# University of Cincinnati

# Quality Assurance

# and

# Radiation Protection Manual

# for

# Non-Human Use

# Radiation Generating

# Equipment

**RECORD OF REVISION PAGE**

| Revision # | Date of Revision | Change Entered |
|---|---|---|
| Original | 9/15/1998 | |
| 1 | 2/18/2004 | Incorporated new or revised ODH regulations; added an audit function for the Radiation Safety Office. |
| 2 | 2/15/2006 | Added statement University of Cincinnati issued dosimeters cannot be used outside the RCSP. Statement added to section 9.6. Added this record of revision page. Updated Notice to Employees sample. |
| 3 | 6/17/06 | Incorporated updated forms and ODH notice to employees. The documents are attachments to the manual and were approved by the RSC for The University Hospital leaving the RCSP. |
| 4 | 1/1/08 | Corrected typographical error in Appendix B. Corrected collar multiplication factor in footnote from 0.4 to 0.04. |
| 5 | 8/20/08 | Modified Appendix B, ALARA Investigational Levels, to delete special investigational level for the head. |
| 6 | 5/13/09 | Modified manual to incorporate new QA requirements enacted by the ODH in December 2008. Added reference to QA materials being available on the Radiation Safety website (www.uc.edu/radsafety). Corrected minor typographical errors and style inconsistencies. |
| 7 | 2/16/11 | Added IRRP to list of abbreviations, updated RGE type definitions to be equivalent to current ODH definitions, added requirements for use of new RSC approved form for inoperable RGE; corrected a few typographical errors noted. |
| 8 | 5/16/12 | Corrected an error in the examples under "industrial irradiation device"; a bomb detection unit is an industrial radiography not an irradiation device. Updated requirements for regulatory changes effective 5/1/12, including incorporation of new OAC 3701:1-68 rules. Replaced biannually with biennially to make it clear that RSC audits are every other year. Removed all references to particle accelerator and veterinary mammography, since there are none under the RCSP.<br>Corrected some typographical and formatting errors. |
| 9 | 05/15/13 | Complete review. Updated a couple definitions to become more in line with current ODH wording. Added preventative maintenance requirement for veterinary RGE after UC Blue Ash inspection resulted in citation for failure to include in program. Corrected the RSOf inspection frequency for cabinet industrial radiographic units. Added reference to the Human Use QA Manual for QC tests associated with veterinary RGE.<br>Corrected typographical errors. |
| 10 | 11/12/14 | Added definition for the word "Annual". Updated fluoroscopy unit dosimeter requirement. |
| 11 | 02/08/21 | Added ring dosimeter requirement for handheld RGE. Updated links to online training, modified format to meet ADA.. |

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**General**

1.1. The possession and/or use of radiation generating equipment (RGE) classified by the state of Ohio as industrial radiography equipment, industrial irradiation device, industrial analytical and/or veterinary use (i.e., on animals) RGE shall be conducted in accordance with policies, procedures and guidelines presented in this manual.

1.1.1. "Industrial radiography equipment" means any RGE which produces ionizing radiation to examine the macroscopic structures of material by nondestructive testing methods. Industrial radiography units include RGE used for bomb detection.

1.1.2. “Industrial irradiation device” means any RGE used to alter the chemical, biological or physical properties of materials or to sterilize materials. Industrial irradiation devices include, but are not limited to, electron beam processors, electron beam welders, electron beam coaters, and cabinet irradiators.

1.1.3. "Industrial analytical" RGE means a group or system of components which produce ionizing radiation as either a primary or secondary result and is used to determine or alter properties of materials being measured or analyzed. Industrial analytical RGE include, but are not limited to, gauging units, x-ray diffraction devices, x-ray spectrometer devices, and electron microscopes.

1.1.4. “Veterinary RGE” includes any RGE (e.g., radiographic or fluoroscopic unit) used for the radiographic diagnosis or examination, or therapy of an animal.

1.2. Each department possessing RGE and each contact person (CP) responsible for one or more industrial radiography equipment, industrial irradiation device, industrial analytical, and/or veterinary RGE under the University of Cincinnati Radiation Control and Safety Program (RCSP) shall maintain a copy of this manual.

1.2.1. The CP is responsible for ensuring a copy of this manual is readily available to personnel for consultation and information purposes.

1.2.2. The chair of each department possessing RGE is responsible for ensuring a CP is designated for each RGE possessed by the department and the designated CP is an individual currently employed by the institution with sufficient knowledge, time and authority to perform the duties of the CP.

1.3. This manual incorporates quality assurance (QA) and radiation protection policies, procedures and guidelines, as applicable to non-human use RGE.

1.3.1. The Radiation Safety Committee (RSC) has reviewed and approved the initial and each subsequent version of this manual.

1.3.2. The Individual Responsible for Radiation Protection (IRRP)/Radiation Safety Officer (RSO) is responsible for ensuring the current version of the manual is posted on the Radiation Safety website (https://research.uc.edu/support/offices/radsafety).

1.3.3. The manual shall be updated as necessary to reflect changes in policies, procedures, institutional equipment and/or regulatory changes.

1.3.3.1. The IRRP/RSO is responsible for distributing copies of each revision to each CP within 30 days of RSC approval.

1.3.3.2. The CP is responsible for ensuring each RGE radiation worker (RW) under their responsibility is informed regarding applicable changes incorporated in a revision within 60 days of RSC approval.

1.4. All employees operating RGE for non-human use shall read and understand this manual prior to operating RGE.

## 2. Purpose

2.1. The purpose of this manual is to satisfy the requirements of the Ohio Administrative Code (OAC) regarding the provisions of for quality assurance (QA) and radiation protection.

2.1.1. QA requirements for veterinary RGE are listed in OAC 3701:1-66-04.

2.1.2. QA requirements for industrial RGE are listed in OAC 3701:1-68-02.

2.1.3. General radiation protection requirements are listed in OAC 3701:1-38.

2.1.4. Machine specific requirements for veterinary RGE are listed in the applicable OAC 3701:1-66 rule for the specific RGE type.

2.1.5. Machine specific radiation safety requirements are industrial RGE are listed in the applicable OAC 3701:1-66 rule for the specific RGE type.

2.2. This manual also provides significant regulatory requirements that may impact day-to-day usage of non-human use RGE.

## 3. Definitions and Abbreviations

3.1. Definitions

3.1.1. Ancillary Radiation Worker (AW)

3.1.1.1. An individual who

3.1.1.1.1. is not a RW

3.1.1.1.2. is in the restricted area (e.g., room) when the RGE is energized (e.g., x-ray is on) (and)

3.1.1.1.3. is performing a duty as part of their "job" (e.g., employee, student, volunteer).

3.1.2. Annual

3.1.2.1. At intervals not to exceed one year, or once per year at about the same time each year, plus or minus one month.

3.1.3. Cabinet x-ray system

3.1.3.1. A RGE with the x-ray tube installed in a shielded enclosure such that every location on the exterior of the cabinet meets the dose limits for a member of the public. The cabinet must be independent of existing architectural structures except the floor, must contain at least that portion of the material being irradiated, and must exclude all personnel including extremities from its interior during generation of radiation.

3.1.4. Contact Person (CP)

3.1.4.1. An individual designated by a department, division or unit as responsible for ensuring compliance with policies, procedures and guidelines covered in this manual.

3.1.5. Declared pregnant worker

3.1.5.1. An RW or AW who has declared their pregnancy in writing to the Radiation Safety Office (RSOf).

3.1.6. Direct supervision

3.1.6.1. Within eye sight of the individual providing the supervision.

3.1.7. Enclosed x-ray system

3.1.7.1. Industrial RGE operated in an enclosure or cabinet.

3.1.8. Minor

3.1.8.1. Any individual under the age of 18.

3.1.9. RGE Radiation Worker (RW)

3.1.9.1. An individual who operates a RGE.

3.1.10. Restricted area

3.1.10.1. For industrial radiography RGE, the restricted area is that area where the dose rate may exceed 2 millirem in any one hour.

