North Carolina A&T State University

RADIATION SAFETY MANUAL

Radiation Safety Committee
October 2013
NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY

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This document is available online at http://www.ncat.edu/research/rsc-manual.pdf
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## HISTORY OF CHANGES

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<td>Original Document</td>
<td>Louisa V. Thomas</td>
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<td>09/06/13</td>
<td>Updated throughout&lt;br&gt;Revised Sections:&lt;br&gt;- B. Roles and Responsibilities&lt;br&gt;- G. Emergencies&lt;br&gt;- Appendix A - Application for Use of Radioisotopes, Sealed Sources and Radiation Producing Equipment&lt;br&gt;<strong>New Sections added:</strong>&lt;br&gt;- N. Veterinary Medicine Radiographic Installations&lt;br&gt;- O. Analytical X-Ray Equipment&lt;br&gt;- P. Industrial Radiography&lt;br&gt;- Q. Notification of Incidents&lt;br&gt;- R. Annual Program Review&lt;br&gt;- Appendix D - Emergency Procedures for Radioisotopes and Sealed Sources</td>
<td>Dan Hurley</td>
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| D        | 09/18/13       | Updated Table of Contents  
Added new application in Appendix - A  
Added zip codes and prefixes to telephone numbers. | Tonya Hargett |
| E        | 10/11/13       | New Section Added: Section P - Electron Microscope Requirements. Subsequent section designation revised | Dan Hurley     |
A. INTRODUCTION

Research in science and technology at North Carolina Agricultural and Technical State University utilizes radioactive materials. To oversee the use of all radioactive material and ionizing radiation-producing devices and to ensure compliance with the North Carolina Radiation Protection Act (G.S. 104E), the Chancellor of the University has established a Radiation Safety Committee, whose chair reports to the Vice Chancellor for Research and Economic Development.

For the list of committee members and other current information, go to http://www.ncat.edu/research/dored/rsc.html.
B. ROLES AND RESPONSIBILITIES

1. Radiation Safety Committee

As required by 15A NCAC 11, the Radiation Safety Committee will review annually the content and implementation of the radiation protection safety program and record the review for audit. A copy of this record will be maintained with other committee documents. Accordingly, the N.C. A&T Radiation Safety Committee has these responsibilities:

A. Monitoring and modifying when appropriate policies and procedures to ensure compliance with radiation protective standards including but not limited to the North Carolina Department of Environment and Natural Resources, Radiation Protection Section;

B. Developing a list of responsibilities and duties for the University Radiation Safety Officer, the Radiation Safety Committee, and Principal Investigators;
C. Under the authority of a license issued by the North Carolina Radiation Protection Section, approving or disapproving individuals to use radioactive materials after a review of the proposed use, facilities, and experience of the applicants;

D. Reviewing reports of the Radiation Safety Officer relative to receipt, use, monitoring, disposal, and any augmentation of existing license requirements for radioactive material;

E. Suspending any project or procedure that it finds to be a threat to health or property upon review of the report of the Radiation Safety Officer;

F. Recommending to the Chancellor the termination of any project that fails to take appropriate corrective action.

2. Radiation Safety Officer

Responsibilities of the N.C. A&T Radiation Safety Officer (RSO):

A. Reviewing and assuring compliance of all users with applicable radiation standards and procedures:

1. Maintaining records of acquisition and receipt of radioactive materials and waste disposal;
2. Distributing personnel monitoring devices and keeping records of exposures;
3. Monitoring facilities, including sealed sources and X-ray-emitting devices, for contamination and/or radiation leakage; and
4. Maintaining inventories of radioisotopes to ensure that possession limits are not exceeded.

B. Serving as contact person for the University with all regulatory agencies and waste disposal firms;

C. Maintaining accurate records of the individuals authorized to use radioactive materials;

D. Reviewing, approving, and coordinating the receipt of all purchases of radioactive materials and equipment;

E. Reviewing and overseeing facilities for radioactive materials use, storage, and disposal;
F. Arranging and/or conducting training programs for users of radioactive materials and equipment;

G. Serving as emergency contact person for all matters involving radioactive materials;

H. Reviewing all instances of noncompliance with safety policies and recommending corrective measures;

I. Maintaining inspection reports by the North Carolina Department of Environment and Natural Resources and/or federal inspectors;

J. Approving all property and equipment transfers for items incorporating radioactive material or emitting ionizing radiation.

L. Establishing and overseeing operating, emergency and ALARA (“as low as reasonably achievable”) procedures and reviewing them at least annually to assure that the procedures are current and conform with these rules and to license conditions;

M. Overseeing and approving/disapproving all phases of the training of radiographic personnel so appropriate and effective radiation protection practices are taught;

N. Ensuring that required radiation surveys and leak tests are performed and documented in accordance with this rule, including corrective measures when levels of radiation exceed established limits;

O. Ensuring that personnel monitoring devices are calibrated and used properly by occupationally-exposed personnel, that records are kept of the monitoring results, and that timely notifications are made as required by Rule 15A NCAC 11.1646 of the N.C. Regulations for Protection Against Radiation; and

P. Assuring that operations are conducted safely and assuming control and having the authority to institute corrective actions, including stopping operations when necessary in emergency situations or unsafe conditions.
3. Authorized Radiation Users

   A. Submit Radiation Safety Applications for the use of Radioisotopes, Sealed Sources and Radiation-Producing Equipment.
   B. Attend annual radiation safety training.
   C. Maintain an up-to-date list of Designated Users under their Radiation Safety Application.
   D. Ensure that all authorized users under their radiation safety application have received initial and annual radiation safety training and equipment-specific project training.
   E. Comply with the requirements of their radiation safety application, the N.C. A&T Radiation Safety Manual, and North Carolina radiation-protection regulations.
   F. Maintain all required records.
   G. Inform the Radiation Safety Officer when the project has ceased operations.
   H. Inform the Radiation Safety Officer when a potential over-exposure occurs.

4. Designated Radiation Users

   A. Use radioisotopes, sealed sources or radiation-producing equipment under the supervision of an Authorized Radiation User.
   B. Complete initial and annual radiation safety training and equipment-specific project training.
   C. Comply with the requirements of their radiation safety application, the N.C. A&T radiation Safety manual, North Carolina radiation protection regulations.
   D. Maintain all required records.
   E. Inform the Radiation Safety Officer when a potential over-exposure occurs.
C. Authorization to Use Radioactive Materials or Radiation-Producing Equipment

Authorization to use and possess radiation sources and equipment containing sealed sources and radiation producing equipment is under the authority of the University Radiation Safety Committee.

1. Authorization for Use

A. All persons desiring to use radioactive materials, equipment containing a radioactive source or equipment that emits X-rays are required to consult with the Radiation Safety Officer before acquiring or purchasing any source or equipment.

B. An application for approval of users of radioactive materials must be submitted on the appropriate application form, titled “Application for Use of Radioisotopes, Sealed Sources and Radiation Producing Equipment” (Appendix A). This form is available online or from the RSO or the Radiation
Safety Committee Administrator and must be completed and returned to the Radiation Safety Committee Administrator.

C. Upon receipt of the application, the University Radiation Safety Committee evaluates the proposed use of the radioisotope(s) and equipment to determine for the State of North Carolina:

1. Whether the applicant has sufficient training and qualifications to work safely with radioisotopes, as proposed;
2. Whether the applicant has the necessary facilities and equipment to use the radioisotope(s) and equipment safely and in a manner that complies with applicable regulations; and
3. Whether to amend or restrict certain portions of the proposed work because of certain inadequacies.

