATION PROCEDURES MANUAL

Procedure Cover Sheet

Procedure Title:	Radiation Safety for Accelerator Halls and Experimental Cells
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Revision History

Revision Number	Author Name	Date	Approved by/date
IAC-RP-102.0	Mason Jaussi & John Longley	08/01/21	RSC-08/01/21
IAC-RP-102.0	Kishor Paudel & Mason Jaussi	10/14/24	RSC-08/01/21

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1. INTRODUCTION

This procedure specifies instructions for radiation safety when operating radiation producing machines at the Idaho Accelerator Center (IAC), particularly the Main Hall and White Room accelerators. It specifies safety measures for accelerator operation and target handling. The irradiation of targets in the accelerator halls and experimental cells have the potential to create removable and/or fixed contamination and excess dose rates. The targets must be properly handled, monitored, and controlled to prevent the spread of contamination and unnecessary radiation exposure to personnel entering the accelerator halls or experimental cells.

2. PURPOSE

This procedure provides steps for keeping radiation exposures and the spread of contamination as low as reasonably achievable (ALARA) when working with accelerators, targets, converters, and shielding associated with radiation producing machines.

3. SCOPE

This procedure applies to all Radiation Workers when working in the accelerator halls or experimental cells during accelerator operations at the Idaho Accelerator Center.

4. ROLES AND RESPONSIBILITIES

All IAC Radiation Workers that enter the accelerator halls or experimental cells during experiments or operations have the responsibility to read, understand, and follow this procedure.

Accelerator operators are responsible for overall radiation safety when operating accelerators and for directing authorized visitors and ensuring their safety.

The Radiation Safety Department staff have the responsibility of providing radiological support to the accelerator operators and ensuring they have the proper PPE, instruments, etc. to safely perform their work.

The Radiation Safety Officer (RSO) has the responsibility to oversee the radiation safety program.

5. ACRONYMS/DEFINITIONS

ALARA:	As Low As Reasonably Achievable
HRA	High Radiation Area
IAC	Idaho Accelerator Center
ISU	Idaho State University
MeV	Megaelectron Volt
PPE	Personal Protective Equipment
RA	Radiation Area
RSO	Radiation Safety Officer
RWP	Radiological Work Permit

6. REQUIRED MATERIAL(S)

- Ta Whole-body dosimeter (for Radiation Workers who have been issued a Ta dosimeter)
- Electronic dosimeter
- Extremity dosimeter (when applicable)
- Beta/gamma dose rate instrument
- Neutron dose rate instrument (when applicable)
- GM survey instrument

7. REQUIRED TRAINING(S)

- ISU Radiation Safety Training

8. PROCEDURE

8.1. Visitor Policy

All visitors to the IAC controlled areas, outside of the Main Office and Receiving Areas, must comply with the following requirements. ISU facility maintenance and custodial staff are exempt from these requirements; except, they must be escorted into restricted areas.

8.1.1. All visitors to the IAC, with potential to enter a restricted area, are to receive radiation safety awareness training by the Authorized User or designee in accordance with the ISU Radiation Safety Manual, Section 8.4.

8.1.2. Visitors must sign the visitor log before accessing the IAC outside of the Main Office and Imaging Office areas.

8.1.3. Visitors accessing IAC restricted areas are to be escorted by IAC personnel.

8.1.4. The restricted area including Accelerator Halls and Experiment Cells must be surveyed prior to access by visitors or ISU facility maintenance personnel.

8.1.5. No visitor is allowed to tour the IAC or Imaging Lab outside of the Main Office area or Imaging Office area without being accompanied by an IAC escort. IAC facility maintenance workers are exempt from this requirement.

8.1.6. Tours must be approved by the Director of the IAC or by the RSO.

8.1.7. No more than 15 people may be in one tour group with one escort unless approved by the Director of the IAC.

8.1.8. All IAC customers and collaborators who intend to be present in IAC restricted areas when working on experiments must complete ISU general radiation safety training.

8.1.9. IAC customers and collaborators will be issued an electronic dosimeter if their work will enable them to access accelerator halls or experiment cells during accelerator operations. Issuance of an electronic dosimeter shall be performed by the accelerator operator.

8.2. Cell Preparation

The radiation producing machine should be started up using the machine specific procedure after performing the following steps.

8.2.1. Don dosimetry and fill out the Accelerator Log Form as appropriate.

8.2.2. Contact the Radiation Safety Department technicians to arrange instrument response checks on the handheld radiation detection instruments. If the gamma and neutron radiation area monitors are being used to determine area dose rates and associated postings, and not used to make supplemental or qualitative measurements, they must pass a response check. Neutron radiation area monitors are appropriate if the accelerator beam energy is to exceed 8 MeV. Ensure they complete the Survey Instruments section of the Accelerator Log Form.