3.1.10.2. For industrial irradiation device, the restricted area is the RGE unit and associated shielding and/or housing, or any area where the dose rate may exceed 2 millirem in any one hour, whichever is larger.

3.1.10.3. For industrial analytical RGE, the restricted area is the RGE unit and associated shielding and/or housing, or any area where the dose rate may exceed 2 millirem in any one hour, whichever is larger.

3.1.10.4. For veterinary RGE, the restricted area is the room in which the RGE is present when energized or 6 feet from the x-ray tube, whichever is smaller.

3.2. Abbreviations

3.2.1. AW: Ancillary Radiation Worker

3.2.2. CP: Contact Person

3.2.3. IRRP Individual Responsible for Radiation Protection

3.2.4. ODH: Ohio Department of Health

3.2.5. QA: Quality Assurance

3.2.6. RCSP: Radiation Control and Safety Program

3.2.7. RGE: Radiation Generating Equipment

3.2.8. RSC: Radiation Safety Committee

3.2.9. RSO: Radiation Safety Officer

3.2.10. RSOf: Radiation Safety Office

3.2.11. RW: RGE Radiation Worker

## 4. QA Program

4.1. The QA Program addresses the following:

4.1.1. Intervals and procedures for evaluation of RGE (manual section 13)

4.1.2. Radiation monitoring including audits and surveys (manual sections 5 and 13), occupational exposure limits (manual section 9.1), maintenance of records (manual section 9.7) and procedure regarding the use of personnel and/or area monitoring (manual sections 9.2-9.5)

4.1.3. ALARA and overexposure notification (manual section 10)

4.1.4. Radiation safety specifics for each type of RGE (manual section 8)

4.1.5. RGE operator training (manual sections 6 and 7)

4.1.6. General training (manual section 7)

4.1.7. Quality control tests and frequencies (manual section 14)

4.1.8. Notification of QA Program changes (manual paragraphs 1.3 and 7.1.4)

4.1.9. RGE RW roles and responsibilities (RCSP Manual, manual paragraphs 1.2, 3.1.1, 3.1.2, and 13.4)

4.1.10. Personnel protection (manual paragraph 6.3)

4.1.11. Prenatal exposure (manual paragraph 8.3.1)

4.1.12. AW training (manual section 7.2)

4.1.13. QC task responsibilities and training (none specified in rule for industrial RGE)

4.1.14. Protection of the public (manual sections 6.4 and 11)

4.1.15. Equipment logs (manual section 15)

4.1.16. Posting and signage (manual section 11)

4.1.17. Incident action (manual section 12)

4.2. Oversight and Maintenance of the QA Program

4.2.1. Oversight and maintenance of the QA Program for non-human use RGE is the responsibility of the RSC.

4.3. Implementation of the QA Program

4.3.1. Implementation of the QA Program for non-human RGE is the responsibility of the University of Cincinnati IRRP/RSO.

## 5. Audits

5.1. Each RGE shall be audited by the Radiation Safety Office (RSOf) as deemed necessary by the IRRP/RSO to ensure compliance with rules, regulations and/or good health physics practices.

5.1.1. The minimum frequency of RSOf audits shall be annual.

5.1.2. The audits, at a minimum, shall include a review of significant regulatory and program requirements.

5.1.3. The CP shall ensure an operator is available to operate the RGE, as necessary, during RSOf audits.

5.2. The QA Program, as it applies to non-human use RGE, shall be audited at least biennially as part of the annual RCSP audit performed by the RSC.

5.2.1. RSC audits shall include, at least one of the following:

5.2.1.1. a review of RGE audits and/or surveys performed by the RSOf

5.2.1.2. a review of RGE inspections performed by the ODH and the status of the implementation of corrective action

5.2.1.3. a review of QA policies and procedures

## 6. RGE Operator Requirements

6.1. Before operating any RGE, the operator shall ensure they are familiar with the RGE's operating characteristics, as well as the purpose and function of protective devices. Any operator who has questions concerning or doubts regarding the operation of a RGE shall immediately seek guidance from their supervisor or other appropriate individual.

6.2. Operators shall report promptly to their CP any condition they believe might lead to or cause a violation of rules or regulations, or unnecessary exposure to radiation. If the condition goes uncorrected, the operator shall report the condition to the IRRP/RSO.

6.3. Operators shall minimize their and other individual's in the restricted area radiation exposure by:

6.3.1. Reducing the time in the restricted area.

6.3.2. Staying as far away as possible from the radiation beam (e.g., increasing distance).

6.3.3. Wearing any required protective shielding (e.g., lead apron).

6.3.4. Ensuring protective devices, such as interlocks and protective housing or shielding, are functioning as designed for the specific RGE.

6.4. Operators shall minimize radiation exposure to members of the public by:

6.4.1. Closely following RGE operating procedures.

6.4.2. Not overriding interlocks or other safety features.

6.4.3. Ensuring members of the public are not in the restricted area whenever an RGE is energized.

6.5. Operators who are minors shall:

6.5.1. Obtain written approval from their parents or guardians. Both the "Release of Liability and Waiver Claim for Minors" form (RS Form 38) and the "Supervisor's Statement for Minors" form (RS Form 38A) shall be completed. Both forms are available on the Radiation Safety website (https://research.uc.edu/support/offices/radsafety).

6.5.2. Be limited to an occupational dose of 0.5 rem total effective dose equivalent per year.

## 7. Training Requirements

7.1. Radiation Worker (RW), e.g., operators

7.1.1. Prior to allowing an individual to operate a non-human use RGE, the CP shall ensure the individual has obtained sufficient training to operate the RGE competently and safely. At a minimum, this training must include:

7.1.1.1. general radiation safety training

7.1.1.1.1. the general radiation safety training for RW shall include:

7.1.1.1.1.1. possible health effects from exposure to radiation

7.1.1.1.1.2. general precautions and procedures to minimize exposure to radiation

7.1.1.1.1.3. instruction to watch for and report promptly any condition that may constitute or lead to or cause a violation of radiation protection or QA procedures, policies, rules or regulations (and)

7.1.1.1.1.4. applicable warning signage

7.1.1.1.2. the general radiation safety training for RW may be obtained by:

7.1.1.1.2.1. viewing the general radiation protection training film "Ancillary Worker Awareness Training Video" available online at (https://ce.uc.edu/cpd/Workshops/Index/RSF)

7.1.1.1.2.2. attending the RSOf Basic training course (course session schedule available on the RSOf or on the Radiation Safety website (https://ce.uc.edu/cpd/Workshops/Index/RSF) (or)

7.1.1.1.2.3. the CP (or designee) providing equivalent instruction

7.1.1.2. area specific training - the CP (or designee) shall provide instruction that includes:

7.1.1.2.1. a review of the QA manual

7.1.1.2.2. the location and purpose of the restricted area

7.1.1.2.3. a description and location of RGE(s) in use (and)

7.1.1.2.4. appropriate response to warnings or unusual conditions

7.1.1.3. machine specific training - the CP or an approved machine operator designated by the CP shall provide instruction that includes:

7.1.1.3.1. machine operating instructions

7.1.1.3.2. unit specific safe operating procedures

7.1.1.3.3. location of and documentation requirements for maintenance and use logs (and)