The University Radiation Safety Committee does not issue an opinion of the technical merit of any proposal; it is concerned only with safety and regulatory compliance.

Applications are approved for a three-year period and must be resubmitted as a new application at the end of the third year if the research is to be continued.

2. Authorization for Use of Radioisotopes in Animals

To use a radioisotope in animals, follow these procedures:

A. Obtain IACUC approval for animal use by completing the Application to Use Live Vertebrate Animals via the ACAP system. ([https://ncat.myresearchonline.org/acap/](https://ncat.myresearchonline.org/acap/))

B. Once an IACUC application is submitted, complete an “Application for Use of Radioisotopes, Sealed Sources and Radiation Producing Equipment” (Appendix A).
D. ACQUISITION AND RECEIPT OF RADIOACTIVE MATERIALS AND EQUIPMENT

1. Acquisition

All radioactive materials and equipment (including sealed sources and X-ray-emitting equipment) must be ordered through Aggie Mart.

The "Deliver To" section of the requisition must read:

Deliver To: Radiation Safety Officer
North Carolina A&T State University
1601 E. Market St.
Greensboro, NC 27411
EHS/OSHA

The RSO approves the requisition in Aggie Mart.
2. Receipt

Upon the delivery of the shipment to Central Receiving, contact the RSO by telephone. If required by regulation (15A NCAC 11.1627 Procedures for Receiving and Opening Packages) or if contamination is suspected, the RSO will monitor the external surfaces of the packages of radioactive materials for radioactive contamination caused by leakage of the contents. The authorized user or designee will acknowledge, by signature, receipt of the material. The RSO will maintain a record of the received material. Central Receiving personnel then will forward the receiving report to the Accounts Payable Office.

NOTE: In absence of the RSO, the assistant RSO serves in the capacity of the RSO.

3. Cessation of Operations and Maintenance of Records

The State Division of Radiation Protection and N.C. A&T require authorized users to maintain accurate records of the receipt, use, and disposal of all radioactive materials in their possession. These records must be available for periodic review by the RSO, the Radiation Safety Committee, or inspectors from the State Radiation Protection Office. All investigators are required to keep receipt, utilization, and disposal records of each radioisotope on the "Radioisotope Inventory Form" (Appendix B) and "Radioactive Waste Material Disposal Form" (Appendix C).

If an authorized user is required to cease using radioactive materials, the user will notify the RSO in writing. The authorized user will:

A. Notify the RSO of the date operations are to cease and ask for an inspection of the operations area before the official end of all activities; and

B. Turn over records of leak test, wipe test, and inventory to the RSO.
Unless authorized otherwise, all radioactive sources will remain the property of N.C. A&T and will be transferred to the care of the RSO. In addition, the disposition (including storage) of all radioactive waste will be handled by the RSO, which is congruent with the general policy of the Radiation Safety Program.

An inspection of the lab will be documented by the RSO and the authorized user. Once the inspection has been conducted, the RSO will notify, in writing, the Chair of the Radiation Safety Committee, and the Committee Chair will inform the Vice Chancellor of Research in writing of the status of the lab equipment, etc., and the associated radioactive sources.

Failure of any authorized user to notify the RSO of the intention to cease operations for radioactive research is a violation of the Environmental Health and Safety policies for the University and may result in personnel action by the University.

4. Material Receipt Procedures

A. Upon receipt of each radioisotope, record the:
   - Date
   - P.O. number
   - Isotope
   - Form
   - Quantity (number of mCi or µCi)
   - Person receiving shipment

B. If the authorized user receives radioactive material directly from the shipper or through Central Receiving, the user must notify the RSO immediately. The RSO will then determine whether contamination monitoring is needed for the package (15A NCAC 11.1627 Procedures for Receiving and Opening Packages). The RSO will complete the other necessary records.

C. Each authorized user will establish and maintain procedures for safely opening packages in which radioactive material is received and will assure that these procedures are followed. At a
minimum, the handling methods given in Section F, Standard Laboratory Procedures, of this manual must be followed.

D. Records of receipt must be maintained for at least three years from when they were made. Disposal records may be required to be maintained for a much longer period of time. Check with the RSO before discarding any records to determine whether a longer retention period is required.
E. Security of Radioactive Materials and Radiation Equipment

1. Lock All Rooms
   Rooms containing radioisotopes, sealed sources and/or radiation-producing machines must remain locked when authorized users are not present.

2. Lock Disposal Storage Areas
   Radiation disposal storage areas will remain locked at all times and under direct supervision of the Radiation Safety Officer or the Assistant Radiation Safety Officer.

3. Access Control for Labs
   Laboratories containing radioactive sources will be controlled by the laboratory supervisor to prevent unauthorized entry into research areas either by staff or the general public.
4. Lab Security
   Laboratories containing radioactive sources will be secured at all times to include appropriate surveillance against unwarranted entry. When the laboratory supervisor is away from the laboratory, the laboratory will be locked or monitored closely by designated personnel.

5. Suspicious Activity
   Any suspicious activity around or near any laboratory should be reported to security immediately.
F. Standard Laboratory Procedures

1. General laboratory procedures

A. The laboratory is normally divided into active and inactive areas. Radioisotopes are to be used only in active areas!

B. Radiation warning signs must be posted on laboratory entrance doors, refrigerators, freezers, and other pertinent equipment and radiation warning tape must be attached to glassware, plastics, etc. containing radioactive materials.

C. Smoking is prohibited in all lab areas.

D. Eating, storing, and preparing food is prohibited in lab areas.

E. Pipetting of radioactive materials by mouth is prohibited.

F. Personnel sustaining minor injuries, cuts, abrasions, or skin disorders should be aware that these conditions could increase the probability of absorption of radioactive materials. The proper personal protective equipment (PPE) is donned when working with radioactive materials.
G. Radioactive spills are discussed in the Emergency Procedures section of this manual.

H. The dispensing of radioisotopes from manufacturers’ stock containers must be performed within the assigned area (preferably a fume hood). Work using gamma-emitting radioisotopes or high-energy beta particle emitting radioisotopes will be conducted using appropriate shielding, as designated by the RSO.

I. Film badge dosimeters will be worn by personnel working with millicurie quantities of gamma or high beta emitting types of radioisotopes.

J. Solid and liquid radioactive wastes will be disposed of only in designated and labeled containers.

K. Radioactive cleaning baths should be maintained adjacent to waste disposal receptacles and washing sinks to minimize contamination. Protective gloves, glasses, and aprons will be worn by personnel when cleaning glassware, plastics, etc., that have been in contact with radioactive materials.

L. No radioactive materials, including radioisotopes and sealed sources, or radiation-producing equipment will be transferred to other departments, programs, users, universities, companies, governmental agencies, or individuals without the prior knowledge and approval of the RSO.

2. Handling radioactive materials

Handling radioactive materials requires lab personnel to follow protective measures relating to safety procedures, safe work habits, and personal cleanliness. These protective measures are:

A. When using radioactive liquids, work on trays or tables lined with absorbent paper.

B. When using radioactive solid materials, handle such materials with tongs or other protective devices.
C. Use hood ventilation if sterile conditions are not warranted. Hood ventilation is provided in laboratories and should therefore be used.

D. When handling relatively large amounts (>1 mCi) of radioactive material, wear PPE (i.e., gloves, glasses, coveralls, apron).

