Juniata College

Radiation Safety Manual Table of Contents

RADIATION SAFETY POLICY 4

INTRODUCTION 5

PROGRAM MANAGEMENT 6

Organization 6

Authority and Responsibilities 7

President\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 7

Dean of the College\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_7

Radiation Safety Officer \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_7

Radiation Safety Lab Technician\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 8

Department Heads 9

Faculty & Staff Members 9

Undergraduate Research Students 10

Ancillary Workers 10

TRAINING & QUALIFICATIONS 10

*Radioactive Material Workers* 10

Initial Training 11

Annual Training 11

*Radiation Safety Officer* 11

Initial Training 11

Annual Training 12

*Faculty & Staff Members* 12

Initial Training 12

Annual Training 12

*Ancillary Workers 13*

Initial Training 13

Annual Training 13

RADIOACTIVE MATERIAL CONTROL 13

Possession Limits 13

Sealed & Unsealed Sources of Radioactive Material 13

X-ray Generating Devices 14

Receipt 14

Inventory 15

Storage 15

Shipping 15

Disposal 15

EXPOSURE CONTROL AND MONITORING 15

Contamination Control 15

Administrative Measures \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_15

Engineering Measures \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_16

External Exposure Monitoring 16

Administrative Measures 16

Engineering Measures 16

Surveys 17

WASTE MANAGEMENT 17

EMERGENCY RESPONSE 17

Responsibilities 18

Radiation Worker 18

Radiation Safety Officer 18

Administration 19

PROGRAM ASSESSMENTS 19

Audits and Assessments 19

Incident Investigation 19

RECORD KEEPING 20

APPENDICES

Appendix 1 Policy Concerning Dose to the Embryo/Fetus of an Occupationally Exposed Radiation Worker

Appendix 2 Procurement of Radioactive Material

Appendix 3 General Radioisotope Laboratory Safety

Appendix 4 Radioactive Material Receipt Survey Methods

Appendix 5 Surveys of Radioactive Material Use and Storage Areas

Appendix 6 Safe Operation of the Electron Microscope

Appendix 7 Radiation Generating Device Survey Methods

Appendix 8 Safe Practices for the Storage and Disposal of Radioactive Materials

Appendix 9 Emergency Instructions for the Handling of Radioisotopes

Appendix 10 USNRC Materials License No. 37-06520-01

PA DEP Certificate of Registration No. 40-02872

# RADIATION Safety Policy

The safety and health of our employees is of primary concern to Juniata College. Compliance with all applicable Federal, State and local regulations governing our operations is one element of a program to ensure a safe and healthy work environment.

This Radiation Safety Program has been designed to meet the applicable requirements of the Pennsylvania Department of Environmental Protection (PADEP) or Nuclear Regulatory Commission (USNRC). Where differences between state and federal requirements exist, the standards of the agency with the responsible jurisdiction will be implemented and specified in site specific procedures. This program establishes minimum radiation protection standards for all personnel at Juniata College. These standards are applicable to all contractors and Juniata College user personnel who may be exposed to radiation or radioactive material resulting from activities within the facilities at the College. Exceptions for planned or anticipated deviations from the requirements of this manual shall be authorized only through Radiation Safety Officer.

Radiation safety procedures and regulatory standards shall be followed in the event specific detailed guidance on a particular subject is not provided for in manuals, procedures or supervisory instructions. Where the requirements of this program differ from the referenced procedures or federal standards, the one providing the most restrictive, i.e., greater personnel protection, shall govern.

This program is to be implemented as a mandatory standard, for all employees whose jobs result in a potential occupational exposure to the sources of ionizing radiation utilized at Juniata College.

Non-compliance with this standard can result in disciplinary action.

