

University of Maryland Baltimore

Radiation Safety Procedure

Procedure Number: 5.1

Title: Radiation Safety Involving Irradiators

Revision Number: 0

Effective Date: March 1, 2002

Technical Review and Approval:

_____ **Date:** _____
Radiation Safety Officer

Radiation Safety Committee Approval:

_____ **Date:** _____
Chair, Radiation Safety Committee

PROCEDURE 5.1 - RADIATION SAFETY INVOLVING IRRADIATORS

1.0 PURPOSE:

This procedure outlines the organizational and administrative programs established by UMB to ensure that the Radiation Safety Program is implemented in a manner that provides an optimum level of radiological safety for affected workers, members of the public, and the environment. This procedure establishes organizational and administrative systems that will ensure effective program implementation and compliance with applicable regulations and licenses, in particular:

- Maryland State Regulations for the Control of Radiation, Part D, "Standards for Protection Against Radiation";
- Maryland State Regulations for the Control of Radiation, Part G, "Use of Radionuclides in the Healing Arts";
- Maryland State Regulations for the Control of Radiation, Part J, "Notices, Instructions, and Reports to Workers; Inspections"; and
- Maryland State Radioactive Material Licenses 07-014-01 and 07-014-04

2.0 SCOPE:

The requirements of this procedure apply to all self-shielded irradiators that operate under UMB's Radiation Safety Program.

3.0 PROCEDURE

3.1 *Authorized Users*

Any individual who wishes to acquire, receive, possess, use, or transfer a self-shielded irradiator must be authorized by EHS and the RSC. The Authorized User is responsible for ensuring that the irradiator is used, handled, and stored in accordance with the requirements of the UMB Radiation Safety Program and any other written or verbal instructions provided by EHS.

Specific responsibilities of the Authorized User include:

- Ensuring that all individuals using the irradiator have attended irradiator radiation safety training provided by EHS
- Instructing individuals under their supervision in the principles of radiation safety as may be appropriate to the individual's activities (Note: Radiation safety training provided by EHS addresses general radiation safety principles. The AU's responsibilities in this regard extend only to those measures that are applicable to the specific irradiator and procedures in use);
- Reviewing the supervised individuals' use of irradiators and records of that use and providing additional instruction as needed

3.2 Facilities and Equipment:

UMB recognizes that self-shielded irradiators incorporate many engineering features to protect individuals from unnecessary radiation exposure. Facility and equipment requirements for self-shielded irradiators will be evaluated on a case-by-case basis by EHS.

- 3.2.1 Since irradiators vary in weight, the floors supporting an irradiator must be evaluated to ensure that they are sufficient. Upon notification of acquisition, EHS will work with Facilities Management to evaluate the structural support of irradiator locations to ensure the facility is adequate in this regard.
- 3.2.2 All irradiator facilities must be secured in order to prevent unauthorized access to the irradiator as well as unauthorized removal of the equipment.
- 3.2.3 Each area where a self-shielded irradiator is located shall be equipped with an automatically operated fire detection and control system (sprinkler, chemical, or gas) or the area and other controls ensure a low-level radiation risk attributable to fires.

3.3 Audit Program

EHS will perform routine audits of irradiator facilities to ensure radiation safety procedures are complied with and appropriate records are maintained. Procedures for performing such audits are established in Procedure 1.5, *Radiation Safety Audit Program*.

3.4 Radiation Monitoring Instruments

Authorized users of irradiator facilities must possess, or have access to, radiation monitoring instruments, that are necessary to protect health and minimize danger to life and property. Instruments used for quantitative radiation measurements must be calibrated on an annual basis.

Additionally, users of J.L. Shepherd Mark I or Model 81-22 irradiators must comply with the terms of the order in Appendix E of NUREG 1556, Volume 5, "Program Specific Guidance About Self-Shielded Irradiator Licenses". Users of such irradiators must ensure that radiation detection instruments meet these requirements.

3.5 Material Receipt, Leak Testing and Accountability

The RSO and Authorized Users must maintain accountability for self-shielded irradiators by conducting physical inventories at intervals not to exceed six months to account for all sealed sources. Procedures for performing inventories and leak tests of sealed sources are described in Procedure 2.3, *Sealed Radioactive Source Use, Inventories, and Leak Tests*.

UMB may achieve access control by permitting only Authorized Users or the RSO to have access to the keys for the irradiator and or the irradiator area. Accountability of an operating irradiator may be ensured by using a log book to record irradiator use, maintenance, service calls, and sealed source leak tests. Each activity requires an individual to interact in some way with the irradiator and thereby verify its presence. Records of use and leak tests may be used as part of the accountability program.

3.6 Control of Exposures

3.6.1. Occupational Dose

- UMB must perform an evaluation demonstrating that unmonitored individuals are not likely to receive, in one year, a radiation dose in excess of 10% of the allowable limits; or
- UMB must provide dosimetry to irradiator users.

3.6.2. Public Dose

- UMB must ensure that self-shielded irradiators will be used, transported and stored in such a way that members of the public will not receive more than 100 mrem in one year, and the dose in any unrestricted area will not exceed 2 mrem in any one hour.