3. Protective measures

Maintaining distance from the source is perhaps the best protective measure against personal contamination. Therefore, the following measures will be followed:

A. Keep as far from the source as possible when you open it.
B. Especially avoid placing your body above the container.
C. Do not handle sources with your hands. Use tongs.
D. Take advantage of the inverse square law for shielding by distance (i.e., two times the distance results in one-fourth the exposure).

4. Time

The dosage of radioactivity received is proportional to the time of exposure. One-half the exposure time will result in receiving one-half the dosage; therefore, handle the sources as quickly and as efficiently as possible.
5. Equipment Decontamination

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<td>Paint</td>
<td>Water, detergents, complexing agents (oxalates, carbonates, citrates), organic solvents, caustics, abrasion (wet)</td>
</tr>
<tr>
<td>Glassware</td>
<td>Detergent reagents (mineral acids, tri-sodium phosphate, etc.)</td>
</tr>
<tr>
<td>Metal</td>
<td>Water, detergent, organic solvents complexing agents (oxalates, carbonates, citrates), inorganic acids, acid mixtures, abrasion (wet)</td>
</tr>
<tr>
<td>Concrete and brick</td>
<td>Abrasion (vacuum blasting) vacuum cleaning</td>
</tr>
<tr>
<td>Wood paneling</td>
<td>Remove</td>
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6. Equipment malfunction

If equipment containing a sealed source or X-ray emitting device becomes suspect of a malfunction, turn off the equipment immediately and notify the RSO as to the nature of the problem. If equipment becomes damaged due to movement, fall, etc., notify the RSO immediately. The equipment will be leak-tested as soon as possible.
G. EMERGENCIES

1. Personnel Contamination

If liquid radioactive materials are going to be used, contact the Radiation Safety Officer before use to develop a protocol to determine the proper personnel protective equipment for the project and how to handle decontamination of personnel.

In case of the ingestion of radioactive materials, seek medical aid from the Emergency Room at Moses Cone Hospital. If immediate action is warranted, induce vomiting repeatedly with ingestion of two to four glasses of lukewarm water between times.

2. Laboratory Contamination

As a general rule, minor spills involve microcurie quantities while major spills involve millicurie quantities. Emergency plans are included in Appendix D.
H. SURVEY AND MONITORING

1. Radioisotopes

The authorized user is responsible for the measurement of contamination levels and exposure rates on working surfaces and in storage areas. Therefore, the user must:

1. Conduct monthly surveys to measure contamination of those areas previously identified by a diagram of the laboratory working area,
2. Record and keep on file the results of the surveys, and
3. Send the RSO a copy of the results.

When the user begins working with radioactive materials, monthly surveys become mandatory. Surveys are conducted at monthly intervals whether or not radioactive materials are being actively used. The RSO periodically (at least twice yearly) surveys the laboratory area of each authorized user. A survey report of the monthly wipe
test will be completed by the authorized user and forwarded to the RSO before the end of the first work day of each new month.

In accordance with 15A NCAC 11 .1637, all survey records must be retained for at least three years from when the record was made. Before disposing of survey records, contact the RSO to make sure a longer retention time is not needed.

Users must either possess or have access to instruments that are capable of detecting and measuring contamination levels for the isotopes they are authorized to possess.

For beta radiation, contamination checks are performed by taking a wipe smear of a surface area and analyzing the activity on the wipe smear by counting in a liquid scintillation counter.

For gamma radiation, portable ionization chambers or GM counters are used to measure contamination of surface areas. In addition, a wipe smear of surface area can be performed and analyzed by counting in a gamma counter.

**Note:** For significant contamination (> 300 counts/minute/100 cm²), individuals are asked to decontaminate and re-survey the area. The RSO must be contacted if the contamination level still exceeds 300 counts/minute.

2. Sealed Sources

Sealed radioactive sources must be leak-tested at six-month intervals for contamination and evidence of leakage of ionizing radiation. The authorized user leak-tests the sealed sources and mails the sample to the authorized vendor if the RSO cannot provide that service. This includes instruments that are inoperable, in storage, etc. The arrangement, contract, expense, and documentation of commercial test by outside vendors will be the responsibility of the EHS Office. The RSO will monitor these procedures to insure timely surveying and record retention. Any failure by an authorized user to conduct a
leak-test as required by regulations will be reported promptly to the Radiation Safety Committee.

3. Veterinary Medicine X-ray Machines

A. Radiation Survey

1. For installations of X-ray equipment, an area radiation survey will be performed within 30 days after initial operation of each radiation machine to show compliance with Rule .0604(b) of the North Carolina radiation protection regulations. This survey will include a drawing of the room in which a stationary X-ray system is located and radiation levels in adjacent areas; and the name of the person approved by the agency performing the survey and the date the survey was performed.

2. Any modification to the X-ray room or adjacent areas that could increase the radiation dosage to any individual will require a new survey.

3. Records must be maintained.

4. Analytical X-ray Equipment and Electron Microscopes

Surveys will be conducted:

1. Upon installation of equipment;

2. Following any change in the initial arrangement, number, or type of local components in the system; and

3. After any maintenance requiring disassembly or removal of a local component in the system that could affect the radiation exposure to personnel.

Radiation monitoring will be performed during maintenance. Personnel monitoring or wrist dosimeters will be provided to and used by analytical X-ray equipment workers using systems having an open beam configuration and not equipped with a safety device and to personnel maintaining analytical X-ray equipment if maintenance
procedures require the presence of a primary X-ray beam when any local component in the analytical X-ray system is disassembled or removed.

5. Personnel Monitoring/Occupational Dose Limits for Adults

Under ordinary circumstances, the RSO will issue personnel dosimeters to individuals working with X-ray devices and millicurie quantities of gamma-emitting radioactive materials and higher energy beta particle-emitting materials. The RSO is responsible for maintaining records of exposure rates of individuals and notifying individuals if their exposure dosimeters exceed levels established for age and pregnancy status.

Personnel monitors are not issued to personnel working solely with low-energy beta particle-emitters such as tritium (3H), carbon-14 (14C), and sulfur-35 (35S) since the devices are insensitive to the radiation from the radionuclides.

Per 15A NCAC 11, Section .1604, the University will control the occupational dose to individual adults, except for planned special exposures as provided in Section .1608 (which are unlikely and usually performed only in plant maintenance of nuclear power plants), to the following dose limits:

A. An annual limit, the more limiting of:

1. The total effective dose equivalent being equal to five rems (0.05Sv); or

2. The sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye being equal to 50 rems (0.5 Sv);

B. The annual limits to the lens of the eye, to the skin, and to the extremities, which are:

1. An eye dose equivalent of 15 rems (0.15 Sv), and

2. A willow-dose equivalent to 50 rems (0.50 Sv) to the skin or to each of the extremities.
C. Dose received in excess of the annual limits, including doses received during accidents, emergencies, and planned special exposures, will be subtracted from the limit for planned special exposures that the individual may receive during the current year and during the individual's lifetime. Dose limits for planned special exposures are provided in Item (5) of Section .1608 of 15A NCAC 11.

D. The University will reduce the dose that an individual may be allowed to receive in the current year by the amount of occupational dose received while employed by any other institution. Requirements for determining prior occupational exposure are provided in Section.1638 of 15A NCAC11.

E. The dose to pregnant employees will not exceed 0.5 rem (5mSv) per year. All other requirements of Section .1610 and Section .1640 of the rule will strictly be adhered to. For further requirements of this rule and pregnancy declaration, see the pregnancy policy in Appendix E.