(Signed) Date

 **PRESIDENT OF THE COLLEGE**

(Signed) Date

#  PROVOST

(Signed) Date

 **RADIATION SAFETY OFFICER**

# Introduction

Juniata College possesses a specific license issued by the Nuclear Regulatory Commission for the use and possession of radioactive materials. The College maintains a current registration with the PA Department of Environmental Protection for the use of radiation generating devices. The operations that involve the use of radioactive material or sources of ionizing radiation include the following:

* Use of 60Co sealed sources in laboratory experiments.
* Use of radiation generating machines in the laboratory.
* Use of unsealed radioisotopes in laboratory experiments and research projects.

This program is designed to maintain exposures **A**s **L**ow **A**s **R**easonably **A**chievable (ALARA) through the use of engineering controls, training and awareness and administrative control procedures.

# Program Management

## Organization

Figure 1 below shows the organization and reporting structure for conduct of Juniata College’s Radiation Safety Program.

Figure 1

Juniata College

Radiation Safety Program Organization

 Juniata College President

 Provost

Director of Science Facilities and Safety Radiation Safety Officer

 Faculty & Staff

 Research Students

## Authority and Responsibilities

### President

Is responsible for general direction and assurance of quality measures within the radiation safety program. The President delegates the daily overview to the Provost and Radiation Safety Officer.

*Provost*

Is the person to whom the Radiation Safety Officer directly reports. The provost is the institutional official that signs all correspondence to the USNRC and PADEP. Originals of USNRC documents are filed in the Office of the Provost. The Provost receives and reviews the written report containing the results of the annual radiation safety program audit and recommendations for corrective action.

Radiation Safety Officer

The Radiation Safety Officer (RSO) has responsibility for the overall conduct of the program and compliance with license requirements. The RSO has the authority to suspend laboratory operations immediately, in part or in whole, if the laboratory supervisor fails to maintain full compliance with the Juniata College radiation safety program.

If suspension of operations is necessary, the RSO will generate a written incident investigation. This report will describe the reasons for suspension, the actions taken and the recommended corrective actions that need to be implemented to prevent recurrence.

Changes to written procedures or other documents related to the radiation safety program must be authorized by the RSO before implementation. Provided the change does not alter 10CFR20 requirements, Title 25 requirements or license conditions, the change need not be submitted to the USNRC or PADEP as an amendment request.

The Radiation Safety Officer is responsible for:

* Developing program procedures and policies and disseminating information contained within those documents.
* Reviewing and approving changes to radiation safety program procedures;
* Ensuring development and implementation of a training program that meets the requirements of the license and manual;
* Initiating and submitting license changes when revisions to license are needed to maintain compliance with USNRC and PADEP regulations;
* Monitoring work practices, periodically, to ensure compliance with procedures and license requirements.
* Performing or ensuring the performance of an annual program assessment; and
* Coordinating the implementation of corrective actions needed for items of non-compliance or recognized general program deficiencies.

Director of Science Facilities and Safety

* Reviewing and verifying the receipt and shipment of radioactive materials;
* File quarterly waste disposal reports to the Pennsylvania Department of Environmental Protection;
* Perform or supervise the periodic surveys of analytical x-ray devices; and
* Assist the RSO during annual program reviews and/or inspection by the regulatory agency, or at other times at the request of the RSO.

Science Department Staff

* Performing or supervising surveys of incoming packages of radioactive material and ensuring that the materials are delivered to the authorized individuals;
* Performing or supervising surveys of radioisotope lab(s) as required by Juniata College license and this manual;
* Maintaining the inventory for radioactive materials;
* Notifying the radiation safety officer of incoming or outgoing shipments of radioactive materials; and
* Responding to worker notifications of program deficiencies, unsafe conditions or unsafe practices by either correcting the problem or alerting the RSO and asking for help in resolving.

###  Department Heads

* Ensuring that members of faculty and staff, and undergraduate students adhere to program and license requirements; and
* Participating in the review of incidents and the development and implementation of corrective actions to prevent recurrence.

