CONTROL AND ACCOUNTABILITY
OF RADIOACTIVE MATERIALS

1.0 PURPOSE

To provide instructions for the procurement, use, storage, disposal, control and accountability of radioactive sources on the Georgia Institute of Technology campus (Georgia Tech).

2.0 SCOPE

This procedure is applicable to the entire Georgia Tech campus covering all operations involving radioactive materials.

3.0 RESPONSIBILITIES

3.1 The Radiation Safety Committee (RSC) is responsible for establishing policies governing the procurement, use, storage, control, and accountability of radioactive materials.

3.2 The RSC is responsible for acting on applications submitted by the Georgia Tech faculty and staff for the use of radioactive materials. All applications for use of these materials must be approved by the RSC.

3.3 The Office of Radiological Safety (ORS) has the administrative responsibility for the Georgia Institute of Technology Radiation Safety Program. The ORS provides radiation protection services such as personnel monitoring, waste disposal, periodic laboratory surveys, maintenance of records required by the State of Georgia, and consultation on the safe use of radioactive materials and radiation devices.

3.4 The Radiation Protection Officer (RSO) is responsible for the Radiation Protection Program of the campus including determining compliance with rules and regulations, license conditions, and the conditions of Authorized User (AU) approval as established by the RSC.

3.5 The Authorized User (AU) is responsible for using radioactive materials in accordance with the requirements of this procedure. The AU is also responsible for insuring that students and staff using radioactive materials and/or radiation generating devices under their RSC authorization are trained in safe laboratory practices, are familiar with the terms of the authorization, and are in compliance with Georgia Tech policies and regulations of the State of Georgia.
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4.0 REFERENCES/REQUIREMENTS

4.1 Requirements and Specifications

4.1.1 State of Georgia Radioactive Material License No. 147-1 (SNM).

4.1.2 State of Georgia Rules and Regulations for Radioactive Materials, Chapter 391-3-17.

4.2 Related Procedures

4.2.1 None

4.3 Equipment/Materials Required

4.3.1 None

4.4 Others

4.4.1 None

5.0 PROCEDURAL STEPS

5.1 Definitions

5.1.1 Authorized User (AU) - An AU is a Georgia Tech faculty or staff member whose use of radioactive material or radiation generating devices has been approved by the Radiation Safety Committee. The AU is normally in charge of a research project involving radiation or is responsible for a course with laboratory or field exercises in which radiation is involved.

5.2 Obtaining Radiation Worker Status

5.2.1 To provide Georgia Tech with a record of the training and experience of persons working with radiation, each individual (including staff, faculty, and students and all Authorized Users) who will be working with radioactive materials or radiation generating equipment shall file a Radiation Worker Registration Form (Form B) with the Office of Radiological Safety. This application shall include the following information:

5.2.1.2 Applicant Information (Name, Georgia Tech Identification number, Date of Birth,
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Addresses, (etc).

5.2.1.3 What radioactive materials or radiation producing equipment the applicant will be working with, including isotope, activity, and chemical form.

5.2.1.4 Name of the Authorized User under whom the applicant will be working and the principal duties as a radiation worker.

5.2.1.5 Previous Training and experience using radioactive material or radiation producing equipment, and

5.2.1.6 Previous employers where radiation exposures have been incurred, including addresses and dates of employment.

5.2.1.7 **EXEMPTION:** There will be no requirement for Worker Registration forms to be filed for each student working in a regularly scheduled laboratory class. However, graduate students performing work will be required to have a Worker Registration Form filed with the ORS.

5.2.2 The AU shall be responsible for providing adequate laboratory specific training for individuals working with radiation under their sponsorship so as to ensure that the health and safety of these individuals will be safeguarded.

5.2.3 On a periodic basis, the ORS shall arrange training sessions in radiation safety as is needed.

5.2.4 Radioactive Material Safety Training and Hands on Training shall be completed by all radioactive material radiation workers before handling licensed radioactive material at Georgia Tech. The initial Radioactive Material Safety Training certificate expires after three years. Annual RAM Refresher training is required after the initial training certificate has expired. Noncompliance with refresher training will result in radiation worker suspension by the ORS.