6. Dose Limits for Individual Members of the Public

Members of the public and non-essential staff employees are allowed only minimal entry and time spent within research areas. Equipment and radioactive sources will be secured at all times and kept under surveillance to prohibit entry by unauthorized persons into any restricted area.

In the event that any unauthorized person enters a laboratory or other restricted area, exposure will be kept as low as reasonably possible and in any event will not be allowed to exceed 0.1 rem (1 mSv) in a year as required by 15A NCAC 11, paragraph .1611 (1).
I. BIOASSAYS

Thyroid assays are required for individuals using greater than 5 millicuries of iodine-125 (125I) and iodine-131 (131I) as iodide in a single procedure or greater than 10 millicuries in multiple procedures in one month. Periodic urine analysis may be required for individuals using large quantities of 3H and 14C. Requirements for these analyses are a component of the user's authorization. The RSO arranges these analyses.

Routine bioassay monitoring is conducted when any individual is working with radionuclide form/activity combinations exceeding established limits.

Any employee's request for a bioassay analysis is honored. Pregnant radiation workers using radioactive materials are placed on a mandatory monthly bioassay schedule.

An outside laboratory specializing in bioassay services is used for analysis requiring extraordinary equipment or procedures. Internal dose results are recorded, added to any external occupational dose, and maintained as part of the radiation worker’s overall personnel monitoring history.
J. TRANSPORTATION OF RADIOACTIVE MATERIALS

These criteria pertain to the transportation of radioactive materials on the North Carolina A&T campus:

1. Prior Approval Required

   No radioactive materials and/or equipment may be moved without the prior approval of the RSO. The RSO must be notified of intent to move radioactive materials. All matters involving transportation of radioactive materials and equipment must be arranged through the RSO.

2. Containers

   All radioactive materials must be transported in the original shipping containers, plastic containers, or other containers approved by the RSO.
3. Intra-Facility

Radioactive materials are to be transported only to other licensed laboratories with the approval of the RSO.

4. Intra-Campus

Radioactive materials are to be transported only through the coordination of the RSO and, when appropriate, in a placarded vehicle designating the presence of radioactive materials.

5. Disposal

Radioactive materials for disposal will be transported only through the coordination and approval of the RSO. They will be transported to the HAZMAT facility, 1905 Lutheran Street, where they will be held until there are sufficient quantities for disposal.

**Note:** For intra-campus transportation of shipments of radioactive materials received from commercial vendors, a placarded vehicle will be used when the exterior surface of the shipping package contains a Radioactive Yellow-III label, which denotes a radiation level of 50 mrem/hr. at the package surface. Radioactive White-1 and Yellow-II levels do not require a placarded vehicle.
K. DISPOSAL OF RADIOACTIVE WASTE MATERIALS

1. Storage

Solid radioactive waste must be stored in a steel drum or plastic container, each with a plastic liner and a securely fitting cover. Liquid waste must be kept in plastic bottles or jugs and sealed. Animal carcasses, excreta, etc., must be stored frozen within a suitable container.

2. Disposal

A. Disposal of radioactive waste into city sewage and landfill systems is not permitted unless approved by the RSO.

B. Before disposal, all investigators must submit a completed Radioactive Waste Materials Disposal Form to the RSO (refer to Appendix C for form).

C. For disposal, all materials including but not limited to liquids, solids, trash, animal carcasses, and excreta must be placed in
the appropriate container. This container must be properly labeled to include the building name, lab number, investigator, contents, and container number.

D. All needles must be packaged in an appropriate sharps container along with other sharp objects.

E. Radioactive waste containing short half-life materials may be stored for periods of time sufficient to allow the materials to decay to background levels. The RSO must be informed by the authorized user of this intent. Waste containing radioactive materials with a half-life less than 90 days will be allowed to decay following a 10 half-life storage period. Solid and liquid waste receptacles will be sealed for decay storage and secured in appropriate storage areas, e.g., sealed receptacles of waste containing P 32 will be stored minimally for 143 days. After decay, the RSO will remove warning labels for subsequent disposal into the city landfill. Before disposal, the package surface will be monitored to determine that the radioactivity cannot be distinguished from the background radiation level using a radiation detection survey meter capable of detecting a dose rate of 0.1 millirem per hour and with no interposed shielding. Aqueous material will not be disposed of in the sanitary sewage system unless authorized by the RSO. All chemical waste will be disposed of according to federal and state guidelines and under the guidance of the University Safety Director and the RSO.

F. Since radioactive waste materials are included as inventory, it is imperative that the total possession limits for each radioisotope are not exceeded.

G. For the disposal of equipment containing sealed sources, the RSO will arrange for removal of the source by a certified technician before disposal.
L. Posting of Notices and Signs

Investigators are required to post these notices and warning signs in laboratories or other facilities where radioactive materials, sealed sources, or X-ray emitting devices are used.

<table>
<thead>
<tr>
<th>Type</th>
<th>Where Used</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>State of North Carolina &quot;Notice to Employees&quot; (Standards for Protection Against Radiation; Notices; Instructions and Reports to Workers; Employee Protection)</td>
<td>All areas where radioisotopes, sealed sources or X-ray-emitting machines are located</td>
<td>EHS</td>
</tr>
</tbody>
</table>

Continued on next page
<table>
<thead>
<tr>
<th>Type</th>
<th>Where used</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Caution Radioactive Material</strong></td>
<td>All areas where radioisotopes, or sealed sources, are handled, used or stored. Also on equipment.</td>
<td>Authorized Radiation User</td>
</tr>
<tr>
<td><strong>Radioactive Material tape</strong></td>
<td>Radioactive material containers, sealed source equipment, hoods, lab benches, and other areas in the laboratory used for radioactive work</td>
<td>Authorized Radiation User</td>
</tr>
<tr>
<td>&quot;CAUTION - X-RAY EQUIPMENT&quot;, or words having a similar intent.</td>
<td>Analytical X-ray machines, X-ray machines</td>
<td>Authorized Radiation User</td>
</tr>
<tr>
<td><strong>Radioactive Waste</strong></td>
<td>Radioactive waste containers</td>
<td>Authorized Radiation User</td>
</tr>
<tr>
<td>Emergency procedures - radioactive materials (RSC-4)</td>
<td>Radioisotopes and sealed sources</td>
<td>EHS</td>
</tr>
<tr>
<td>Emergency procedures - X-ray-emitting equipment</td>
<td>X-ray-emitting equipment</td>
<td>EHS</td>
</tr>
<tr>
<td>Emergency procedures - provided by vendor</td>
<td>X-ray-emitting equipment Sealed sources</td>
<td>Authorized Radiation User</td>
</tr>
</tbody>
</table>
Investigators are responsible for purchasing radioactive warning signs and labeling tape. The RSO will advise the user on their proper display. "Notice to Employees" and "Emergency Procedures" notices are provided by the RSO.
M. TRAINING

All users of radiation-producing equipment and sealed sources are required to complete the Radiation Safety online training module.

Access to the N.C. A&T Research Training System, http://ncatresearchtraining.org/login.php, is provided through the Radiation Safety Committee Administrator. To gain access, send an email to trharget@ncat.edu with your name and email address.

The RSO is responsible for providing additional radiation safety training for authorized users, laboratory personnel using radioisotopes, personnel using equipment containing sealed sources and X-ray-emitting devices, laboratory personnel intending to use radioisotopes, administrators, University police officers, students, housekeepers, etc.