Faculty Members

* Monitoring site work practices to ensure compliance with program and license requirements;
* Ensuring that work by personnel and students under their supervision is performed in accordance with written procedures and the requirements of this manual;
* Ensuring untrained personnel do not perform duties related to receiving, disposing or otherwise handling radioactive material and/or radiation generating devices;
* Coordinating and ensuring personnel receive training at the frequency noted in this manual;

### Undergraduate Research Students

* Performing work in accordance with written procedures and the requirements of this manual;
* Maintaining potential exposures ALARA by reducing non-productive work time in an area where radioactive materials are present; and
* Notifying their supervisor or the RSO whenever they identify a program deficiency, unsafe condition, or unsafe practice.

### Ancillary Workers

* Participating in annual radiation safety awareness training;
* Adhering to warnings and postings involving access to or handling of radioactive materials or radiation generating devices;
* Reporting potential program deficiencies to their supervisor or the RSO.

# Training & Qualifications

### Radioactive Material Workers

Personnel are considered radioactive material workers if their work involves entry into a restricted area or direct handling of radioactive material sources or radiation generating devices. This includes the following individuals:

* department heads and faculty members
* staff members or visiting researchers
* undergraduate research students

The above list does not include those personnel who happen to have duties that cause them to pass by but not be involved in radioactive material work or analytical x-ray equipment use.

### Initial Training

All radioactive material workers will receive training prior to handling of the radioactive material. Likewise, all operators of radiation generating devices will receive training prior to the utilization of the equipment. All training will be designed to ensure the student can meet specific objectives as stated in each training program.

### Annual Training

Annual ‘refresher’ training will be provided to all workers and will consist of:

* A summarization to reinforce the initial training objectives
* A summary of license and procedure changes and their impact on the users of radioactive materials and the operators of radiation generating devices;
* A review of incidents, audit results and assessments and associated corrective actions since the last training session.
* A review of emergency response actions and procedures

## Radiation Safety Officer

### Initial Training

The Radiation Safety Officer (RSO) must be qualified through previous training and experience with sources of ionizing radiation. Otherwise, the RSO requires an initial forty hour RSO course which is approved by the Nuclear Regulatory Commission or comparable state agency/organization and ensures that the following topics are covered.

* Fundamentals of radiation and radioactivity
* Interaction and detection of radiation including hands on use of detection equipment
* Administrative exposure control methods
* ALARA and optimization and their application for radiation safety programs
* Engineering exposure control methods
* Regulatory requirements related to the use, disposal or transport of radioactive materials; in general EPA, US NRC, DOT and applicable state or local regulations
* Program audits and assessments
* Biological effects of ionizing radiation
* Emergency response to radiological incidents
* Radioactive material management, disposal, and transport

### Annual Training

Annual training is not required as the RSO will be providing or attending the annual training of the radioactive material workers. An eight hour RSO “Refresher” course will be completed as needed. The course should provide a summary of the topics covered in the initial training and also changes to regulations.

Faculty Members

### Initial Training

The training should be the same as that of the radioactive material workers.

### Annual Training

The training should be the same as that of the radioactive material workers.

Ancillary Workers

Ancillary workers are those workers who by virtue of their routine job duties do not come in direct contact with radioactive materials or analytical x-ray equipment or enter a radioactive materials restricted area.

### Initial Training

All ancillary workers will receive training prior to their assignment to tasks near where radioactive material is being stored or processed. The training will be designed to ensure the worker can meet the following objectives:

* Identify radiation source use areas and explain the meaning of postings, signs and other warning labels.
* Explain ancillary worker rights and responsibilities relative to the Materials License and 10 CFR 19,20 requirements
* Describe the actions to be taken in the event of an incident involving radioactive materials

### Annual Training

Ancillary workers should receive annual “refresher” training, which should consist of the following:

* A summarization to reinforce the initial training objectives
* A review of incidents, audit results and assessments and associated corrective actions since the last training session that are related to the ancillary worker activities.