7.1.1.3.4. additional training applicable to the RGE to be operated/used

7.1.1.3.4.1. industrial radiography and irradiation RGE

7.1.1.3.4.1.1. bomb detection units

7.1.1.3.4.1.1.1. record-keeping requirements

7.1.1.3.4.1.1.2. survey requirements

7.1.1.3.4.1.1.3. restricted area control requirements, such as ropes, tapes and signs

7.1.1.3.4.1.2. cabinet radiography or irradiation RGE

7.1.1.3.4.1.3. all other industrial radiographic RGE

7.1.1.3.4.1.3.1. meet the training requirements listed in OAC 3701:1-68-03(E)

7.1.1.3.4.2. industrial irradiation device

7.1.1.3.4.2.1. how to use a survey meter and perform a pre-operational check

7.1.1.3.4.2.2. to check for obvious defects prior to each day the RGE is used

7.1.1.3.4.2.3. to check control devices and/or alarm systems for high radiation areas at the beginning of each day the RGE is used

7.1.1.3.4.3. industrial analytical RGE

7.1.1.3.4.3.1. x-ray diffraction and spectroscopy units

7.1.1.3.4.3.1.1. view one of the films covering radiation safety for analytical units, which can be viewed at or signed out from the RSOf and include:

7.1.1.3.4.3.1.1.1. The Double Edged Sword available on the Radiation Safety website (https://ce.uc.edu/cpd/Workshops/Index/RSF)

7.1.1.3.4.3.1.1.2. X-ray Diffraction Hazards, Howard Hughes Institute

7.1.1.3.4.3.1.2. review machine alignment techniques

7.1.1.3.4.3.1.3. discuss interlocks and safety controls andthe importance of using them as intended (e.g., not overriding interlocks)

7.1.1.3.4.4. veterinary use RGE

7.1.1.3.4.4.1. procedures for holding and/or stabilizing the animal

7.1.1.3.4.4.2. where to stand during a procedure

7.1.1.3.4.5. veterinary fluoroscopy units, including C-arms

7.1.1.3.4.5.1. review the fluoroscopy training manual

7.1.1.3.4.5.2. pass the fluoroscopy test

7.1.2. Annually, a competency assessment shall be performed which shall include:

7.1.2.1.1. an assessment by the CP (or designee) of the individual's ability to competently and safely operate each pertinent RGE; this assessment may be performed:

7.1.2.1.1.1. by the individual reviewing their skills with the supervisor (or)

7.1.2.1.1.2. the supervisor observing the individual operating the RGE

7.1.3. New equipment - when new RGE is installed operators shall be trained in the operation by:

7.1.3.1. the manufacturer

7.1.3.2. an operator or supervisor who was trained by the manufacturer (or)

7.1.3.3. an operator or supervisor who is skilled at using the RGE (e.g., individual trained by an individual who was trained by the manufacturer)

7.1.4. Changes to operating procedures and/or the QA Program shall be communicated to applicable operators in a timely manner, but no later than 60 days after the change by:

7.1.4.1. written and/or verbal communication (e.g., memo to operators, discussion at departmental meeting) from the CP (or designee) (and)

7.1.4.2. addition of revised procedure in the RGE operations manual

7.2. Ancillary Worker (AW)

7.2.1. All AWs who may receive an occupational dose under the RCSP in excess of 100 millirem (0.1 rem) shall receive:

7.2.1.1. general radiation protection training

7.2.1.1.1. the general radiation safety training for AW shall include:

7.2.1.1.1.1. possible health effects from exposure to radiation

7.2.1.1.1.2. general precautions and procedures to minimize the exposure

7.2.1.1.1.3. instruction to watch for and report promptly any condition that may constitute or lead to or cause a violation of radiation protection or QA procedures, policies, rules or regulations (and)

7.2.1.1.1.4. applicable warning signage

7.2.1.1.2. the general radiation safety training for AW may be obtained by:

7.2.1.1.2.1. viewing the general radiation protection training film "Ancillary Worker Awareness Training Video" available online at (https://ce.uc.edu/cpd/Workshops/Index/RSF)

7.2.1.1.2.2. attending the RSOf Basic training course (course session schedule available through the RSOf or on the RSOf website at (https://ce.uc.edu/cpd/Workshops/Index/RSF) (or)

7.2.1.1.2.3. the CP (or designee) providing equivalent instruction

7.2.1.2. area specific training - the CP (or designee) shall provide instruction that includes:

7.2.1.2.1. the location and purpose of the restricted area (and)

7.2.1.2.2. a description and location of the RGE in use

7.3. Documentation

7.3.1. All training shall be documented and the documentation shall be maintained by the CP. If the individual will be monitored (i.e., issued a dosimeter), copies of the documentation shall be forwarded to the RSOf, along with the dosimeter application. The dosimeter application form "Radiation Worker/Dosimeter Application" (RS Form 2.0) is available on the Radiation Safety website (https://research.uc.edu/support/offices/radsafety).

7.3.1.1. The form "Radiation Safety Training for Non-Human Use RGE" (RS form 2.1(x-ray non-human)), or its equivalent, shall be used to document the training. A copy of RS form 2.1(x-ray non-human) is available on the Radiation Safety website (https://research.uc.edu/support/offices/radsafety).

## 8. Radiation Safety Procedures

8.1. All Non-Human Use RGE

8.1.1. All individuals shall wear their assigned dosimeters as required (see radiation monitoring requirements, section 9).

8.1.2. All individuals must operate the RGE in accordance with manufacturer's operating procedures or procedures approved in writing by the IRRP/RSO.

8.1.3. All individuals must abide by the machine operating instructions and the unit specific safe operating procedures.

8.1.4. All RGE must be secured from tampering and unauthorized use.

8.2. Additional Safety Procedures by RGE type:

8.2.1. Industrial radiography and irradiation RGE enclosed in a cabinet:

8.2.1.1.1. a readily visible failsafe warning light must be present on or near the source housing labeled with the words "x-ray on" that notifies individuals the x-ray is on

8.2.1.1.2. a readily discernible sign must be present bearing the radiation symbol and the words:

8.2.1.1.2.1. "Caution – High Intensity X-ray Beam" or equivalent on or near the source housing, and

8.2.1.1.2.2. "Caution – This Equipment Produces Radiation When Energized" or equivalent near any switch or control that directly energizes the unit

8.2.2. Industrial radiography RGE used for bomb detection:

8.2.2.1. a readily visible failsafe warning light must be present on or near the source housing labeled with the words "x-ray on" or equivalent that notifies individuals the x-ray is on

8.2.2.2. a readily discernible sign must be present bearing the radiation symbol and the following or equivalent wording:

8.2.2.2.1. "Caution – High Intensity X-ray Beam" on or near the source housing, and

8.2.2.2.2. "Caution – This Equipment Produces Radiation When Energized" any switch or control that directly energizes the unit

8.2.2.3. an operable calibrated survey instrument must be available at each use site where the bomb detection unit may be used

8.2.2.4. appropriate barriers must be used to keep out unauthorized individuals and ensure exposure to radiation from the RGE does not exceed regulatory limits

8.2.2.5. when not in use, the RGE must be secured within a locked area

8.2.3. Industrial radiography or irradiation RGE that are neither in a cabinet or used for bomb detection:

8.2.3.1. a readily visible failsafe warning light must be present on or near the source housing labeled with the words "x-ray on" or equivalent that notifies individuals the x-ray is on

8.2.3.2. a readily discernible sign must be present bearing the radiation symbol and the following or equivalent wording:

8.2.3.2.1. "Caution – High Intensity X-ray Beam" on or near the source housing, and

8.2.3.2.2. "Caution – This Equipment Produces Radiation When Energized" any switch or control that directly energizes the unit

8.2.3.3. whenever the RGE is energized,

8.2.3.3.1. two individuals must physically be present at the job site and at least one of the individuals must be an approved operator