The training can consist of topics related to types and activities of radioisotopes, methods of safe handling in the laboratory, emergency procedures, radiation safety during pregnancy, waste disposal methods, state and federal regulations, etc.
Failure of authorized users to attend training must be communicated in writing to the RSO before the event. The failure of authorized users to attend annual training is reviewed by the Radiation Safety Committee.

<table>
<thead>
<tr>
<th>Table M: Training Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type of radiation</strong></td>
</tr>
<tr>
<td>-------------------------</td>
</tr>
<tr>
<td>Radioisotopes used for research</td>
</tr>
<tr>
<td>Sealed Sources</td>
</tr>
<tr>
<td>Analytical X-rays</td>
</tr>
<tr>
<td>Veterinary X-ray Machines</td>
</tr>
<tr>
<td>Soil Probe</td>
</tr>
<tr>
<td>Cabinet Radiography</td>
</tr>
<tr>
<td>Electron Microscope</td>
</tr>
</tbody>
</table>

Authorized users are required to document any non-A&T radiation safety training and all hands-on radiation safety training using the form appended.
N. Veterinary Medicine Radiographic Installations

North Carolina requirements for veterinary radiographic units:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative Controls</td>
<td>Do not use non-compliant equipment.</td>
</tr>
<tr>
<td>(continues on next page)</td>
<td>Instructed in Safe Operating Procedures.</td>
</tr>
<tr>
<td></td>
<td>Demonstrate understanding and use of equipment.</td>
</tr>
<tr>
<td></td>
<td>Posting of usual examinations and use of equipment.</td>
</tr>
<tr>
<td></td>
<td>Written safety procedures and rules.</td>
</tr>
<tr>
<td></td>
<td>Only necessary personnel present when using machine and required doses.</td>
</tr>
</tbody>
</table>
## Table N: Veterinary Radiographic Requirements

<table>
<thead>
<tr>
<th>Topic</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administrative Controls (continued)</td>
<td>Gonad shielding required.</td>
</tr>
<tr>
<td></td>
<td>Mechanical holding devices selection requirements.</td>
</tr>
<tr>
<td></td>
<td>Human holding procedures.</td>
</tr>
<tr>
<td></td>
<td>Equipment designed to minimize patient and personnel exposures.</td>
</tr>
<tr>
<td></td>
<td>Monitoring devices.</td>
</tr>
<tr>
<td></td>
<td>Current registration information and other correspondence with the agency regarding that machine.</td>
</tr>
<tr>
<td></td>
<td>Records of surveys and calibrations.</td>
</tr>
<tr>
<td></td>
<td>Records of maintenance or modifications which affect the useful beam, along with the names of persons who performed the service.</td>
</tr>
<tr>
<td>Plans Review</td>
<td>Before construction or structural modification, the floor plans and equipment arrangement of all installations utilizing X-rays for diagnostic or therapeutic purposes will be reviewed by a qualified expert. The registrant will submit recommendations of the expert to the agency.</td>
</tr>
<tr>
<td>Surveys</td>
<td>Per Section H.3.</td>
</tr>
</tbody>
</table>

*Continued on next page*
<table>
<thead>
<tr>
<th>Topic</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Installation Requirements</strong></td>
<td>Diagnostic protective tube.</td>
</tr>
<tr>
<td></td>
<td>Diaphragms or cones will be provided.</td>
</tr>
<tr>
<td></td>
<td>The total filtration permanently in the useful beam will not be less than 0.5 millimeters aluminum equivalent for machines operating up to 50 kVp.</td>
</tr>
<tr>
<td></td>
<td>Total filtration permanently in the useful beam will not be less than 1.5 millimeters aluminum equivalent for machines operating at 50-70 kVp.</td>
</tr>
<tr>
<td></td>
<td>Total filtration permanently in the useful beam will not be less than 2.5 millimeters aluminum equivalent for machines operating above 70 kVp.</td>
</tr>
<tr>
<td></td>
<td>A device will be provided to terminate the exposure after a preset time or exposure.</td>
</tr>
<tr>
<td></td>
<td>A dead-man type of exposure switch will be provided, together with an electrical cord of sufficient length, so that the operator can stand out of the useful beam and at least six feet from the animal during all X-ray exposures or behind a protective barrier adequate to assure compliance.</td>
</tr>
<tr>
<td><strong>Primary and Secondary Barriers</strong></td>
<td>All wall, ceiling and floor areas will be equivalent to or provided with primary and secondary protective barriers necessary to comply with Rule .1604 and Rule .1611 of this Chapter.</td>
</tr>
</tbody>
</table>

Continued on next page
<table>
<thead>
<tr>
<th>Topic</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating procedures</td>
<td>The operator will stand well away from the useful beam and the animal during radiographic exposures. No individual other than the operator will be in the X-ray room while exposures are being made unless such individual's assistance is required. When an animal must be held in position during radiography, mechanical supporting or restraining devices will be used; except if the animal must be held by an individual, that individual will be protected with appropriate shielding devices, such as protective gloves and apron, and will be so positioned that no part of the individual's body will be struck by the useful beam. The exposure of any professional staff or ancillary personnel used for this purpose will be monitored and permanently recorded. Exposures will comply with Rule 1604 and Rule 1609 of this Chapter.</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Per Section H.5, Page 25</td>
</tr>
<tr>
<td>Postings</td>
<td>Per Table L, Page 32</td>
</tr>
</tbody>
</table>
**O. ANALYTICAL X-RAY EQUIPMENT**

North Carolina radiation protection regulations provide special requirements for analytical X-ray equipment that are in addition to, and not in substitution for, applicable requirements in the other sections of this manual. Table O is a summary of North Carolina requirements for analytical X-ray machines.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Requirements</td>
<td><strong>Open beam</strong>: Safety device to prevent entry into primary beam path.</td>
</tr>
<tr>
<td>(continued on next page)</td>
<td><strong>Open beam</strong>: X-ray tube status (ON-OFF) located near the radiation source housing if the primary beam is controlled in this manner.</td>
</tr>
</tbody>
</table>

*Continued on the next page*
<p>| Open beam: Shutter status (OPEN/CLOSED) located near each port on the radiation source housing if primary beam is controlled this way. |
| Warning devices will be labeled so their purpose is easily identified. Warning devices will have fail-safe characteristics. |
| Unused ports on radiation source housings will be secured in the closed position in a manner that prevents casual opening. |
| All analytical X-ray equipment will be labeled with a readily discernible sign or signs bearing the radiation symbol and the words, “CAUTION - HIGH INTENSITY X-RAY BEAM,” or words having a similar intent, on the X-ray source housing; and “CAUTION - RADIATION - THIS EQUIPMENT PRODUCES RADIATION WHEN ENERGIZED”, or words having a similar intent, near any switch that energizes an X-ray tube if the radiation source is an X-ray tube; or “CAUTION - RADIOACTIVE MATERIAL”, on the source housing, if the radiation source is a radionuclide. |
| Open Beam: Each port on the radiation source housing will be equipped with a shutter that cannot be opened unless a collimator or a coupling is connected to the port. |
| Continued on next page |</p>
<table>
<thead>
<tr>
<th>Equipment Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Beam: An easily visible warning light labeled with the words &quot;X-RAY ON&quot; or words having a similar intent, will be located outside each entrance into the room containing an analytical X-ray tube and will be illuminated only when the tube is energized or in the case of a radioactive source will be illuminated only when the shutter is open. Warning lights will have fail-safe characteristics.</td>
</tr>
<tr>
<td>Each X-ray tube housing will be so constructed that when all shutters are closed the leakage radiation measured at a distance of five centimeters from its surface is not capable of producing a dose in excess of 2.5 mrem in one hour. Each X-ray generator will be supplied with a protection cabinet that limits leakage radiation measured at a distance of five centimeters from its surface such that it is not capable of producing a dose in excess of 0.04 mrem in one hour.</td>
</tr>
</tbody>
</table>

