



# **RADIATION GENERATING EQUIPMENT SAFETY MANUAL**

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Gordon Krueger – Environmental Safety Coordinator/Radiation Safety Officer

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## 1. INTRODUCTION

### a. Purpose of the Guide

This regulatory guide is provided to describe the type and extent of information for registration to possess and use radiation emitting equipment in Iowa.

Registration of radiation emitting machines is required only for those machines that are operational and in use. Machines in storage or not operational are not required to be registered. Typically, the equipment is designed and manufactured for utilizing x-rays for examining a structure and/or composition of material or for medical therapeutic use. A radiation emitting machine must be labeled as such by the manufacturer, and must be used and maintained in accordance with the manufacturer's instructions.

This guide should be studied carefully and other applicable rules in Iowa Administrative Code (IAC) 641, Chapters 38 through 41 and Chapter 45 and then complete the registration form. IDPH may request additional information to provide reasonable assurance that the applicant has established an adequate radiation protection program.

### b. Applicable Regulations

Rules pertaining to this type of registration are found in the IAC 641, Chapters 38, 39, 40, 41 and 45 of the Radiation Machine and Radioactive Materials Rules. You may go to <http://idph.iowa.gov/radiological-health> and follow the links to the Bureau of Radiological Health.

### c. As Low As Reasonably Achievable Philosophy (ALARA)

Paragraph 641-40.1(3) states "...Every reasonable effort should be made to maintain radiation exposures as low as reasonably achievable (ALARA)." As a registrant, you should consider the ALARA philosophy in the development of work plans involving radiation emitting equipment.

The success of an ALARA program depends on the cooperation of each person who works at your facility. Management should make a formal policy commitment to the ALARA philosophy and implement that commitment with the use and maintenance of radiation emitting equipment. Management needs to designate one or more responsible persons who will oversee the day-to-day operations of the radiation safety program, including the mandatory annual assessment of the radiation safety program.

### d. General Definitions

*Radiation Producing Machine:* any device capable of producing ionizing radiation when the associated control devices are operated, except devices which produce radiation only by the use of radioactive material.

*Enclosed System:* A radiation producing machine which satisfies the requirement that all areas with exposure rates greater than 0.25 mR/hr are enclosed within an interlocked barrier.

*Open Systems:* Any other radiation producing machine that does not fit the definition for an enclosed system. Examples are x-ray diffraction and radiography units, particle accelerators, electron microscopes, tokamaks, and high voltage rectifiers operating above 10kV.

## **2. REGISTRATION**

### **a. Initial Registration**

Any time an X-ray producing machine is purchased for use at the University of Northern Iowa, it must immediately be registered with the Iowa Department of Public Health. It is the responsibility of the individual user to provide the following information to the Radiation Safety Officer: type of machine: analytic x-ray, electron microscope, cabinet x-ray, medical and non-medical accelerators, industrial radiographic x-ray, x-ray fluorescent analyzer and portable or fixed gauges

### **b. Updates**

It is the responsibility of the individual user to provide information regarding any changes involving the use of their x-ray emitting equipment such as changes in location, equipment maintenance and transfer/destruction of the equipment.

## **3. DUTIES OF RADIATION SAFETY OFFICER (RSO)**

### **a. Responsibilities**

The main duty of the RSO is to ensure all x-ray operations are done safely and has the authority to stop operations deemed unsafe. Other duties include ensuring all functioning x-ray equipment is registered with the Iowa Department of Public Health and the use of such machines follow the requirements set forth by state and federal regulations. This person performs required annual assessments which are described in the Annual Assessment of the Radiation Safety Program section.. The RSO will also ensure x-ray equipment is either properly disposed or properly transferred to another facility when it is no longer used at the University.

## **4. DUTIES OF THE INDIVIDUAL USER**

### **a. Training**

Individual users must be trained by a representative (usually the technician who installs the equipment) of the manufacturer of the equipment as to the proper operation, storage and maintenance of the equipment. Such training must be documented and copies of the documentation must be forwarded to the Radiation

Safety Officer to be recorded. The individual user must also train any employees and/or students who may have occasion to use the machine. With the exception of Scanning Electron microscopes this training must also be documented.

**b. Operating Procedures**

Operating manuals need to be kept in the vicinity of the equipment for reference to ensure proper procedures are followed while using the machine. The individual user should ensure ALARA principles are strictly enforced.

**c. Responsibilities**

It is the responsibility of the individual user to maintain their equipment. They must keep records of any maintenance performed on their machine. They must perform regular inspection and maintenance as described in Section 5 of this manual. Finally, it is their responsibility to inform the RSO of operability, location or potential transfer or disposal of their machine. The user must also ensure that the machine is maintained in a space that is secured by key or card access.