8.2.3.3.2. an approved operator must be physically present to ensure security of high radiation areas or any high radiation area must be protected by interlocked failsafe safety mechanisms

8.2.3.4. an operable calibrated survey instrument must be available at each use site

8.2.3.5. each operator or individual within the restricted area must wear an appropriate direct reading personnel dosimeter, along with dosimetry described in 9.3 of this manual

8.2.3.6. appropriate barriers and signage must be used to warn individuals, keep out unauthorized individuals and ensure exposure to radiation from the RGE does not exceed regulatory limits

8.2.3.7. a survey must be performed after each use to ensure the beam is "off"

8.2.3.8. when not in use, the RGE must be secured within a locked area

8.2.4. Industrial analytical RGE enclosed in a cabinet:

8.2.4.1. the cabinet must be interlocked to ensure the beam is shut off if the cabinet is breached

8.2.4.2. the cabinet must ensure dose rates outside the cabinet are less than 0.25 millirem per hour at 5 centimeters

8.2.4.3. any temporary alteration of safety devices, including by-passing interlocks or removing shields must be approved in writing in advance by the IRRP/RSO; this approval shall be:

8.2.4.3.1. documented and documentation must include the date of alteration and the length of time the alteration will be in effect, along with IRRP/RSO's signature

8.2.4.3.2. posted near the RGE source housing when applied (and)

8.2.4.3.3. maintained with RGE records for at least 3 years

8.2.4.4. radiation leakage surveys must be performed after non-routine operations, such as maintenance, repair or alignment; the surveys shall be:

8.2.4.4.1. performed by

8.2.4.4.1.1. the CP (or)

8.2.4.4.1.2. upon request, the RSOf

8.2.4.4.2. documented and documentation maintained with RGE records for at least 3 years

8.2.5. Industrial analytical open beam RGE:

8.2.5.1. an interlocked failsafe device must be present to prevent entry of any portion of an individual's body into the primary beam

8.2.5.2. all unused ports must be secured in the closed position

8.2.5.3. a readily visible failsafe warning light must be present on or near the source housing that notifies individuals the x-ray is on

8.2.5.4. any temporary alteration of safety devices must be approved in advance by the IRRP/RSO; this approval shall be:

8.2.5.4.1. documented and documentation must include the date of alteration and the length of time the alteration will be in effect, along with the IRRP/RSO's signature

8.2.5.4.2. posted near the RGE source housing when applied (and)

8.2.5.4.3. maintained with RGE records for at least 3 years

8.2.5.5. radiation leakage surveys shall be performed after non-routine operations, such as maintenance, repair and alignment; the surveys shall be:

8.2.5.5.1. performed by

8.2.5.5.1.1. the CP (or)

8.2.5.5.1.2. upon request, the RSOf

8.2.5.5.2. documented and documentation maintained with RGE records for at least 3 years

8.2.6. Veterinary RGE – radiographic, dental and CT units:

8.2.6.1. individuals whose presence during an exam is not required shall not stay as an observer unless required as a part of the clinical learning process

8.2.6.2. reasonable efforts shall be made to avoid holding animals during radiologic examinations; immobilization devices and restraint devices shall be used whenever possible to avoid holding the animal being x-rayed

8.2.6.3. individuals in the restricted area shall minimize their radiation exposure by:

8.2.6.3.1. minimizing the time spent in the restricted area when the RGE is on

8.2.6.3.2. staying as far away as possible from the radiation beam (e.g., increasing distance)

8.2.6.3.3. wearing appropriate protective shielding

8.2.6.3.3.1. aprons of at least 0.5 mm lead equivalence in front shall be worn by all individuals in the restricted area

8.2.6.3.3.2. gloves of at least 0.25 mm lead equivalence shall be worn by all individuals whose hands are in or close to the "primary beam" because of the need to hold an animal

8.2.6.3.3.3. collar shields (i.e., thyroid shields) of at least 0.5 mm lead equivalence shall be worn by individuals who risk significant exposure to the head and neck (e.g., within a few feet of an energized fluoroscopic unit or C-arm)

8.2.6.4. the holding of film cassettes shall be minimized; if a film cassette must be held then lead-lined gloves shall be worn

8.2.7. Veterinary RGE - fluoroscopic, including C-arms

8.2.7.1. individuals who must be in the restricted area during a procedure shall stand as far away from the tube as practical

8.2.7.2. individuals who must work in the restricted area when the RGE is activated shall wear protective apparel,

8.2.7.2.1. under no circumstances shall less than a lead apron, 0.5 mm lead equivalent, be worn

8.2.7.2.2. lead gloves shall be worn when the hands must be placed in the primary x-ray beam

8.2.7.2.3. lead thyroid shields, lead eyeglasses and protective barriers should be used as applicable

8.2.7.3. portable protective shields shall be used when possible

8.2.7.4. for permanent installations, a table apron shall be installed and used unless it interferes with the procedure or compromises a sterile field

8.2.7.5. avoid unnecessary fluoroscopic exposure

8.2.7.5.1. use image freeze capabilities when possible

8.2.7.5.2. utilize pulsed fluoroscopy techniques if the machine is so equipped

8.2.7.5.3. conduct examinations with as little fluoroscopy time as possible

8.3. Additional Requirements for Specific Workers

8.3.1. Pregnant worker:

8.3.1.1. pregnant workers may choose to declare their pregnancy, at which time lower doses will apply

8.3.1.2. pregnant workers are not considered declared pregnant workers until they declare the pregnancy in writing to the RSOf

8.3.1.3. the declaration must include the following information (The RSC approved form “Declaration of Pregnancy” (RS Form 33) is available on the Radiation Safety website (https://research.uc.edu/support/offices/radsafety) and may be used to declare a pregnancy.)

8.3.1.3.1. the name of the individual

8.3.1.3.2. the date of declaration

8.3.1.3.3. the type of radiation exposed to in the workplace (and)

8.3.1.3.4. the estimated date of conception

8.3.1.4. the radiation dose limit to the fetus/embryo of a declared pregnant worker is 500 millirem total effective dose equivalent over the term of the pregnancy

8.3.1.5. declared pregnant workers may request a meeting with the IRRP/RSO and during this meeting the IRRP/RSO will:

8.3.1.5.1. review the individual's exposure record

8.3.1.5.1.1. if the record indicates an exposure to the embryo/fetus greater than 500 millirem may occur, the IRRP/RSO will initiate steps

to move the individual to a position of lower radiation exposure and one that the exposure can be maintained less than 500 millirem

8.3.1.5.2. review procedures to minimize exposure to the embryo/fetus (and)

8.3.1.5.3. answer any questions the individual may have

8.3.1.6. pregnant individuals may continue to operate and work around RGE unless deemed otherwise by the IRRP/RSO

8.3.1.7. pregnant individuals shall not enter or be in a restricted area unless they are wearing a lead protective apron

8.3.1.7.1. pregnant individuals should consider wearing the wrap-around type apron whenever possible as they provide the best protection

8.3.1.8. pregnant individuals should review NRC regulatory guide 8.13; this guide

8.3.1.8.1. covers the effects of radiation to the embryo and fetus

8.3.1.8.2. is available on the NRC website (www.nrc.gov) or from the RSOf

8.3.2. Minor

8.3.2.1. minors shall have written authorization from their parent(s) or guardian(s) authorizing their potential exposure to radiation (The "Release of Liability and Waiver Claim for Minors" form (RS Form 38) and the "Supervisor's Statement for Minors" (RS Form 38A) form shall be completed. Both forms are available on the Radiation Safety website (https://research.uc.edu/support/offices/radsafety)

8.3.2.2. minors, who are RWs or AWs, are limited to a radiation dose that is 10% of the limits for other workers

## 9. Radiation Monitoring Requirements

9.1. Exposure Limits – The annual occupational exposure limits are:

9.1.1. Adult -

9.1.1.1. Whole body effective dose - 5 rem

9.1.1.2. Any individual organ or tissue, other than the lens of the eye - 50 rem

9.1.1.3. Lens of the eye - 15 rem

9.1.1.4. Skin - 50 rem

9.1.1.5. Extremity - 50 rem

9.1.2. Minor – one tenth adult value

9.1.3. Declared pregnant worker – 0.5 rem (500 millirem) to the fetus during the pregnancy

9.2. General Personnel Dosimetry Requirements

9.2.1. In accordance with regulations at a minimum dosimetry shall be worn by all

personnel who may receive greater than 10% of the annual limit. However, under the RCSP additional (more restrictive) dosimetry is required as outlined in this manual, or as deemed necessary by the RSC.