Continued on next page
<table>
<thead>
<tr>
<th>Area Requirements</th>
<th>The local components of an analytical X-ray system will be so located and arranged and will include sufficient shielding or access control that no radiation levels exist in any area surrounding the local component group that could result in a dose to an individual present therein in excess of the dose limits given in Rule .1611 of this Chapter. For systems utilizing X-ray tubes, these levels will be met at any specified tube rating.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posting</td>
<td>Per Table L, Page 32.</td>
</tr>
<tr>
<td>Operating</td>
<td>Normal operating procedures will be written and available to all analytical X-ray equipment workers. No person will be permitted to operate analytical X-ray equipment in any manner other than that specified in the procedures unless the person has obtained written approval of the person responsible for radiation safety.</td>
</tr>
<tr>
<td>Requirements</td>
<td>No person will bypass a safety device unless the person has obtained the approval of the person responsible for radiation safety. Such approval will be for a specified period of time. When a safety device has been bypassed, a readily discernible sign bearing the words “SAFETY DEVICE NOT WORKING”, or words having a similar intent, will be placed on the radiation source housing and the control panel during the period such bypassing is in effect.</td>
</tr>
<tr>
<td></td>
<td>Continued on next page</td>
</tr>
</tbody>
</table>
| **Training** | No person will be permitted to operate or maintain analytical X-ray equipment unless the person has received instruction in:  
(A) Identification of possible radiation hazards and biological effects associated with the use of the equipment;  
(B) Significance of the various radiation warning and safety devices incorporated into the equipment, or the reasons they have not been installed on certain pieces of equipment and the extra precautions required in these cases;  
(C) Proper operating procedures for the equipment;  
(D) Appropriate use and limitation of dosimetric devices;  
(E) Proper procedures for reporting an actual or suspected exposure. |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Each licensee or registrant will maintain, for inspection by the agency, records of training that demonstrate that the requirements of this rule have been met.</td>
</tr>
<tr>
<td><strong>Monitoring</strong></td>
<td>Per Section H.4, Page 24</td>
</tr>
<tr>
<td><strong>Surveys</strong></td>
<td>Per Section H.4, Page 24</td>
</tr>
</tbody>
</table>
# P. Electron Microscopes

Requirements for electron microscopes:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment Requirements</td>
<td>A label bearing the statement: “Caution Radiation - This Equipment Produces Radiation When Energized”, should be posted on the electron microscope. Radiation emitted from electron microscopes will not exceed a dose equivalent rate (averaged over 10 square centimeters) of 0.5 mrem (5 µSv)/hr at 5 cm from any accessible surface. All miscellaneous X-ray producing equipment (electron microscopes) will contain sufficient shielding and be located and operated so exposure rates in unrestricted areas do not exceed 2 mrem/hr or 100 mrem/yr.</td>
</tr>
<tr>
<td><strong>Table P: Electron Microscope Requirements</strong></td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Topic</strong></td>
<td><strong>Requirements</strong></td>
</tr>
<tr>
<td>Area Requirements</td>
<td>Access door to electron microscope room will be lockable.</td>
</tr>
<tr>
<td>Posting</td>
<td>No area posting is required for electron microscopes.</td>
</tr>
<tr>
<td>Operating Requirements</td>
<td>Operating procedures will be written and available to all users. Utilization log will be kept for each electron microscope. The electron microscope user should keep a logbook of any maintenance done on the equipment. Each machine should be key** controlled when not in use. **REMOVE the key from the instrument and keep it in a secure place when not in use. Interlocks, if present, must remain operational unless approved by the RSO.</td>
</tr>
<tr>
<td>Training</td>
<td>Individuals who wish to operate electron microscopes are required to complete documented radiation safety training for electron microscopes. All individuals should receive hands-on instruction and training (e.g. working with experienced users, reading the manufacturer's operation manual) before independently using the equipment</td>
</tr>
<tr>
<td>Monitoring</td>
<td>No personnel monitoring is required.</td>
</tr>
<tr>
<td>Surveys</td>
<td>Per Section H.4, Page 24</td>
</tr>
</tbody>
</table>
Q. INDUSTRIAL RADIOGRAPHY

North Carolina Radiation protection regulations ([15A NCAC 11 .0500](https://www.ncrcc.gov)) contain rules for the safe use of industrial radiography. "Industrial radiography" means the examination of the structure of materials by nondestructive methods using ionizing radiation to make radiographic images. Any use of industrial radiography in university departments, programs, or services must meet North Carolina requirements.
R. NOTIFICATION OF INCIDENTS

1. State Requirements

The North Carolina Regulations for Protection Against Radiation (15A NCAC 11) require that:

A. Each licensee or registrant immediately notify the agency by telephone of any incident involving any source of radiation that may have caused or threatens to cause:

- A dose to the whole body of any individual of 25 rems (0.25 Sv) or more, or an eye dose equivalent of 75 rems (0.75 Sv), or a willow dose equivalent to the skin or extremities of 250 rads (2.5 Gy);
- The release of radioactive materials in concentrations that, had an individual been present for 24 hours, the individual could receive 5 times the limits;
- A loss of one working week or more of the operations of any facilities; or
- Damage to property in excess of $200,000.
B. Each licensee or registrant will within 24 hours immediately notify the agency by telephone of any incident involving any source of radiation that may have caused or threatens to cause:
   - A dose to the whole body of any individual of 5 rems or more, a willow dose to the skin of the whole body of any individual of 50 rems or more, or an eye dose equivalent exceeding 15 rems (.15 Sv);
   - The release of radioactive materials in concentrations that, had an individual been present for 24 hours, the individual could receive 1 times the limits.
   - A loss of one working day or more of the operations of any facilities; or
   - Damage to property in excess of $2,000.

C. The RSO will prepare a report within 30 days concerning a notification of incidents per Section .1647. The name of individuals who have received exposure will be stated in a separate and detachable part of the report.

2. Other Requirements

Other notification requirements may include:
A. NRC 10 CFR 20.2202
B. OSHA 29 CFR 1910.1096(f)(1) and (2)

3. NRC Requirements

NRC requirements apply to incidents involving by-products, sources, or special nuclear materials licensed by the NRC.

4. Exempt from OSHA Reporting

Notification and reporting requirements imposed by OSHA do not apply to:
A. Licensees of the NRC.
B. NRC agreement state licensees or registrants. North Carolina is an agreement state.
S. Annual Program Review

The RSO will conduct an annual review of the radioactive materials license, X-ray registration, Radiation Safety manual, and program to determine compliance and effectiveness. The results of this review will be reported to the Radiation Safety Committee.
APPENDICES
Appendix A:
APPLICATION FOR USE OF RADIOISOTOPES, SEALED SOURCES, AND RADIATION-PRODUCING EQUIPMENT

Available as a fillable form online at:
http://www.ncat.edu/research/rsc-application.pdf
North Carolina A&T State University
Radiation Safety Manual

North Carolina A&T State University
RADIATION SAFETY COMMITTEE

SECTION I
Application for Use of Unsealed Radioisotopes, Sealed Sources, and Radiation Producing Equipment

Application is for use of:
☐ Unsealed Radioisotopes  ☐ Sealed Source  ☐ Radiation Producing Equipment

Project Title:

SECTION II
Person Responsible for Overseeing Radioisotopes, Sealed Sources, or Radiation Producing Equipment

Name:  
Office Location:  
Campus Phone:  
Email Address:  
Department:  
Lab (Building and Rm#):  
After-hours Emergency Number:

SECTION II-A
Training and Experience with Radioisotopes and Ionizing Radiation: Report actual use in types and quantities for which the application is being made.