- UMB will control and maintain constant surveillance over self-shielded irradiators that are not in storage and secure stored irradiators from unauthorized access, removal, or use.

3.7 Operating and Emergency Procedures

Before operating an irradiator the RSO and Authorized User must have operating and emergency procedures in place.

3.7.1 Operating Procedures

UMB shall develop, implement and maintain model-specific operating procedures containing the following elements:

1. An analysis of each type of material to be placed in the irradiator to ensure that it is compatible with the irradiator's design or to determine if any special safety procedures are needed;
2. Instructions for using the self-shielded irradiator and performing routine maintenance, according to the manufacturer's (or distributor's) written recommendations and instructions;
3. Instructions for maintaining security to prevent unauthorized use, access, or removal of self-shielded irradiators and the associated sealed sources;
4. Steps to take to keep radiation exposures ALARA;
5. Steps to maintain accountability;
6. Steps to control access to a malfunctioning or damaged irradiator;
7. Steps to take, and whom to contact (e.g., RSO, local officials), when an irradiator malfunctions or has been damaged.

3.7.2 Emergency Procedures

UMB shall develop, implement and maintain model-specific emergency procedures containing the following elements:

1. Instructions to leave the irradiator room to reduce radiation exposure;
2. Control access (e.g., lock door);
3. Contact the individual responsible for the irradiator program for further instructions and to initiate emergency response (Telephone numbers for the responsible individual, the

- irradiator manufacturer (or distributor) or its representative, fire department, or other emergency response organization, and the State of Maryland should be posted or easily accessible);
4. Survey areas outside the irradiator room to determine whether further restriction of the area is necessary to ensure that no one can enter if the radiation level exceeds 2 mrem per hour;
 5. As appropriate, require timely reporting to State Of Maryland according to COMAR 26.1.2.01.01.

Copies of operating procedures shall be provided to all irradiator users. A current copy of operating and emergency procedures must be maintained at each irradiator's control panel (or, if this is not practicable, post a notice describing the procedures and stating where they may be examined).

3.8 Maintenance

3.8.1 Routine Maintenance

Authorized Users must routinely maintain self-shielded irradiators according to the manufacturer's (or distributor's) written recommendations and instructions. For self-shielded irradiators, radiation safety procedures for routine maintenance must consider ALARA and ensure that the irradiator functions as designed and source integrity is not compromised. Authorized Users are permitted to perform routine maintenance of the irradiator provided they follow the self-shielded irradiator manufacturer's (or distributor's) written recommendations and instructions. Although manufacturers may use different terms, "routine maintenance" includes, but is not limited to, cleaning, lubrication, changing batteries, relays or fuses. Routine maintenance does not include any activities that involve the source, source drive mechanism, or removing the shielding or source and any other activities during which personnel could receive radiation doses exceeding State limits. Records of routine maintenance shall be maintained in the log book of the specific irradiator serviced.

3.8.2 Non-routine Maintenance

Non-routine maintenance must be performed by the self-shielded irradiator manufacturer (or distributor) or a person specifically authorized by NRC or an Agreement State. Non-routine maintenance means any repair, replacement, or alteration involving: electrical and mechanical systems that control source or shielding movement, the irradiator's shielding or sealed source, safety interlocks, any component that may

affect safe operation of the irradiator, or any other activities during which personnel could receive radiation doses exceeding State limits. Individuals who perform non-routine maintenance do require personnel monitoring devices.

Generally, before any maintenance or repair work is done, Authorized Users need to determine the following:

- The tasks to be performed;
- The protocol or procedures to be followed;
- The radiation safety procedures including possible need for compensatory measures;
- ALARA considerations;
- Training and experience of personnel performing the work;
- The qualification of parts, components, other materials to be used in the irradiator;
- The tests (to be performed before the irradiator is returned to use) to ensure that it functions as designed.

3.9 *Transportation*

Authorized Users must notify EHS before relocation or transportation of any self-shielded irradiator. EHS will develop, implement, and maintain safety programs for transport of irradiators to ensure compliance with MDE and DOT regulations.

3.10 *Disposal*

Authorized Users must notify EHS prior to discontinuing use or disposing of any self-shielded irradiator. EHS will arrange for the proper disposal via transfer to an authorized recipient.

4.0 *Records and Reports*

4.1 *Records*

Records are required to document material accountability, leak testing, program audits, maintenance, transportation and disposal of self-shielded irradiators. Procedures for producing, reviewing, and maintaining radiation safety records are established in Procedure 1.2, *Radiation Safety Records*.

4.2 Reports

Maryland State regulations governing UMB's Radiation Safety Program establish requirements for reports addressing incidents, individual doses, and other matters. Requirements for preparing and filing these reports are established in Procedure 1.3, *Radiation Safety Reports*.

5.0 References:

COMAR, Sections A-J
UMB Radiation Safety Program
Maryland License MD-07-014-01
American National Standard, ANSI/ASQC Q9001-1994
USNRC NUREG 1556, Vol. 5, "Program Specific Guidance About Self-Shielded Irradiator Licenses", 1998.