**5. INSPECTION AND MAINTENANCE**

Each registrant will need to develop, document, and implement a radiation protection program in compliance with IAC 641-40.10(1). Inspections of industrial radiography x-ray equipment should consist of:

1. Change in the general operating characteristics of the unit;
2. Wear of electrical cables and connectors;
3. Proper labeling of console;
4. Proper console with machine, as appropriate;
5. Proper operation of locking mechanism;
6. Timer run-down cutoff;
7. Damage to tube head housing that might result in excessive radiation levels

**6. ANNUAL ASSESSMENTS OF THE RADIATION SAFETY PROGRAM**

An annual audit is required by IAC 641-40.10(3). It is essential that once problems are identified; they are corrected. IDPH will review a registrant's audit program and determine if corrective actions are thorough, timely, and sufficient to prevent recurrence. IDPH encourages registrants to regulate their own compliance. Normally self-identified violations that have been corrected by the registrant will not be cited.

Audits should include personnel training, inventory, operational checks (if appropriate), actual observations of machine use, identification of any problems, and resolution of those problems. Any equipment failure must be reported immediately to IDPH. A copy of a model audit checklist is included as Appendix A. However, this model may need to be modified for your specific operations.

## **7. POSTINGS AND SIGNS**

All machine labels must be clean and legible, and caution individuals that radiation is produced when energized. IDPH recognizes that in a manufacturing setting it may not be possible to maintain these conditions. However, it is appropriate to clean labels and check them for legibility any time the equipment is inventoried, or checked for operation. IDPH “Notice to Workers,” must be posted to allow individuals to observe it on the way to or from the area where equipment is used or stored. This can be posted on a bulletin board in the employee lounge, on the door to the area where the equipment is located, or on a notification bulletin board where other official documents (for example, Occupational Safety and Health Administration or the US Environmental Protection Agency information) are posted.

Also, postings must either include: (1) the certificate of registration, inspection reports, other documents pertaining to the equipment; or (2) information where these documents can be located

## **8. TRANSFER OR DISPOSAL**

The Radiation Safety Officer must be notified of x-ray machines are transferred to another room, building or another institution. The RSO must also be notified if the machine is no longer operable and needs to be disposed of. The RSO is solely responsible for ensuring proper transfer or the disposal of x-ray emitting equipment.

## APPENDIX: FORMS

### Certificate of Transfer or Destruction of Radiation Generating Equipment

Authorized User: \_\_\_\_\_ Location: \_\_\_\_\_

Manufacturer: \_\_\_\_\_ Model Number: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Final Survey Meter Reading of Equipment: \_\_\_\_\_ mrem/hr

Survey Meter Used:

Manufacturer: \_\_\_\_\_ Model Number: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Final Disposition of X-ray      Destroyed      Transferred to another Facility  
for further use

Name and address of facility where X-ray transferred to or destroyed (Please attach a receipt from this facility)

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### X-ray Assessment Form

**Building:** \_\_\_\_\_ **Room:** \_\_\_\_\_ **Authorized User:** \_\_\_\_\_

**Audit covering Dates:** \_\_\_\_\_ **Date:** \_\_\_\_\_ **Assessment performed by:** \_\_\_\_\_

AUDITS	Y	N	N/A	Comments
1. Were previous audits conducted annually [40.10(3)]				
2. Were records of previous audits maintained [40.81(136)]				
3. Are safety systems checked every 6 months?				
ORGANIZATIONAL				
1. Are current uses consistent with the authorized uses?				
2. IA State and UNI registration numbers posted.				
3. Are labels, signs, postings and/or indications of x-ray emitting equipment available.				
4. Is an IDPH Notice to Employees posted?				
5. "Caution: X-Ray" signs posted on doors entering the controlled area.				
TRAINING				
1. Has the user/users received training according to manufacturer's instructions.				

2. Does the user provide training and refresher training to those students who may have occasion to use the machine.				
3. Can documentation be provided.				
4. Do the user/users and students know the emergency procedures.				
<b>MAINTENANCE</b>				
1. Are manufacturer's procedures followed?				
2. Are on-off mechanisms tested for proper operation every 6 months or at prescribed intervals?				
3. Has there been a change to the general operating characteristics of the unit?				
4. Are the electrical cables and connectors in good shape?				
5. Is the console of the machine properly labeled and is it the proper console for the machine?				
6. Is interlock mechanism operating correctly?				
7. Is timer run-down cutoff behaving correctly?				
8. Is there damage to the tube head housing that might result in excessive radiation levels?				
9. For Analytical Machines only: Radiation levels do not exceed 0.1 mR/hr at 5 cm from any accessible surface of the machine for analytical machines.				Survey meter used: Model # _____ Serial # _____
10. Are maintenance records available?				