5.3 Obtaining Authorized User Status

5.3.1 The prospective user must complete an Application for Authorized User Status for Acquisition and Use of Radioactive Materials form (Form A) and forward the completed application to the Office of Radiological Safety (ORS). This application shall include the following information:
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5.3.1.1 Applicant Information (Name, Title, Department, Laboratory Location, etc.),

5.3.1.2 Project Information (Title and Number of persons working on project),

5.3.1.3 Radiological Data (Isotopes and activities (mCi) to be used, physical and chemical form, etc.),

5.3.1.4 Description of project or experiment including purpose and/or objectives,

5.3.1.5 Storage Areas (Where and how radioactive materials will be stored),

5.3.1.6 Security of radioactive materials from theft or misuse,

5.3.1.7 Handling Procedures (Routine use procedure, Dilution or Aliquoting methods, labeling procedures, shielding, etc.),

5.3.1.8 Radiological Precautions (Handling and shielding procedures to minimize exposure and contamination),

5.3.1.9 Radiation Surveys (Available instrumentation, method, and frequency), and

5.3.1.10 Waste Disposal (Nature, quantity, and volume of waste, Identify any solvents, the pH, and any chemical or biological hazardous characteristics of expected waste).

5.3.2 The Radiation Safety Officer (RSO) will review the application and when appropriate, schedule an interview with the prospective user to evaluate the facilities available, training and experience of the applicant, survey equipment available, and the details of the work to be performed.

5.3.3 Upon review and concurrence with the application by the RSO, the application shall be forwarded to the Radiation Safety Committee (RSC). RSC approval will be signified by the signature of the Chairman on the application form.

NOTE: Since the RSC may meet only once per quarter, the Chairman of the RSC is empowered to signify an interim approval of the application. In such instances, the application will be presented to the entire body of the RSC for final review and approval at the next meeting of the Committee.
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NOTE: The RSC has the prerogative of requiring further data for the application, changing the conditions of use of the application, and of returning the application to the applicant without approval.

NOTE: Upon the occasion of submittal of a Form A for AU Status, the AU shall also provide to the ORS a key to the room(s) where the radioactive materials will be used and/or stored.

5.3.4 The procedure as described in the approved application along with any modifications incorporated during the review process shall become the conditions under which the AU and his/her personnel are authorized to use the radioactive materials.

NOTE: If during periodic surveys and inspections of the campus, individuals are observed to be using radioactive materials in a manner or under conditions other than that approved by the RSC, the radioactive material will be retrieved and returned to the ORS.

5.3.5 Any AU who wishes to make any change to the approved procedure, or make any change in storage or disposal of radioactive materials must notify the Office of Radiological Safety (ORS) by filing an amended Form A prior to instituting any change.

5.3.6 Non-compliance with Annual RAM Refresher training by an AU will result in suspension of all Form A's under the AU by the RSC. Radioactive material under the effected Form A will be retrieved by ORS until the Form A is reinstated by the RSC.

5.4 Acquisition of Radioactive Materials

5.4.1 Prior to ordering radioactive materials, an Authorized User must submit a Certification of Current Inventory Form (Form C) to the ORS for approval. This form should contain the following information:

5.4.1.1 The name and original signature of the Authorized User,

5.4.1.2 The radionuclide that is being requested (including activity, and physical and chemical form), and

5.4.1.3 The AU's current inventory of the requested radionuclide.

5.4.2 The RSO shall review the requisition to determine:
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5.4.2.1 That the requestor has been "authorized" to receive and use the type and quantity of radioactive material being ordered.

5.4.2.2 That the radioactive material being ordered, when added to the AU's current inventory, will not cause the AU's authorized inventory limits to be exceeded, and

5.4.3.3 The AU's radionuclide inventory report is correct.

5.5 Receipt of Radioactive Materials

5.5.1 All radioactive materials sent to the Georgia Tech campus will be received by the ORS.

NOTE: Radioactive materials that have not been requisitioned in the proper manner as described above, will NOT be accepted when they arrive at the ORS.

5.5.2 Upon receipt of a package, ORS staff will perform smear surveys and direct radiation surveys to ensure that the package meets the permissible standards for transport of radioactive material as established by the State of Georgia and the U.S. Department of Transportation.

5.5.3 After transportation and receipt survey requirements have been met, a unique source number will be assigned to this radioactive material. The source number will consist of three parts:

5.5.3.1 The AU Identification number,

5.5.3.2 The consecutive source number for the AU, and

5.5.3.3 The split number.

Example: 008-021-00 means AU number 08, source number 21 for that AU and split number 00 indicating that no aliquots have been removed from the source.

5.5.4 The following information shall be entered into the radioactive material inventory:

5.5.4.1 Source number,

5.5.4.2 Radionuclide, e. g., Co-60,
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5.5.4.3 Half life in days,

5.5.4.4 Assay date (mm/dd/yy),

5.5.4.5 Physical form (solid, liquid, gas, sealed source),

5.5.4.6 Chemical formula, if known,

5.5.4.7 Total activity as of the assay date in millicuries,

5.5.4.8 Storage location.

5.5.4.9 The ORS staff shall affix a label to the source specifying the source number, isotope, activity, and assay date as a minimum.