# Radioactive Material Control

## Possession Limits

### Sealed and Unsealed Sources of Radioactive Material

Juniata College is responsible for assuring periodic surveys, as described in the license and in this manual, are performed and taking the emergency actions noted in this document.

### X-ray Generating Devices

X-ray generating devices are registered with the state where the facility is located. X-ray generating devices should not be activated on site until registered with the PA Department of Environmental Protection.

Juniata College is responsible for assuring periodic surveys, as described in this manual, are performed and taking the emergency actions noted in this document.

## Receipt

Written receipt procedures will be used and personnel responsible for receipt will be trained in the use of those procedures. In general the receipt process will be as follows.

Authorized Users, responsible for placing orders for radioisotopes, will obtain the counter-approval of the RSO for the amount, physical form and expected receipt date of the material.

Either the Science Department Staff person, the Authorized User or the RSO will perform the initial receipt survey within three hours after receipt at the facility or within eighteen hours if received during an “off-hour” time period.

The RSO will designate the area the material is to be stored in while waiting for use in the next process step.

## Inventory

The Science Center Staff person will log the received radioactive material into an inventory system. This individual will be responsible for updating the inventory whenever material is received on the site or transferred to another facility.

At least every six months, the RSO will review the inventory and storage locations to ensure the written inventory is in agreement with the material possessed at that time.

Every 12 months the RSO will review the radiation device registrations, locations of devices and operational status of each device and update the registrations and inventory accordingly.

## Storage

Radioactive materials will only be stored in posted and secured areas unless under the control of an individual or work group in the area.

Except for material being readied for transport or being actively worked on, the storage area should be locked with a key controlled by the radiation safety officer.

Movement of material from the posted storage location for use in an unrestricted area must be approved by the RSO.

Material will be stored in such a manner that the dose rate at 30 cm from the storage location and in any adjacent accessible area will be less than 0.06 mrem/hr.

X-ray generating devices will be rendered inoperable if taken out of service and no further use is planned for the next 12 months.

## Shipping

Shipping of radioactive materials will be performed in accordance with written procedures and personnel responsible for shipping will be trained in those procedures.

Authorization to ship can only be provided by the RSO.

Upon completion of a shipment, the RSO will be given the shipping papers and related survey information and then update the facility inventory.

## Disposal

Further information regarding disposal and waste management issues are outlined in Appendix No. 8 **“**Safe Practices for the Storage and Disposal of Radioactive Materials” located at the end of this manual.

# EXPOSURE Control and Monitoring

## Contamination Control

### Administrative Measures

Written procedures will be developed for work involving the handling of unsealed sources. These procedures will contain at a minimum:

* Surveillance instructions for the material use area
* Instructions for personnel monitoring (“frisking”)and the use of personal protective equipment
* Postings and barrier controls
* Response actions to be taken in case of a spill of radioactive material

All unsealed sources will be labeled, posted and contain warning signs in accordance with state or federal requirements.

### Engineering Measures

Where feasible, operable fume hoods, spill trays, secondary liquid containment devices, and other laboratory equipment will be employed to control the spread of radioactive materials in the work and storage areas.

## External Exposure Monitoring

### Administrative Measures

Written procedures will be developed for work involving the handling of sealed sources or x-ray generating devices. These procedures will contain at a minimum:

* Lock/Out Tag-Out instructions
* Surveillance instructions for the material or device use area
* Instructions for personnel monitoring (“frisking”)and the use of personal protective equipment
* Postings and barrier controls

All sources and x-ray generating devices will be labeled, posted and contain warning signals in accordance with state or federal requirements.

### Engineering Measures

Where feasible, the primary means of exposure control will be the employment of shutters, shielding or interlocks to prevent exposure to radioactive sources or x-ray generating devices.

## Surveys

Written procedures will be used to perform radiation and leak test surveillance. In general the following criteria will be used for determining surveys:

Radiation exposure rate surveys and removable contamination surveys will be conducted when receiving radioactive materials, when conducting surveys of material use/storage areas, when packaging materials for shipment and when placing sources in a container for storage.

