X-Ray Radiation Safety Management Program
The University of Tulsa (TU)
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References:

1. Oklahoma Administrative Code (OAC) 252:410, titled “Radiation Management”

2. 10 Code of Federal Regulation (CFR) titled “Standards for Protection Against Radiation” or abbreviated NRC10 CFR 20.

3. TU X-ray license # XR-114.

Summary: The radiation safety management program is based on references incorporated from the Nuclear Regular Commission (NRC) and Oklahoma Department of Environmental Quality (DEQ) requirements for managing our X-ray machines and protecting the public and us from injury.

The radiation safety officer (RSO) is Scott A. Holmstrom, Ph.D.

A written radiation protection plan is required by OAC 252:410-1-6(1) and OAC 252:410-3-32(a). The RSO is responsible for ensuring this written plan is implemented as described and ensuring that the X-ray machines are used safely.

X-Ray machine users are responsible for attending the radiation safety management program training and for using the X-ray machines safely.

The X-ray machines are to be stored and operated as designed. Improper use or loss of an X-ray machine must be reported promptly to the RSO. Acquisition, transfer, sale, or assemblage of an X-ray machine must have prior approval of the RSO. If an outside company is to be contracted for use of an X-ray system on campus, the RSO must be notified in advance.

(A) Training

1. Each X-ray operator shall receive 1 hour of initial training covering the following subjects:
   (a) radiation hazards associated with the use of the equipment,
   (b) the warning, safety devices and interlocks incorporated into the equipment,
   (c) recognizing symptoms of an acute localized radiation exposure and knowing how to report a suspected actual exposure, and
   (d) proper operating procedure for the equipment.

2. Refresher training is required for each X-ray operator annually. Refresher training shall consist of a review of the proper operating procedures and any changes to the radiation management plan.
3. No person shall operate an X-ray machine until that individual has received radiation training and demonstrated the ability to use the X-ray machine in a safe and competent manner. The RSO will be responsible for making sure that each X-ray operator is properly trained and competent before authorizing the person to use an X-ray machine.

(B) Training Records

Records of radiation safety training will be maintained for at least three years.

(C) Dosimetry

1. Personnel dosimeters will be submitted to a National Voluntary Laboratory Accreditation Program (NVLAP)-approved laboratory quarterly for processing. If the dosimeter is lost, stolen, or damaged the user will notify the RSO immediately.

2. The RSO will review the dosimetry records quarterly for elevated levels of radiation exposure. If there are elevated levels of radiation exposure, the RSO will investigate.

3. Any maintenance involving the removal, assembly, rearrangement, and/or realignment of the X-ray components will require a ring badge to be worn and be performed with the approval of the RSO.

4. If an X-ray operator is pregnant, she may voluntarily declare the pregnancy by notifying the RSO in writing and provide an estimated date of conception. The RSO will work to ensure compliance with NRC 10 CFR 20.1208.

(D) Area Surveys

1. Shall be performed:
   
   (a) when an X-ray system is installed,
   (b) every 12 months after installation,
   (c) following any changes in the initial arrangement of the X-ray components, and
   (d) following maintenance requiring removal or disassembly of the X-ray components of the system.

2. Each area survey record will include the following information:
   
   (a) the date the survey was performed,
   (b) who performed the survey,
   (c) manufacturer, make, model, and serial number of the X-ray machine,
(d) the kV and mA settings during the survey,
(e) the make, model, serial number, and calibration date of the survey instrument,
(f) the background reading, and
(g) a diagram of the X-ray instrument with survey locations and results.

(E) Survey Meter Requirements

Survey meters will be calibrated annually or whenever there is a service/repair performed on the survey instrument excluding battery replacement.

(F) Safety Devices or interlocks

For cabinet systems, safety device or interlocks may not be bypassed except by a permitted third party and with prior approval by the RSO. For handheld systems, the proximity safety device may be disabled for small samples with the approval of the person responsible for the safety of the device or the RSO.

If there is a malfunction in the X-ray machine, it must be shut down immediately. Repairs may only be made by an appropriately trained party and with the approval of the RSO.

(G) X-ray Machine, Posting, and Labeling Requirements

1. Each room containing X-ray equipment will be posted with a sign bearing the radiation symbol and words “Caution – X-ray Equipment,” or words having similar intent.
2. Each X-ray machine will have a warning light labeled “X-ray On,” or with words and/or symbols having similar intent, that will light up only when the X-ray tube is on.
3. Each X-ray machine will be labeled with a sign bearing the radiation symbol and words “Caution Radiation – This Equipment Produces Radiation When Energized,” or words having similar intent, near the switch that energizes the tube.
4. Each X-ray tube housing that is visible and accessible without the use of tools, will have a label “Caution – High Intensity X-ray Beam,” or words having similar intent.

(H) Notice of Transfer

If an X-ray machine is transferred, DEQ will be notified within 15 days after the transfer in writing with the following information:
(a) the name and address of the transferee
(b) the manufacturer, model and serial number of each transferred machine
(c) the transfer date
(I) Updating Registration

If a new X-ray machine is acquired or an X-ray machine is sold, transferred, or disposed of, an updated registration form “Registration of Industrial and Analytical X-Ray Machines” shall be submitted to DEQ within 30 days.

(J) Reporting Overexposures

If a user suspects that he/she has had an overexposure of radiation, the employee will notify the RSO immediately and the incident will be investigated. If the employee feels that the investigation was not handled properly, he/she may contact Oklahoma DEQ (http://www.deq.state.ok.us)

If the radiation is proved to cause or threatens to cause a person to receive:

(a) a dose exceeding 5 rems, or
(b) a lens dose exceeding 15 rems, or
(c) a shallow dose to the skin or extremities exceeding 50 rems,

the RSO will notify DEQ within 24 hours of the discovery of the incident.
A report will be submitted to the DEQ within 30 days containing the following information:

(a) estimates of each individual’s dose,
(b) levels of radiation involved,
(c) cause of the elevated exposures and dose rates, and
(d) corrective steps taken or planned to ensure against recurrence.

(K) Use and Safety

If an automated, non-portable X-ray system is being used while unattended, software and instruments will be on but access to software/hardware control will be password protected and the door to the room containing the X-ray machine will be locked and have appropriate signage. An experiment that automatically completes will be set to shut off the X-ray tube upon completion.

When not in use, the person responsible for an X-ray machine’s safety (see TU DEQ Registration Form 410-13-2) will store the operation key in a secure place that is only accessible by qualified X-ray operators.

During use of portable X-ray producing devices, users must wear a wrist or ring dosimeter. Portable X-ray producing devices may only be used at temporary jobsites with the permission of the person responsible for the machine’s safety.
(L) Review of Radiation Safety Program

The Radiation Safety Plan will be reviewed annually for program content and implementation by the RSO and will include a review of the appropriate Oklahoma Administrative Codes and a documented audit of the radiation safety plan.