NCA&T Online Radiation Safety Training  Date:
Other Formal Radiation Safety Training
   Course:  
   Organization:  
   Date:  
Radioactivity measurement, standardization and monitoring techniques and instruments
   On-the-job Training:  
   Course:  
   Organization:  
   Date:

Page 1 of 8
Revised 9202013
Years of experience working with:
- Radioisotopes
- Sealed Sources
- Radiation Producing Equipment
  Type:

SECTION III
LAB SUPERVISOR: Person responsible for safety in the absence of the PI

Name: Department:
Office Location: Lab (Building and Rm#):
Campus Phone: After-hours Emergency Number:
Email Address:

SECTION III-A
Training and Experience with Radioisotopes and Ionizing Radiation: Report actual use in
types and quantities for which the application is being made.

NCA&T Online Radiation Safety Training Date:
Other Formal Radiation Safety Training
  Course:
  Organization:
  Date:

Radioactivity measurement, standardization and monitoring techniques and instruments
  On-the-job Training:
  Course:
  Organization:
  Date:

Years of experience working with:
- Radioisotopes
- Sealed Sources
- Radiation Producing Equipment
  Type:
Section IV

DESIGNATED USERS

Complete section below to add designated user’s training and experience.
*(If more than 2 users need to be added, send an additional page with information requested below for each additional person)*

1. Name:
   NCA&T Online Radiation Safety Training       Date:
   Other Formal Radiation Safety Training
   Course:
   Organization:
   Date

   Radioactivity measurement, standardization and monitoring techniques and instruments
   On-the-job Training:
   Course:
   Organization:
   Date:

   Years of experience working with:
   Radioisotopes
   Sealed Sources
   Radiation Producing Equipment
   Type:

2. Name:
   NCA&T Online Radiation Safety Training       Date:
   Other Formal Radiation Safety Training
   Course:
   Organization:
   Date

   Radioactivity measurement, standardization and monitoring techniques and instruments
   On-the-job Training:
   Course:
   Organization:
   Date:

   Years of experience working with:
   Radioisotopes
   Sealed Sources
   Radiation Producing Equipment
   Type:
SECTION V
RADIOACTIVE MATERIAL/EQUIPMENT

Purpose for Radioactive Material/Equipment (Explain what you will be doing with the material/equipment).

SECTION VI
RADIOISOTOPES

(Complete section below if you are using radioisotopes)

Radioisotopes ONLY

<table>
<thead>
<tr>
<th>Radioisotope</th>
<th>Chemical form</th>
<th>Physical form</th>
<th>Half life</th>
<th>Type of radiation</th>
<th>Activity per experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

SECTION VII
FACILITIES AND EQUIPMENT

1. Lab Facilities Description (Describe your lab facilities in the space below)*

2. Lab Security (Check all that apply):
   - Key lock door  □ Yes  □ No
   - Card Access    □ Yes  □ No
   - Combination lock □ Yes  □ No

3. Fume Hood (provide the date of the last flow rate check)  Date:

Page 4 of 8
Revised 9/20/2013
4. Remote Handling Equipment Description

5. Storage Description

6. Type of Shielding

7. Other

(*Provide a diagram of the location and/or a photograph of sealed sources/radiation producing equipment in a separate document along with this application)

SECTION VII-A
STORAGE AREA

☐ Not applicable: (Sealed Source or Radiation Producing Machine being used)

1. Specify where radioactive materials are stored, quantities, and security measures (List isotope, material and equipment separately).

   *Storage Location (building and room):
   Quantities/Power maximum dose rate:

2. Security Measures:
   How will you maintain safety?
   ☐ Key lock door ☐ Card access ☐ Combination lock

   How will you keep unauthorized users from access?
   ☐ Key lock door ☐ Card access ☐ Combination lock

(*Provide a diagram of the location. Send as a separate document along with this application)
SECTION VIII
CONTAMINATION

☐ Not Applicable: (Radiation Producing Machine being used)

Describe your plan to survey your lab for contamination at regular time intervals. Include the manufacturers’ recommended interval for leak testing if sealed source is being used.

SECTION IX
RADIATION PROTECTION PROGRAM FOR RADIOISOTOPES

☐ Not applicable: (Sealed source or Radiation Producing Machine being used)

1. Absorbent paper will be used for experiments using radionuclides. ☐ Yes ☐ No ☐ N/A
2. Procedures will be carried out in a fume hood. ☐ Yes ☐ No ☐ N/A
3. Disposable rubber gloves and protective clothing will be worn when handling radionuclides. ☐ Yes ☐ No ☐ N/A
4. Technicians and others working with radioactive materials will be instructed by the applicant in safe handling of radioactive materials. ☐ Yes ☐ No ☐ N/A
5. Technicians and others working with radioactive materials will be instructed by the applicant in emergency procedures for radioactive materials. ☐ Yes ☐ No ☐ N/A
6. Film badges have been ordered for technicians and students. ☐ Yes ☐ No ☐ N/A

SECTION X
RADIATION PROTECTION PROGRAM FOR SEALED SOURCES

☐ Not applicable: (Radioisotopes or Radiation Producing Machine being used)

1. Manual for sealed source is available in lab and a copy submitted to EHS. ☐ Yes ☐ No
2. Leak tests intervals for this sealed source is every ______ months.
3. Technicians and others working with radioactive materials will be instructed by the applicant in emergency procedures for radioactive materials. ☐ Yes ☐ No
SECTION XI
RADIATION PROTECTION PROGRAM FOR RADIATION EMITTING MACHINES

☐ Not applicable: (Radioisotopes being used)

1. Manual for radiation producing machine is available in lab/work area and a copy has been provided to EHS. ☐ Yes ☐ No
2. Technicians and others working with radiation producing equipment will be instructed by the applicant in safe operation of radiation producing equipment. ☐ Yes ☐ No
3. A Standard Operating Procedure has been developed for the machine. ☐ Yes ☐ No
4. Technicians and others working with radiation producing equipment will be instructed by the applicant in emergency procedures for radiation producing equipment. ☐ Yes ☐ No
5. Film badges have been ordered for technicians and students. ☐ Yes ☐ No

SECTION XII
HANDLING WASTE/SURPLUS EQUIPMENT

☐ Not applicable

List the plan for disposal of radioactive waste/surplus equipment.
PRINCIPAL INVESTIGATOR

I understand that:

I, not my technical staff, am responsible for radiation safety and the accuracy of records within my lab.

I must obtain prior approval from the Radiation Safety Committee before implementing any changes to procedures in an already approved application.

I must inform the Radiation Safety Officer if I have additional users who will handle these materials.

Transfer of radioactive materials/equipment to others is not permitted without prior approval.

Once the lab is decommissioned, I must report it to the Radiation Safety Officer.

