



Radiation Safety

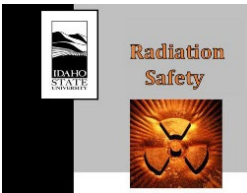


RADIATION PROCEDURES MANUAL **Procedure Cover Sheet**

Procedure Title: Operational Procedures for the Shepherd Irradiators
Procedure Number: RS-15 Rev.0
Effective Date: 01/31/2021

Approved By: Radiation Safety Committee

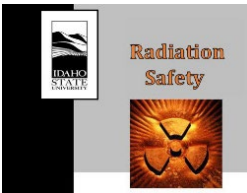
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Revision History

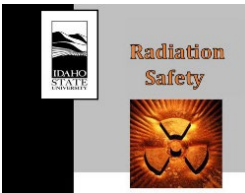
| Revision Number | Author Name | Date | Approved by/date |
|-----------------|-----------------------------|----------|------------------|
| RS 15.0 | Mason Jaussi & John Longley | 01/04/21 | RSO-01/04/21 |
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1. INTRODUCTION

The Shepherd irradiators are traceable calibration sources from the National Institute of Standards and Technology (NIST) used to conduct experiments at Idaho State University (ISU).

2. PURPOSE

The purpose of this procedure is to familiarize the user with the safe and compliant operation of the Shepherd irradiators.

3. SCOPE

This procedure applies to radiation safety staff and radiation workers who use the Shepherd irradiators and those radiation workers seeking authorization for unrestricted use.

4. ROLES AND RESPONSIBILITIES

Radiation Safety Staff has the responsibility to train and perform the authorization process for prospective users in accordance with this procedure.

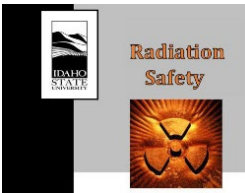
Authorized Personnel have the responsibility of operating the Shepherd irradiators in accordance with the requirements in this procedure.

5. ACRONYMS/DEFINITIONS

ALARA: As Low As Reasonably Achievable
ISU: Idaho State University
NIST: National Institute of Standards and Technology
RSO: Radiation Safety Officer

6. REQUIRED MATERIAL(S)

- Keys
- Ion Chamber
- Whole-body Dosimetry
- Tape measure
- Radiation Postings



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7. REQUIRED TRAINING(S)

- ISU Radiation Safety Training

8. PROCEDURE

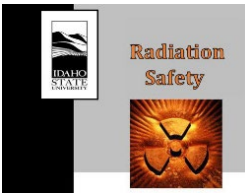
8.1. Specific Precautions

- 8.1.1. Make sure to apply ALARA practices (to keep dose as low as reasonably achievable). Do not stand in the irradiation cell when an irradiation is being performed. Minimize the time setting up or retrieving items from the carriers and never loiter in the irradiation cell, even if both sources are in their secured housing. Maximize the distance between yourself and the irradiators whenever practical.
- 8.1.2. No personnel are allowed in the irradiation cell while the High-Range Irradiator is operating unless pre-authorized written permission is obtained from the ISU Radiation Safety Officer (RSO).
- 8.1.3. Do not operate either irradiator unless you have been authorized by the ISU Radiation Safety Department (RSD).

8.2. Authorization

Radiation workers may be authorized for unrestricted use of the Shepherd irradiators provided they meet the following requirements.

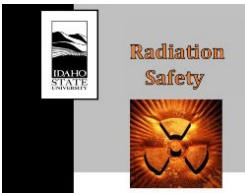
- 8.2.1. The applicant must be a radiation worker, have whole-body dosimetry, and demonstrate a legitimate need to use the irradiator. The RSO reserves the right to **revoke or deny access to the irradiators for any reason they seem fit.**
- 8.2.2. A member of the radiation safety staff will provide the radiation worker with a walk-through demonstration of how to properly use the irradiators per this procedure. The radiation worker must read and acknowledge compliance with this procedure. The radiation worker must successfully pass a written exam pertaining to the instructions in this procedure. Upon successful completion of these requirements, the radiation safety staff member will sign the Shepherd Irradiators Authorization Form, authorizing the individual unescorted access.



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8.3. Operation of the Low-Range Irradiator

- 8.3.1. Gather required materials and verify the ion chamber is within calibration and has been response checked.
 - 8.3.2. Enter the irradiator control room and verify the exposure rate is less than 0.5 mR/hr inside the irradiator cell.
 - 8.3.2.1. If the exposure rate is greater than 0.5 mR/hr, the low range source window is open.
 - 8.3.2.2. Close the low-range source window by pressing down on the black knob on top of the irradiator. Ensure the light on the top of the irradiator is off and re-check the exposure rate.
 - 8.3.2.3. If the exposure rate is still greater than 0.5 mR/hr at the entrance, close and lock the irradiator cell and irradiator control room door and contact the Radiation Safety Department.
 - 8.3.3. Determine the required distance for the desired exposure rate
 - 8.3.4. Following the procedure in RS-12, Calibrations, Appendix A, reset the rail system and enter the required distance on the controller.
 - 8.3.5. Place the item on the carrier and ensure it is centered in the irradiator beam path. Set the camera in the desired position, if necessary.
 - 8.3.6. Ensure the irradiator cell is clear of items that are not intended to be irradiated.
 - 8.3.7. Unlock the padlock on the low-range irradiator and set aside.
 - 8.3.8. Begin irradiation by pulling the black knob on top of the irradiator up and securing the handle with the metal holder.
 - 8.3.9. Close the irradiator cell door. Post the irradiator cell room as High Radiation Area when source is exposed.
- NOTE: The Authorized Personnel is responsible for preventing unauthorized access to the exposed source. If you must leave the irradiator running unattended, the door to the irradiator room and the door to the control room must be locked and the appropriate radiation area posting must be on the doors.
- 8.3.10. After the desired measurement is made, device is calibrated, or when the time required to obtain the desired exposure is reached, remove the metal holder and push the black knob down to close the shutter.
 - 8.3.11. Verify the light on the top of the low-range irradiator is off and survey just inside the cell door to verify the source is in the closed position. The exposure rate will be less than 0.5 mR/hr at the cell door.