5.5.4.10 Upon completion of the above, the AU will be notified by the ORS that the radioactive material is available for pick up.

NOTE: No person may possess radioactive material that has not been surveyed and inventoried by the ORS.

5.5.4.11 Radioactive materials are not to be transported in private vehicles. Radioactive materials packages with an exposure rate at contact in excess of 2 mR/hr will be delivered to the AU by ORS staff.

5.6 Inventory

5.6.1 Authorized Users shall maintain accurate records of the receipt, use, transfer and disposal of radioactive materials under their control.

5.6.2 Each source distributed to an AU shall be accompanied with a Radioactive Materials Inventory Record Form (Form E). This form is provided to the AU to assist him/her in complying with the record keeping requirements of the State of Georgia. This form will include the following information:

5.6.2.1 The name of the Authorized User,

5.6.2.2 The source number, isotope, activity, assay date, receipt date, and storage location, and
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5.6.2.3 Records of the use of the source (Date; Amount of activity removed; Where the activity was removed to - Solid/Liquid Waste, Split Source, Transferred; and remaining Activity).

5.6.3 Each time an aliquot is removed from the source, an entry should be made on this form to show that the source has been decreased by removal, how much is left, and where the removed aliquot was transferred.

5.6.4 On a quarterly basis, a Radioactive Materials Inventory report shall be sent from the ORS to each AU.

5.6.5 The AU shall update the inventory by noting the quantity of radionuclides transferred or split during the previous quarter, the quantity relegated to waste, and the quantity on hand at the end of the inventory period. The data contained on the Form E should be extremely useful in completing the quarterly inventory.

5.6.6 The updated Radioactive Materials Inventory Record form shall be returned to the ORS (Mail Stop 0425).

5.6.7 Maintenance of a current and accurate inventory is a condition of continued AU status at Georgia Tech. Therefore, requisitions for radioactive materials shall not be processed if the inventory form is not kept current.

5.6.8 Inventory records shall be readily available for periodic review by the ORS or by State of Georgia Radiation Program inspectors.

5.7 Splitting of Sources

NOTE: Any time a radioactive source is split, all resulting containers of radioactive material shall be labeled with the standard radiation symbol on a yellow background. Additionally, the radionuclide and its quantity shall be specified on the label. Each AU is responsible for acquisition of proper labels.

5.7.1 When an aliquot of a source is removed for use in an experiment or for a teaching laboratory, if at the completion of the experiment or teaching lab the entire aliquot will be relegated to radwaste, no further labeling of the new source is required other than that specified above in the NOTE. Nonetheless, notation of removal of the aliquot from the original source must be made on the appropriate Radioactive Materials Inventory Record Form E.
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#### 5.7.2
When an aliquot is removed from a source for the purpose of creating a permanent second source, in addition to the label described in the NOTE, a source number must be applied to the newly created source. This source number shall be the same as the original source number except that the third grouping of numbers shall specify the split number (see Step 5.4.3).

**Example:** If the original source is 008-021-00 then the first split will be numbered 008-021-01, and the second split will be numbered 008-021-02 and so on.

#### 5.7.3
A new Radioactive Materials Inventory Record Form E shall be initiated for each newly split source, and a copy of this form shall be sent to the ORS.

#### 5.7.4
If an entire source is split such that the original source no longer exists, this fact shall be noted on the Radioactive Materials Inventory Record Form E.

**Example:** If 008-021-00 containing 1 mCi is split so that it is entirely used, on the Form E the following will be noted:

<table>
<thead>
<tr>
<th>Removed</th>
<th>1 mCi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split Source</td>
<td>0.5 mCi #008-021-01</td>
</tr>
<tr>
<td>Split Source</td>
<td>0.5 mCi #008-021-02</td>
</tr>
<tr>
<td>Left</td>
<td>0 mCi</td>
</tr>
</tbody>
</table>

The result is that the old source will be gone (a copy of the Form E shall be sent to the ORS to inform them) and two new sources will have been created. A Form E shall be completed for each new source and a copy shall be sent to the ORS.