9.2.2. Dosimetry used for individuals exposed to RGE shall be able to detect photon radiation.

9.2.3. Dosimetry shall be provided by and applied for through the RSOf.

9.3. Specific Personnel Dosimetry Requirements by RGE Type

9.3.1. Industrial radiography RGE

9.3.1.1. one dosimeter at waist or collar, whichever location would result in the highest exposure

9.3.2. Industrial irradiation device

9.3.2.1. one dosimeter at waist or collar, whichever location would result in the highest exposure

9.3.3. Industrial analytical RGE

9.3.3.1. electron microscopes

9.3.3.1.1. no dosimetry required

9.3.3.2. diffraction and spectrometry RGE

9.3.3.2.1. one dosimeter at waist or collar, whichever location would result in the highest exposure

9.3.3.3. handheld RGE

9.3.3.3.1. one dosimeter at waist or collar, whichever location would result in the highest exposure

9.3.3.3.2. a ring dosimeter shall be worn on each hand

9.3.4. Veterinary use RGE

9.3.4.1. whole body dosimetry

9.3.4.1.1. radiographic, dental and CT units

9.3.4.1.1.1. one dosimeter at the collar, outside any lead apron worn

9.3.4.1.2. fluoroscopy units, including C-arms

9.3.4.1.2.1. one dosimeter outside the apron, at the collar

9.3.4.2. hand dosimetry

9.3.4.2.1. if an individual's hands are frequently (e.g., weekly) in the x-ray beam, hand dosimetry is also required

9.3.4.2.2. a ring dosimeter shall be worn on each hand frequently in the x-ray beam

9.4. Specific Personnel Dosimetry for Specific Types of Workers

9.4.1. Dosimetry for ancillary workers (AW)

9.4.1.1. dosimetry is required if the AW is frequently (i.e., weekly or 10 hours/month with x-ray on) in the restricted area

9.4.1.2. dosimetry requirements for frequently exposed AW are equivalent to that for RW

9.4.2. Dosimetry for declared pregnant workers

9.4.2.1. declared pregnant workers who frequent the restricted area shall be assigned a dosimeter to be worn at the waist

9.4.2.1.1. if lead apron is worn

9.4.2.1.1.1. one dosimeter worn outside the apron, at the collar (labeled neck or collar)

9.4.2.1.1.2. second dosimeter worn under the apron, at waist level (labeled waist or chest)

9.4.2.1.2. if lead apron is not worn

9.4.2.1.2.1. one dosimeter worn at waist level

9.5. Area Dosimeter Option

9.5.1. A CP may request an area dosimeter for placement in a location of interest to monitor radiation exposure at the location. Locations of interest may include, the control panel or locations where members of the public may frequent.

9.6. Care of Dosimetry

9.6.1. Assigned personnel dosimetry must be worn whenever there is a potential for occupational radiation exposure.

9.6.2. Personnel and area dosimeters issued by the University of Cincinnati are limited for use to monitor radiation exposure from radiation sources covered by the RCSP.

9.6.3. Personnel dosimeters are for use by a single individual and shall not be shared, reassigned or discarded. Area dosimeters are for use at a single designated location.

9.6.4. Personnel dosimetry does not provide protection from radiation; it only provides an "after the fact" assessment of radiation to which it (and presumably the wearer) was exposed.

9.6.5. Dosimeters shall be worn at the position appropriate for the work being performed (see personnel monitoring, section 9.3).

9.6.6. Radiation dosimeters are very sensitive to environmental conditions such as heat, light and moisture. Dosimeters should be used properly, should not be taken home or stored in cars or on window sills.

9.6.7. Radiation dosimeters shall be stored in low background areas (e.g., offices, non-RGE area) when not being worn or used to monitor a specific location.

9.6.8. Personnel radiation dosimeters are for occupational exposure only and are NOT to be worn during personal medical or dental procedures.

9.6.9. Radiation dosimeters are to be exchanged in a timely manner (see section 9.8).

9.6.10. If a dosimeter is lost, damaged or left in an area of high radiation exposure the RSOf must be notified immediately (see section 9.8).

9.7. Dosimetry Analysis and Reports

9.7.1. Personnel dosimetry must be returned in a timely fashion to the RSOf for analysis per section 9.8 of this manual.

9.7.2. Dosimetry analysis reports are sent by the vendor to the RSOf. Copies are maintained in the RSOf. Copies are forwarded as follows:

9.7.2.1. monthly series analysis reports:

9.7.2.1.1. are forwarded to CPs who request, in writing, copies of the monthly report

9.7.2.2. individual analysis reports:

9.7.2.2.1. monitored personnel are issued copies of the previous year's exposure in accordance with 3701:1-38-10(generally with the April or May dosimeters)

9.7.2.2.2. monitored personnel are issued copies of individual dosimetry reports upon request

9.7.2.2.2.1. requests must be made to the RSOf

9.7.2.2.2.1.1. reports will be provided within 30 days after the request is made or within 30 days after receipt of the data for the last dosimeter, whichever is later

9.8. Dosimeter Exchange Procedures

9.8.1. To prevent unmonitored exposure, before used dosimeters are returned, new dosimeters are picked up.

9.8.1.1. all dosimeters shall be picked up from the RSOf during the first 3 working days of the quarter.

9.8.1.2. all dosimeters shall be returned to the RSOf during the first 10 days of the quarter.

9.8.1.3. all late returned and non-returned dosimeters may require completion of a radiation dosimetry follow-up form

9.8.1.3.1. the RSOf shall issue the form upon receipt of a report indicating a dosimeter was not returned as required

9.9. Lost, Late Return or Damaged Dosimeters

9.9.1. Lost or damaged dosimeters shall be reported immediately to the RSOf.

9.9.2. Temporary replacement dosimetry will be issued if dosimeters are lost or damaged prior to the return exchange.

9.9.3. A radiation dosimetry follow-up form may be completed for all lost, late return and damaged dosimeters.

9.9.3.1. the RSOf may issue the form upon receipt of a report indicating a

dosimeter was not returned or was damaged

## 10. ALARA and Overexposure Investigations and Notifications

10.1. ALARA Investigation and Notification

10.1.1. The basic rule for ALARA investigations is ALARA investigations shall be performed when individuals exceed 10% and 30% of the applicable regulatory limits for occupationally exposed individuals. However, to ensure timely ALARA review and implementation of corrective action, reviews are performed on a "quarterly fraction", which is the annual limit divided by 4. The 10% and 30% is applied to the quarterly fraction. The current ALARA investigational level doses are listed in appendix B.