I must inform the Radiation Safety Officer if I’m leaving the University.

_____________________________   _____________________________
PI Signature                  Date

DEPARTMENT CHAIR, DEAN, OR UNIT HEAD

I have:

- Reviewed this application
- Reviewed its applicable proposal submitted for funding, if applicable
- Reviewed the description of space and facilities of this work

I approve of the PI submitting this application to the Radiation Safety Committee.

Name:                          Position:

_____________________________   _____________________________
Signature                  Date

Complete RSC Applications are sent to the RSC Administrator via email to Dr. Tonya R. Hargett at trharget@ncat.edu.
Appendix B:  
**RADIONUCLIDE INVENTORY FORM**

Available online at: [http://www.ncat.edu/research/rsc-forms.doc](http://www.ncat.edu/research/rsc-forms.doc)

A. RECEIPT

*Arrival Intended Quantity*

<table>
<thead>
<tr>
<th>Date</th>
<th>Isotope</th>
<th>Form</th>
<th>Use No. mCi or μCi</th>
</tr>
</thead>
<tbody>
<tr>
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</table>

*Condition on Person Receiving*

<table>
<thead>
<tr>
<th>Activity</th>
<th>Arrival</th>
<th>Manufacturer</th>
<th>Shipment</th>
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B. UTILIZATION

*Initial Quantity*

<table>
<thead>
<tr>
<th>Date</th>
<th>No. mCi or μCi</th>
<th>Removed</th>
<th>Remaining</th>
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<tbody>
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Appendix C:  
**Radioactive Waste Material Disposal Form**

Available online at: [http://www.ncat.edu/research/rsc-forms.doc](http://www.ncat.edu/research/rsc-forms.doc)

Investigator: ________________________________

Building Name: ________________________________

Lab Number: ________________________________

Date: ________________________________

**Total Material**

<table>
<thead>
<tr>
<th>Container</th>
<th>Radioisotope</th>
<th>Activity</th>
<th>Physical Form</th>
<th>Chemical Form</th>
<th>Disposal</th>
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<table>
<thead>
<tr>
<th>No.</th>
<th>Type</th>
<th>When Received</th>
<th>Disposal</th>
<th>Form</th>
<th>Drain/Landfill</th>
<th>Vol – cu.ft. (mCi)(mCi)</th>
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___________________________  
To be reviewed by the RSO

Reviewed by: ________________________________

Radiation Safety Officer  
Date  

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Appendix D

MUST BE POSTED (BOTH PAGES)

EMERGENCY PROCEDURES FOR RADIOISOTOPES AND SEALED SOURCES: PAGE 1 OF 2

EMERGENCY PROCEDURES MUST BE POSTED IN ALL LAB AREAS THAT USE RADIOACTIVE MATERIALS AND EQUIPMENT.

MINOR SPILLS (involving a few microcuries)

1. NOTIFY: Notify persons in the immediate area that a spill has occurred.
2. PREVENT THE SPREAD: Cover the spill with absorbent paper or pad.
3. CLEAN UP: Use disposable gloves and tongs. Carefully fold the absorbent paper or pad into a plastic bag and dispose of in a radioactive waste container. If appropriate, soap and rinse the area repeatedly to remove the contamination.
4. SURVEY: Conduct a wipe test to verify removal of contamination. If not removed by conventional washing, notify Radiation Safety Officer (RSO) by phone: 336 334-7992 or 336 334-7032.
5. REPORT: Report the incident to the RSO: 336 334-7992 or 336 334-7032.

FOR EMERGENCIES AFTER 5 P.M., WEEKENDS, AND HOLIDAYS

Contact the Radiation Safety Officer or University Police:

- Radiation Safety Officer: Louisa Thomas
- Assistant Radiation Safety Officer: Chakeemia Shoulars
- University Police: 336 334-7675

Available online at: http://www.ncat.edu/research/rsc-emergency.pdf
MUST BE POSTED (BOTH PAGES)

EMERGENCY PROCEDURES FOR RADIOISOTOPES AND SEALED SOURCES: PAGE 2 OF 2

EMERGENCY PROCEDURES MUST BE POSTED IN ALL LAB AREAS THAT USE RADIOACTIVE MATERIALS AND EQUIPMENT.

MAJOR SPILLS (greater than 10 millicuries)

1. CLEAR THE AREA: All persons not involved in the immediate vicinity of the spill should vacate the room.

2. CALL FOR HELP IMMEDIATELY:
   - Notify the University Police Department first at 336-334-7675. They will help evacuate and secure the area.
   - Notify the RSO: 336-334-7992 or 336-334-7032.
   - Also notify the following lab personnel:

     (Write in any additional people who should be notified and their contact information)

3. PREVENT THE SPREAD: Cover the spill with absorbent towels or pads, but do not attempt to clean up until approved by the RSO. Confine the movement of all potentially contaminated personnel to prevent spread.

4. CLOSE THE ROOM: Leave the room and lock the doors.

FOR EMERGENCIES AFTER 5 P.M., WEEKENDS, AND HOLIDAYS

Contact the Radiation Safety Officer or University Police:
   - Radiation Safety Officer: Louisa Thomas, 336 558-1772
   - Assistant Radiation Safety Officer: Chakeemia Shoulars, 336 340-0788
   - University Police: 336 334-7675

Available online at: http://www.ncat.edu/research/rsc-emergency.pdf
Appendix E:  
PREGNANCY POLICY

1. This policy is based upon the following concept: to ensure that the dose to the embryo/fetus during the entire pregnancy, due to occupational exposure of the mother, does not exceed 0.5 rem (500 mrem or 5 mSv).

2. Employee may declare her pregnancy by completion of the Pregnancy Declaration Form. The Radiation Safety Officer or designee will review the dosimetry information available to determine whether additional monitoring or safety procedures are needed.

3. The dose to the embryo/fetus before declaration will be estimated to be:
   
   (a) For those working with X-ray units, one-half of the deep-dose equivalent of the torso badge (to compensate for tissue absorption). If a lead apron has been worn with the film badge at the collar outside the apron, an additional reduction in dose of 1/10 for a 0.25 mm apron and ¼ for a 0.5 mm apron may be applied.

   (b) For those working in research labs, the deep-dose equivalent on the TLD badge worn on the torso compensated for tissue absorption of the radioisotopes used by the woman.

   (c) For those who have been monitored for internal exposure, the dosage to the embryo/fetus from radionuclides in the declared pregnant woman is added to the deep-dose equivalent.

4. If the dose to the embryo/fetus is found to have exceeded 0.45 rem (450 mrem) by the time the woman declares her pregnancy, the permitted additional dose to the embryo/fetus will not exceed 0.05 rem (50 mrem) for the remainder of the pregnancy.

5. After pregnancy is declared, the torso badge should be worn at the waist to more accurately estimate the dose. If a lead apron is worn, the usual badge at the collar outside the apron should be supplemented by an additional badge to be worn at the waist under the apron. Compensation for absorption of radiation by the mother’s torso is as specified in (3) above.
PREGNANCY DECLARATION FORM

Available online at: http://www.ncat.edu/research/rsc-forms.doc

I hereby declare that I am pregnant and provide the following estimate to assist the Radiation Safety Officer:

Estimated date of conception _____/_____/_____

_________________________  __________________________
Witness Signature           Employee Signature

_________________________  __________________________
Printed Name of Witness     Printed Name of Employee

Date: ______________________  Date: ______________________