#### 5.7.5
In situations where the AU wishes to recombine sources, it is possible to do so and the end result will be the creation of a totally new source, which will carry the next number in the series. The Form E will be completed as follows:

**Example:** Source #008-021-01

<table>
<thead>
<tr>
<th>Removed</th>
<th>0.5 mCi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Split Source</td>
<td>0.5 mCi #008-021-03</td>
</tr>
<tr>
<td>Left</td>
<td>0 mCi</td>
</tr>
</tbody>
</table>

Source #008-021-02
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Removed - 0.5 mCi
Split Source - 0.5 mCi #008-021-03
Left - 0 mCi

The result is a new source #008-021-03 with a total activity of 1.0 mCi. A new Form E will be completed for the new source and a copy forwarded to the ORS.

5.8 Transfer of Radioactive Material

5.8.1 If an Authorized User wishes to transfer a source (or part of a source) to another Authorized User, the following steps must be followed:

5.8.1.1 The AU receiving the source must be authorized to receive it and must complete a Form C requesting the transfer.

5.8.1.2 A new Form E will be completed and forwarded to the AU.

5.8.1.3 The Form E for the original source shall be completed, indicating the amount removed from the source.

5.9 Disposal of Radioactive Waste

5.9.1 Disposal of radioactive waste is recorded on the Radioactive Waste Disposal Form (Form G)

5.9.2 A copy of the Form G should be attached to each waste container and as additions of radioactive waste are made to the container, specify on the form the source number, the radionuclide, the activity added, and a description of the waste. This information is required to make shipments for burial and also is needed to maintain the master inventory list up-to-date as is required by the State License.

5.9.3 The following shall be used as a guide for disposing of waste:

5.9.3.1 Do not mix different waste forms together. Keep dry, liquid, and scintillation vials separate.

5.9.3.2 Do not mix short half-life (<120 days) waste with long half-life (>120 days) waste.
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5.9.3.3  Dry radioactive waste shall only be placed in ORS approved containers. ORS provides plastic buckets for solid waste disposal.

5.9.3.4  Liquid radioactive waste shall only be placed in ORS approved containers. ORS provides chemical resistant plastic containers for liquid waste disposal.

NOTE: Use a funnel when pouring liquid wastes into the waste container. This will reduce the possibility of splashing the liquid on the side of the container.

5.9.3.5  Scintillation vials shall either be kept in their original trays or placed in an ORS approved container. ORS provides plastic buckets for scintillation vial disposal.

5.10  General Rules and Guidelines for the Use of Radioactive Materials

5.10.1  Nothing By Mouth - No pipetting by mouth. No eating, drinking, smoking, or applying cosmetics is permitted in areas where radioactive materials are used or stored.

5.10.2  Protective Clothing - When working with loose radioactive material, at a minimum, a laboratory coat, gloves, and safety eyewear shall be worn. Remove gloves and labcoat when contaminated or leaving the work area.

5.10.3  Monitor - All persons shall monitor themselves (hands, feet, laboratory coat, etc.) for contamination after each experiment and before leaving a laboratory where loose radioactive is in use. When required, personnel monitoring devices shall be worn at all times when working with or near sources of radiation.

5.10.4  Shielding - Use adequate (appropriate thickness) shielding for the experiment (Lucite or plexi-glass for beta particles and lead for x-rays and gamma rays)

5.10.5  Volatiles - Potentially volatile radionuclides should only be used in an approved (>100 lfpm face velocity) fume hood. Keep hood face as far down as practical.

5.10.6  Equipment - Never handle radioisotopes with your hands. Always use tongs, tweezers, or hemostats of the appropriate length. Radioactive procedures shall be done in or over a tray lined with absorbent material to control potential contamination.

5.10.7  Security - Doors to Radioisotope laboratories must be closed and locked when personnel are not present.

5.10.8  Two-Man Rule - Do not work alone in the laboratory unless with sealed sources or if there is a telephone present.
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5.10.9 Labeling - All unattended radioactive materials must be labeled with radioisotope, activity, date, and potential solvent or reactivity hazard.

5.10.10 Radioactive Waste - Separate all radioactive waste by physical form (solid, liquid, sharps) and half-life (<30 days and >30 days). Never discard radioactive materials down the sink or sewer. Call for radioactive waste pick-up whenever containers are full or when experiment is finished.

6.0 RECORDS

6.1 All records generated as a result of this procedure shall be maintained as permanent records of Georgia Institute of Technology.

7.0 BASIS

7.1 Georgia Institute of Technology uses radioactive materials under a "broad scope" institutional license issued by the State of Georgia. Failure to maintain control and accountability of radioactive materials may lead to unsafe conditions and jeopardize the use of radioactive materials on the Georgia Tech campus.