10.1.1.1. ALARA I (greater than 10% but less than 30% of regulatory limit)

10.1.1.1.1. the IRRP/RSO, or designee will:

10.1.1.1.1.1. provide a written report of the exposure to the individual

10.1.1.1.1.2. request the individual submit an explanation of radiation exposure during the time period in question

10.1.1.1.1.3. review the exposure and the explanation, then investigate if deemed necessary

10.1.1.1.1.4. report the results to the RSC at the next meeting

10.1.1.2. ALARA II (greater than or equal to 30% of regulatory limit)

10.1.1.2.1. the IRRP/RSO, or designee will:

10.1.1.2.1.1. provide a written report of the exposure to the individual

10.1.1.2.1.2. request the individual submit an explanation of radiation exposure during the time period in question

10.1.1.2.1.3. investigate the cause(s) of the exposure

10.1.1.2.1.4. implement corrective action as deemed necessary

10.1.1.2.1.5. report the results to the RSC at the next meeting

10.2. Overexposure Investigation and Notification

10.2.1. When an exposure in excess of regulatory limits is suspected the IRRP/RSO shall be notified.

10.2.2. The IRRP/RSO, or designee shall:

10.2.2.1. investigate the possible overexposure

10.2.2.2. notify the Director of the ODH within 30 days; the notification shall:

10.2.2.2.1. describe the extent of the exposure and include:

10.2.2.2.1.1. an estimation of the individual's dose

10.2.2.2.1.2. the levels of radiation involved

10.2.2.2.1.3. the cause of the exposure

10.2.2.2.1.4. any corrective action taken or planned to assure against recurrence

10.2.2.2.2. and on a separate page list:

10.2.2.2.2.1. the individual's name

10.2.2.2.2.2. social security number

10.2.2.2.2.3. date of birth

10.2.2.3. provide written notification to the individual. The written notification shall include:

10.2.2.3.1. nature and extent of the exposure

10.2.2.3.2. the following statement

"This report is furnished to you under provisions of rule 3701:1-38-10 of the administrative code. You should preserve this report for future reference."

**11. Postings and Signs**

11.1. Posting and signage is the primary mechanism used to inform and protect the public from radiation exposure from non-human use RGE.

11.2. All doors to the room where RGE is stored or housed shall be posted with a sign that contains the radiation trefoil and states "caution - equipment in this room may produce radiation when energized" or equivalent.

11.3. Each room where RGE is stored or housed shall post in conspicuous locations the following (a sample posting is included in appendix C).

11.3.1. ODH notice to employees.

11.3.2. Location(s) where this manual, applicable audit(s) and applicable inspection report(s) are maintained.

11.3.3. Location(s) where applicable rules and regulations are maintained. (and)

11.3.4. Method for contacting the IRRP/RSO.

11.4. Each non-human use RGE shall have a label near any switch that energies the RGE (e.g., the x-ray tube) that states "caution-this equipment produces radiation when energized" or equivalent.

11.5. Each industrial radiographic RGE shall have a label on or near the source housing that states "caution – high intensity x-ray beam".

11.6. Each open beam industrial analytical RGE shall have a label on or near the source housing that states "caution – high intensity x-ray beam".

**12. Incident Action**

12.1. Any problems with the operation of RGE shall be reported immediately to the CP.

12.1.1. Any problems reported to the CP that are not corrected in a reasonable amount of

time shall be reported to the IRRP/RSO.

12.2. Any problems with the operation of RGE that an individual suspects may result in an overexposure (i.e., exposure greater than regulatory limits) shall be reported immediately to the CP and IRRP/RSO.

12.2.1. The IRRP/RSO, in conjunction with the CP, shall investigate the problem and implement corrective action.

12.3. Any suspected or known overexposure shall be immediately reported to the IRRP/RSO.

12.3.1. The IRRP/RSO shall investigate the overexposure and submit required reports to the ODH in accordance with section 10.2 of this manual.

**13. Intervals and Procedures for Evaluation of RGE**

13.1. CP surveys: All industrial analytical RGE must be surveyed by the CP or arrangements made for a survey by the RSOf. CP surveys are not required for all other non-human RGE, including veterinary RGE.

13.1.1. Surveys must be performed:

13.1.1.1. following any change in the initial system arrangement or type of local components

13.1.1.2. following any maintenance requiring disassembly or removal of a local component

13.1.1.3. during the performance of maintenance or alignment procedures requiring activation of the RGE

13.1.1.4. any time a visual inspection of local components reveal an abnormal condition

13.1.2. Surveys must be performed with an appropriate calibrated survey meter.

13.1.3. The survey results must be documented.

13.1.3.1. the documentation must be readily available for inspection by the RSC, IRRP/RSO or ODH

13.1.3.2. the survey results must be maintained with RGE records for 3 years

13.2. RSOf audits and surveys: All operable non-human use RGE shall be audited and/or surveyed by the RSOf upon installation and by the CP in accordance with the following schedule thereafter, unless the IRRP/RSO determines more frequent surveys are required.

13.2.1.1. industrial radiography:

13.2.1.1.1. cabinet - quarterly

13.2.1.1.2. bomb detection units – annually

13.2.1.1.3. all other non-cabinet – quarterly

13.2.1.2. industrial irradiation device - quarterly

13.2.1.3. industrial analytical:

13.2.1.3.1. electron microscopes – annually

13.2.1.3.2. all others - semiannually

13.2.1.4. veterinary RGE – annually

13.2.2. RSOf surveys, at a minimum, shall include a radiation survey of the RGE and a review of RGE safety features, as required by regulations.

13.2.3. The CP must ensure an operator is available to operate the RGE, as necessary, during RSOf surveys.

13.3. Physicist testing: Physicist testing is not required for industrial RGE. Each CP for veterinary RGE shall arrange for a radiation expert (e.g., medical physicist) to evaluate the RGE to ensure compliance with machine specifications regulations. All other veterinary RGE may use the ODH inspection/evaluation in lieu making arrangements for radiation expert testing.

13.3.1. For veterinary fluoroscopy RGE, these evaluations shall be performed prior to first use and annually thereafter, and these evaluations shall include:

13.3.1.1. tests to determine compliance with spot film device limits

13.3.1.2. evaluation of fluoroscopic image quality

13.3.1.3. tests to determine entrance exposure rates

13.3.2. For non-fluoroscopy veterinary RGE, the ODH inspection may be used in lieu of arranging for a radiation expert evaluation.

13.3.3. The results of the evaluation shall be documented.

13.3.3.1. the documentation must be readily available for inspection by the RSC, IRRP/RSO or ODH

13.3.3.2. the documentation must be maintained with RGE records for 3 years

13.4. Preventative maintenance (calibration): Having a preventative maintenance schedule is not required for industrial RGE. Each CP for veterinary shall arrange for routine preventative maintenance and, if necessary calibration of the RGE.

13.4.1. For veterinary fluoroscopy RGE, these evaluations shall be performed at least annually.

13.4.2. For non-fluoroscopy RGE, these evaluations shall be performed at least every three years.

13.4.3. The results of the evaluation shall be documented in the RGE's maintenance log.

13.4.3.1. the documentation must be readily available for inspection by the RSC, IRRP/RSO or ODH

13.4.3.2. the documentation must be maintained with RGE records for 3 years

13.5. ODH inspections: All non-human use RGE shall be evaluated by the ODH in accordance with the inspection schedule of the ODH.

13.5.1. The CP must ensure an operator is available to operate the RGE, as necessary, during ODH inspections.

13.5.2. In accordance with Ohio Revised Code, the ODH may inspect RGE without advanced notice. If advanced notice is provided to the IRRP/RSO, the IRRP/RSO will inform the affected CP(s).

13.5.3. The CP is responsible for the cost associated with any fee assessed by the ODH for an inspection of their RGE.

**14. Quality Control (QC) Tests**

14.1. Industrial RGE: No QC tests are required for industrial RGE.

14.2. Veterinary RGE: QC testing for equipment, such as film, CR and DR cassettes and systems and lead aprons shall be performed in accordance with the requirements for human-use RGE listed in section 15 of the Quality Assurance and Radiation Protection Manual for Human-Use Radiation Generating Equipment.