Surveys of material use/storage areas will be performed at the end of the day and/or experiment. One documented removable contamination survey will be conducted monthly. Material use/storage areas considered “not in use” will be surveyed every six months.

Radiation surveys will be conducted whenever an analytical x-ray equipment shutter is locked out. All x-ray generating devices will be surveyed annually to determine if leakage and scatter radiation levels meet state agency criteria.

Leak tests at three months for alpha emitting sealed sources and six months for beta-gamma emitting sealed, unless license conditions allow for a lesser frequency.

**WASTE MANAGEMENT**

Procedures for the management and disposal of radioactive materials can be found in Appendix No. 8 **“**Safe Practices for the Storage and Disposal of Radioactive Materials” located at the end of this manual.

# Emergency Response

Emergency response and notification procedures will be developed for responding to the following incidents:

* Potential overexposure to a sealed source or x-ray generating device
* Spill of radioactive material
* Receipt of a leaking and/or contaminated package of radioactive material

These procedures should include the following:

* Notification sequence, timing and personnel who are notified
* Exposure mitigation measures to minimize the potential dose when responding to the incident
* Response actions for handling the emergency event
* Emergency organization, authorities and responsibilities
* Recovery actions after situation has been controlled
* Records and reports required for post emergency actions

# rESPONSIBILITIES

*Radiation Worker*

It is the responsibility of all who use radiation or are in any way involved with operations involving radiation to do the following:

1. know what they should do if they know or suspect problems involving radiation;
2. know who to contact immediately to evaluate the situation; and
3. know how to isolate the radiation area in order to avoid unnecessary risks.

*Radiation Safety Officer (RSO)*

The Radiation Safety Officer must assume full responsibility for:

1. The development of effective radiation emergency plans to:
* promptly and accurately evaluate any unusual incident
* limit the extent of damage
* see that personnel receive competent medical attention
* manage all necessary accident repair and recovery operations
* institute remedial action to prevent reoccurrence
1. Instructing all radiation personnel in what action they must take in an emergency.
2. Providing ample emergency equipment, instruments, and protective devices.
3. Knowing who to contact for medical, radiological, fire and police assistance.
4. Notifying proper personnel in the official agencies within the prescribed period of time after discovery of the incident.
5. Documenting the facts concerning the incident.
6. Preparing the prescribed reports to official agencies, management, and insurance carriers.

*Administration*

While the responsibility and authority for radiation control may be delegated, the College remains accountable for any damage. It is essential for the protection of Juniata College personnel, financial resources, and reputation that emergency planning receive proper emphasis and that emergency plans keep pace with the growth of the College.

# Program Assessments

## Audits and Assessments

The RSO will perform or will assure that at least one documented audit of the radiation safety program is performed annually.

## Incident Investigation

All incidents involving radioactive materials or radiation will be investigated within twenty-four hours of the first notification of the incident.

The incident investigation will include as a minimum:

* Incident site review and interview of participants or observers.
* Assessment of potential releases to environment and/or unmonitored or overexposures of personnel.
* Evaluation of immediate and follow-up response actions taken.
* A determination of the cause or causes of the incident.
* A written report documenting the above with a corrective action plan for preventing recurrence.

# Record Keeping

All records associated with the facility radiation safety program will be maintained in designated storage locations for the RSO’s access. All records will be maintained in accordance with 10CFR20 Subpart L. These records include:

* The license and other correspondence with the USNRC relative to the Materials License.
* The Certificate of Registration and other correspondence with the PADEP relative to the use of analytical x-ray equipment.
* Receipt, inventory and disposal/shipping records
* Surveillance records such as removable contamination surveys, leak tests, radiation exposure surveys
* Shipping, transfer, disposal records for radioactive materials
* Records of training including lesson plans and supporting training materials
* Audits, assessments, and responses to audits and assessments
* Incident report records