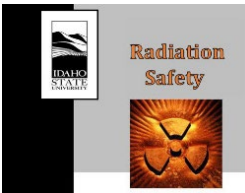
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- 8.3.12. When the irradiations are complete, replace the padlock on the low-range irradiator and lock the padlock.
- 8.3.13. Remove the item that was irradiated.
- 8.3.14. Turn the light off, ensure the irradiator cell door and irradiator control door are locked and the area postings are correct. Update radiological postings.
- 8.3.15. Return the Shepherd keys to the Radiation Safety Department.

8.4. Operation of the High-Range Irradiator

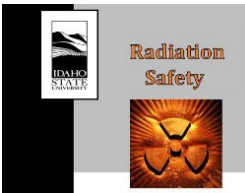
NOTE: The High-Range Irradiator is capable of producing a High Radiation Area (greater than 100 mrem/hr at 30-cm) in the vicinity of the exposed beam. No individuals are allowed in the irradiation cell during operation of the High-Range Irradiator unless written pre-authorization is provided by the Radiation Safety Officer. The irradiator cell door is interlocked with the High Range Source as an additional safety measure. Opening the cell door will trip the interlock and the source window will close. The interlock system should not be used as a method of shutting down the irradiator during routine operations.

- 8.4.1. Gather required materials and verify the ion chamber is within calibration and has been response checked.
- 8.4.2. Enter the irradiator control room and verify the exposure rate is less than 0.5 mR/hr inside the irradiator cell.
 - 8.4.2.1. If the exposure rate is greater than 0.5 mR/hr, the low range source window is open.
 - 8.4.2.2. Close the low-range source window by pressing down on the black knob on top of the irradiator. Ensure the light on the top of the irradiator is off and re-check the exposure rate.
 - 8.4.2.3. If the exposure rate is still greater than 0.5 mR/hr at the entrance, close and lock the irradiator cell and irradiator control room door and contact the Radiation Safety Department.
- 8.4.3. Determine the required distance for the desired exposure rate
- 8.4.4. Measure the required distance from the front of the calibrator
- 8.4.5. Place the item on the carrier and ensure it is centered in the irradiator beam path. Set the camera in the desired position, if necessary.
- 8.4.6. Ensure the irradiator cell is clear of items that are not intended to be irradiated.
- 8.4.7. Close the irradiator cell door.



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- 8.4.8. Turn on the air to the shutter lifting mechanism. The valve is located in room B101 behind the fume hood closest to the irradiator control room. The valve has a yellow handle. Pull the valve into the vertical (ON) position. You will hear the air flow.
- 8.4.9. In the irradiation control room, set the time to irradiate on the interlock controller. If performing a dose-rate calibration and a pre-set time is not necessary, then flip the control switch to the manual position.
- 8.4.10. Turn the power ON to the interlock controller. The yellow overhead door lights will begin to flash.
- 8.4.11. Turn the ORTEC power supply switch to the ON position. The red warning light will illuminate.
- 8.4.12. To begin the irradiation, insert the key into the controller and turn it to the right
- 8.4.13. Post the irradiator cell door as High Radiation Area when the source is exposed.
- NOTE: The Authorized Personnel is responsible for preventing unauthorized access to the exposed source. If you must leave the irradiator running unattended, the door to the irradiator cell and the control door must be locked and the appropriate radiation area posting must be on the doors (Radiation Area or High Radiation Area).
- 8.4.14. To stop the irradiation, press the green OFF button directly below the control key. If using the pre-set timer, irradiation will stop once the time has expired. You will hear a brief sound of air flow once the irradiation has stopped. This is the shutter closing.
- 8.4.15. Wait for the red indicator light to go off and remove the key from the controller and keep it on your person during the remainder of the irradiation operation.
- 8.4.16. Turn the power OFF to the interlock controller.
- 8.4.17. Perform a dose rate survey while entering the room to verify the source is back in the shielded position.
- 8.4.18. Retrieve the irradiated item.
- 8.4.19. When finished using the High-Range Irradiator, turn the air flow OFF, turn the lights OFF, and ensure the irradiator cell and control room doors are locked. Update the radiation area postings on the irradiator cell and control room doors.
- 8.4.19.1. It should not be posted as a radiation area if the irradiators are not running and the sources are in their locked positions. Verify the dose rates with the ion chamber. If you are reading 5 mrem/hr outside the control room door, secure the area and contact the Radiation Safety Department.



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9. LIST OF FORMS

Shepherd Source Personnel Authorization Form

10. REFERENCES

None.

11. CHANGE HISTORY

Revision 1 - Reformatted in accordance with RS-27 and removed steps regarding calibration of dose rate instruments.

12. APPENDICES

None.