**15. RGE Logs and Operation Manuals**

15.1. Logs - each RGE will have a separate maintenance log and use log.

15.1.1. Maintenance log - the maintenance log shall include:

15.1.1.1. identification of the piece of equipment

15.1.1.2. incidents and actions

15.1.1.3. maintenance performed

15.1.1.4. repair information

15.1.1.5. incident summaries

15.1.2. Use log - the use log shall include:

15.1.2.1. RGE identification

15.1.2.2. date of operation

15.1.2.3. operator's name

15.1.2.4. brief description of use

15.1.2.5. for fluoroscopic units, including C-arms

15.1.2.5.1. the procedure's total air kerma or dose area product, or alternately the mode of operation (e.g., high or pulsed mode), the cumulative fluoroscopy time and/or the number of spot films

15.1.2.5.2. if the fluoroscopy unit is being used for an animal, the animal's identification and type of examination performed (this may be included in the brief description of use)

15.1.2.6. for industrial radiography RGE and industrial irradiation device

15.1.2.6.1. the kVp

15.1.2.6.2. the mA

15.1.2.6.3. the on time

15.1.2.7. for industrial radiography RGE and industrial irradiation device used at temporary locations

15.1.2.7.1. date the RGE is removed from storage

15.1.2.7.2. date the RGE is returned to storage

15.1.2.7.3. result of any surveys performed

15.2. Operation Manual - each RGE shall have an operation manual which includes, at a minimum:

15.2.1. a list of operators

15.2.2. a copy of this manual (and)

15.2.3. machine operating procedures and unit specific safe operating procedures

15.2.3.1. for industrial radiography RGE and industrial irradiation device the procedure(s) must also include:

15.2.3.1.1. emergency procedures

15.2.3.1.2. methods and occasions for conducting radiation surveys

15.2.3.1.3. methods for controlling access to radiation areas

15.2.3.1.4. methods for securing the RGE from unauthorized use

15.3. RGE maintenance logs, use logs and operation manuals shall be:

15.3.1. maintained in the area (e.g., room) where the RGE is housed

15.3.2. readily available for use by the operator(s)

15.3.3. available for inspection by the RSC, IRRP/RSO or ODH

**16. RGE Acquisition, Inventory, Disposal or Transfer, and Inoperable Units**

16.1. Acquisition

16.1.1. The CP (or individual who will be the CP upon RGE receipt) is responsible for reporting the anticipated acquisition of RGE to the IRRP/RSO.

16.1.1.1. new purchases - reporting shall be within 30 days of order placement, and at least 30 days prior to the anticipated date of receipt of the RGE

16.1.1.1.1. additional notification time is required for veterinary (radiographic, CT and fluoroscopic) RGE

16.1.1.1.1.1. the notification must be sufficient for the IRRP/RSO to review, modify if necessary, and approve any facility design associated with the RGE purchase

16.1.1.1.1.2. facility design reviews involve a minimum of 30 days (see section 17)

16.1.1.2. replacements - reporting shall be within 30 days of order placement and at

least 5 working days prior to the anticipated date of receipt of the new RGE

16.1.1.3. loaners - reporting shall be as soon as possible, but within 5 working days prior to the anticipated date of receipt of the loaner RGE

16.1.2. Information provided to the IRRP/RSO shall include, but is not limited to:

16.1.2.1. CP's name

16.1.2.2. department

16.1.2.3. machine's application (e.g., veterinary radiographic, industrial radiographic, electron microscope)

16.1.2.4. description of machine (make, model)

16.1.2.5. number of tubes

16.1.2.6. expected delivery date

16.1.2.7. planned location

16.1.3. The IRRP/RSO will ensure the state of Ohio registration allows for the acquisition. If the acquisition will result in the number of tubes exceeding the number listed on the registration, the IRRP/RSO shall amend the registration.

16.1.4. Upon install and prior to use, the CP shall arrange for and ensure:

16.1.4.1. acceptance testing is performed by the manufacturer and/or installer

16.1.4.1.1. the CP shall provide the IRRP/RSO a copy of the manufacturer's and/or installer's acceptance testing

16.1.4.2. a post installation survey is performed by the RSOf

16.2. Inventory

16.2.1. The RSOf shall maintain an inventory of RGE.

16.2.2. CPs shall review the inventory quarterly.

16.2.2.1. by the 15th day of the second month of each calendar quarter (i.e., February, May, August, November), the RSOf shall distribute copies of the current inventory to appropriate CP

16.2.2.2. each CP (or designee) shall review all information included in the inventory report, indicate changes or corrections, then sign and return the inventory to the RSOf by the end of the second month of each calendar quarter

16.2.2.3. the RSOf will review the results of the quarterly submissions and ensure the inventory is in accordance with the applicable registration; if necessary, the IRRP/RSO shall amend the registration

16.3. Disposal or Transfer

16.3.1. At least 5 working days prior to disposal or transfer of RGE, the CP shall inform the IRRP/RSO about the disposal or transfer.

16.3.2. Information provided to the IRRP/RSO shall include:

16.3.2.1. name and location (e.g., address of the facility) where the RGE will be disposed or transferred

16.3.2.2. the make, model and serial number of the RGE being transferred or disposed

16.3.2.3. the anticipated date of disposal or transfer

16.3.3. The RSC approved form "Notice of Transfer or Disposal of Radiation Generating Equipment (x-ray)" should be used to document disposal or transfer of RGE. The form is included in appendix D of this manual and is available on the Radiation Safety website (https://research.uc.edu/support/offices/radsafety).

16.4. Inoperable Units

16.4.1. The CP shall notify the IRRP/RSO whenever a previously operable RGE is determined to be inoperable.

16.4.1.1. notification shall be within 5 business days of the CP becoming aware the RGE is inoperable

16.4.1.2. notification shall include completion and submission of a University of Cincinnati Radiation Control and Safety Program Inoperable/X-ray/Radiation Generating Equipment Form (RS Form 39)

16.4.1.3. the IRRP/RSO, or delegate, shall promptly confirm the RGE is inoperable, determine an approximate time period for repair, and assure the CP is aware that the IRRP/RSO must be promptly informed once the unit is repaired.

16.4.2. The CP shall notify the IRRP/RSO whenever a previously operable RGE unit is repaired.

16.4.2.1. notification shall be within 5 business days of the CP becoming aware the RGE is operable

16.4.2.2. notification shall be by written correspondence, which may include electronic mail, letter or memorandum

16.4.2.3. the IRRP/RSO, or delegate, shall promptly make arrangements to survey the unit.

16.4.3. If during an audit an RGE is determined to be inoperable, the auditor (e.g., IRRP/RSO delegate) shall ensure a University of Cincinnati Radiation Control and Safety Program Inoperable/X-ray/Radiation Generating Equipment Form (RS Form 39) is completed or is on file in the RSOf, and the CP is aware of the requirements for promptly informing the IRRP/RSO when the unit is repaired. A copy of the form shall be provided to the CP and/or attached to the inoperable RGE unit.

16.5. From the information provided, the IRRP/RSO shall submit any necessary quarterly reports to the ODH covering the installation, disposal, transfer, or change in operability status of RGE.

## 17. RGE Room Construction - New or Remodeled

17.1. Prior to construction of a new RGE room or remodeling of an existing RGE room

17.1.1. The CP (or individual who will be the CP upon RGE receipt) must inform the IRRP/RSO regarding new construction or remodeling. The name of the project manager shall be provided to the IRRP/RSO at this time.