8.2.3. Inspect the target area and remove any trash, tools, shielding, or maintenance equipment that is not required for the pending operation or experiment.

8.2.4. Check the exit path to ensure a clear egress.

8.2.5. Setup any converters, beam hardeners, or shielding necessary for the pending operation.

8.2.6. Start the interlock timer and clear the cell. The operator must be the last one out of the cell and must announce the hall/cell being cleared by stating in a loud clear voice "Everybody out" or similar language.

8.2.7. Perform an interlock check

8.2.7.1. This is performed by tripping or not setting any of the interlock limit, scram, or inspection switches.

8.2.7.2. All switches should be checked on a rotating basis.

8.2.7.3. Switches that would require the operator to enter a radiation area to reset the interlocks should not be used routinely for interlock checks.

8.2.7.4. Record the interlock check on the Accelerator Log form including the identification of the interlock used to perform the check i.e., "scram switch", "door interlock", "inspection button", etc.

8.2.8. Issue electronic dosimetry to IAC workers and authorized visitors and record information on the Accelerator Log Form as applicable.

8.2.9. As soon as practical, after the radiation producing machine is energized, perform a radiation dose rate survey covering as a minimum the access door to the hall/cell and the operator's station.

8.2.9.1. Post the area boundaries based on the measured dose rates. If neutron dose rate was also measured, add neutron and gamma dose rates together. The total dose rate value can then be used to determine the radiation area type and appropriate postings.

8.2.9.2. Record the results of the survey on the Accelerator Log Form.

8.3. Cell Entry Post Operation

The machine operator will be the individual to perform the initial entry after accelerator operation. However, the requirements of certain experiments will occasionally require additional individuals to enter the hall/cell to retrieve or replace samples. Visitors and non-ISU radiation workers are not permitted to access High Radiation Areas. Any authorized visitor performing entries to the machine hall/cell must be an approved radiation worker and must be supervised by the accelerator operator. The requirements for entrance into target caves are specified in the applicable Radiological Work Permit (RWP).

8.3.1. After the accelerator machine has been turned off, look for a downward trending dose rate on the RAM in the hall.

8.3.1.1. If there is not a decrease in the exposure rate reading from the RAM after 10-15 seconds, **DO NOT ENTER THE CELL.**

8.3.1.2. Verify that the accelerator is turned off.

8.3.2. A handheld dose rate instrument must be used to enter a hall/cell after running and the audio function must be enabled.

8.3.3. Open the hall/cell door and obtain a dose rate measurement then proceed to enter.

8.3.4. Measure the initial reading at the door and the highest measured reading during the entry. Note any high radiation areas (> 100 mrem/hr at 30-cm) and restrict authorized visitors from accessing these areas.

8.3.5. At completion of operation, lock the hall and update the posting based on the survey results and record on the Accelerator Log Form.

- High Radiation Area (HRA): > 100 mrem/hr at 30-cm
- Radiation Area (RA): > 5 mR/hr at 30-cm.

8.3.6. Record final readings from the electronic dosimeter(s) on the Accelerator Log Form

8.4. General Target Removal

All activated targets must be removed following these procedures unless superseded by a specific procedure e.g., Cu-67 targets under IAC-RP-103.

8.4.1. Have the experimenter (Authorized visitor) complete the target description and expected radionuclide information on the General Activation Form.

8.4.2. Survey the target and converter area with a dose rate instrument prior to attempting to remove the target.

8.4.2.1. Always wear gloves when handling a target and use tongs, bags, and long reach tools to minimize contact with the target during operations.

8.4.2.2. Take a closed-window dose rate measurement 30-cm from the target. If the target exposure rate is greater than 100 mrem/hr coordinate the target movement with the Radiation Safety Department.

8.4.2.3. If the target exposure rate (closed-window) is less than 100 mR/hr at 30-cm, take an open-window measurement on contact with the target. If the open window reading is greater than 500 mR/hr the target must be moved with tongs while wearing a ring dosimeter.

8.4.2.4. Record the target dose rate measurements on the general activation form.

8.4.2.5. Place the target in a plastic bag labeled as radioactive material.

8.4.2.6. If removable contamination is expected, Radiation Safety personnel collect a swipe sample on the plastic bag. If contamination is detected, perform decontamination and re-swipe the bag, transfer the target to a clean bag, or place it in a double bag.

9. FORMS

Accelerator Log Form

General Activation Form

Visitor Log

10. REFERENCES

None.

11. CHANGE HISTORY

None.

12.APPENDICES

None.