17.1.2. The IRRP/RSO shall perform shielding analysis of the design to ensure the room meets the requirements for exposure to members of the public.

17.1.3. Any design documents shall require acceptance approval by the IRRP/RSO prior to start of construction.

17.2. During construction:

17.2.1. The project manager shall keep the IRRP/RSO informed of the status of the project and obtain approval for any changes that may affect shielding.

17.2.2. The IRRP/RSO shall review, as necessary, the construction to ensure shielding is being installed in accordance with the design specifications.

17.3. After construction, but prior to use:

17.3.1. The IRRP/RSO shall perform all necessary surveys to ensure the room meets the requirements for exposure to members of the public. (and)

17.3.2. If applicable, room safety feature evaluation testing (e.g., interlocks, remote visuals).

# Appendix A
# Forms

## Associated Radiation Safety Forms

| | |
|---|---|
| RS FORM 2.0 | RADIATION WORKER/DOSIMETER APPLICATION |
| RS FORM 2.1 (x-ray non-human) | RADIATION SAFETY TRAINING FOR NON-HUMAN USE RGE |
| RS Form 33 | DECLARATION OF PREGNANCY |
| RS FORM 38 | RELEASE OF LIABILITY AND WAIVER CLAIM FOR MINORS |
| RS FORM 38B | SUPERVISOR'S STATEMENT FOR MINORS |
| RS FORM 39 | UNIVERSITY OF CINCINNATI RADIATION CONTROL AND SAFETY PROGRAM INOPERABLE X-RAY/RADIATION GENERATING EQUIPMENT (RGE) FORM |
| RGE Disposition | NOTICE OF TRANSFER OR DISPOSAL OF RADIATION GENERATING EQUIPMENT (X-RAY) |

Forms Available on Radiation Safety Office Website

https://research.uc.edu/support/offices/radsafety

# Appendix B
# ALARA Investigational Levels

# ALARA Investigational Levels

| AREA | ALARA I (10%) LEVEL | ALARA II (30%) LEVEL |
|---|---|---|
| **Effective Dose*** | 125 mrem | 375 mrem |
| **Any organ, other than eye** | 1250 mrem | 3750 mrem |
| **Eye** | 375 mrem | 1125 mrem |
| **Skin** | 1250 mrem | 3750 mrem |
| **Extremity** | 1250 mrem | 3750 mrem |

***Effective dose based on "Webster Formulas" if a lead apron is worn. If two dosimeters are worn the effective dose = 0.04 (collar-outside apron dosimeter reading) + 1.5 (waist-under apron dosimeter reading). If one dosimeter is worn the effective dose = 0.3 (collar-outside apron dosimeter reading)**

# Appendix C
# Sample Posting

# The University of Cincinnati
# Radiation Control and Safety Program (RCSP)

The RCSP covers licensed sources of radioactive material used and possessed at University of Cincinnati campuses (East, West, RWC, OCAS, GRI and Center Hill), The University Hospital, Cincinnati Children's Hospital Medical Center and associated Ohio outpatient clinics, and Cincinnati Shriners Hospital for Children. The RSCP also covers registered radiation generating equipment (RGE) used and possessed at University of Cincinnati campuses (East, West and RWC), Cincinnati Children's Hospital Medical Center and associated Ohio outpatient clinics, and Cincinnati Shriners Hospital for Children. The broad scope license (license# 02110310010), the source material license (license# 01129310010), the RGE registrations and the license/registration inspection reports may be examined at the Radiation Safety Office (RSOf). Copies of policies and procedures are available at the RSOf and are posted on the RSOf website https://research.uc.edu/support/offices/radsafety. Current applicable rules are posted on the Ohio Department of Health (ODH) website https://odh.ohio.gov/.

**University of Cincinnati Radiation Safety Office**
**(513) 558-4110, ML 0591**
**Office-hours 8:00 am – 5:00 pm standard university business days**

## OHIO DEPARTMENT OF HEALTH
## NOTICE TO EMPLOYEES

In radiation protection rules adopted under Chapter 3748 of the Ohio Revised Code, the Ohio Department of Health has established standards for your protection from radiation sources which are required to be licensed/registered with the Ohio Department of Health

**YOUR EMPLOYER'S RESPONSIBILITY**

Your employer is required to:

1) Inform you of the occurrence of radiation or radiation sources and the presence of a restricted area;
2) Instruct you in the safety problems associated with exposure to radiation and in precautions or procedures to minimize exposure to radiation; instruct you in the applicable laws for the protection of personnel from exposure to radiation;
3) Post or otherwise make available to you a copy of the operating procedures applicable to work under the license/registration;
4) Apply the radiation protection rules to all work involving licensed/registered sources of radiation; and
5) Post notices of violation involving radiological working conditions.

**YOUR RESPONSIBILITY AS A WORKER**

You should familiarize yourself with those provisions of the radiation protection rules and operating procedures that apply to the work you are engaged in. You should observe their provisions for your own protection, the protection of your co-workers and others. If you should observe violations of the law, or have a safety concern, you should report them to your supervisor. You may also report them to ODH.

**WHAT IS COVERED BY THESE RULES**

1) Limits on exposure to radiation and radioactive materials in restricted and unrestricted areas;
2) Measures to be taken after accidental exposures;
3) Personnel monitoring; surveys and equipment;
4) Caution signs, labels and safety interlock equipment;
5) Exposure records and reports; and
6) Related matters.

**REPORTS ON YOUR RADIATION EXPOSURE HISTORY**

Your employer is required to advise you of your dose annually if you are exposed to radiation for which monitoring was required by ODH or upon request. In addition, you may request a written report of your exposure when you leave your job.

**INSPECTIONS**

All activities covered by the ORC 3748 and other radiation protection laws are subject to inspection by representatives of the Ohio Department of Health.

ODH inspectors want to speak or talk with you if you are worried about radiation safety or have other safety concerns about licensed/registered activities. Your employer may not prevent you from talking with an inspector. The ODH will make all reasonable efforts to protect your identity where appropriate and possible.

If you believe your employer has not corrected violations involving radiological working conditions, you may request an inspection. Your request should be addressed to the Ohio Department of Health, Bureau of Radiation Protection, and must describe the alleged violation in detail. It must be signed by you, or your representative.

**DISCRIMINATION**

Your employer is prohibited from firing or otherwise discriminating against you for bringing safety concerns to the attention of your employer or ODH. You may not be fired or discriminated against because you:

- ask ODH to enforce the law against your employer;
- refuse to engage in activities that violate the law;
- provide information or are about to provide information to the ODH or your employer about violations of laws or safety concerns;
- are about to ask for, or testify, help, or take part in an ODH or other state proceeding.

The ODH will investigate each allegation of harassment, intimidation, or discrimination.

## CONTACT INFORMATION

Bureau of Radiation Protection
Ohio Department of Health
246 North High Street
Columbus, Ohio 43215
BRadiation@odh.ohio.gov

Radioactive Materials
Phone 614-644-2727
Fax 614-466-0381

Radiologic Technology Section (X-ray)
Phone 614-644-2727
Fax 614-466-0381

## POSTING REQUIREMENTS

Copies of this notice must be posted in a sufficient number of places in every facility where employees are engaged in activities subject to the radiation protection rules of the Ohio Administrative Code to permit employees working in or frequenting any portion of a restricted area to observe a copy on their way to or from their place of employment. OSHA requires 29 CFR 24 Appendix A "Energy Reorganization Act" Poster be displayed when applicable.

**ODH 4786.32 (Rev. 8/06)**

**If you have questions or concerns contact the Radiation Safety Officer or the certified radiation expert (CRE).**
Radiation Safety Officer – (513) 558-4110
CRE for CCHMC and SHC RGE – Lisa Lemen, PhD (513) 558-2197