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The Board of Curators of the University of Missouri has responsibility for management of the University of Missouri, including operations at the University of Missouri Kansas City (UMKC) campuses. The President of the University System has been delegated the executive responsibility and authority for administration of operations.

Chancellor

The President, in turn, delegates to the Campus Chancellors the responsibility and authority for execution of operations conducted on each of the four campuses (and to the Vice Presidents the responsibilities for administration of distinct sub elements of the University.)
Licenses of all types needed by the University of Missouri Kansas City are issued to "The Curators of the University of Missouri." UMKC’s USNRC license is issued to "The Curators of the University of Missouri, The Chancellor." The Chancellor is responsible for providing adequate support for the radiation safety program at UMKC. The responsibilities of the Chancellor may not be transferred to other individuals. Tasks, duties and authority to accomplish the tasks and duties may be assigned or delegated, but final responsibility for the program rests with the Chancellor.

Institutional Official

The Chancellor has assigned to the University’s Institutional Official (IO) the responsibility for providing adequate support for the radiation safety program at UMKC, consistent compliance with the regulations and reasonable assurance that licensed activities will be conducted safely through the Radiation Safety Committee structure.

The IO has the authority to delegate resources for the program and appropriate funds in a timely manner for the radiation safety program. Whenever this support is not provided adequately or if it cannot be provided, the program of use of radiation sources will be curtailed by the Radiation Safety Committee.

Radiation Safety Committee

The UMKC Chancellor ensures adequate control over materials-licensed activities through a Radiation Safety Committee (RSC). Authority is derived from the Board of Curators and the President through the Chancellor. The RSC establishes policies related to the safe use of ionizing radiation sources at UMKC.

Committee members are appointed by the Chancellor in collaboration with the Institutional Official. The RSC membership includes the Radiation Safety Officer, a management representative, and a majority of persons trained and experienced in the safe use of radioactive materials. Because the responsibilities of the RSC include more than safe use of radioactive materials, representation from academic disciplines providing expertise in Law, Business Management and Environmental Science may also be sought.

This committee structure is a requirement specifically for the United States Nuclear Regulatory Commission Type A license of broad-scope as described in 10 CFR 33.13 (c ) (1). This organizational arrangement also coincidentally meets the most constraining option on registration of radiation producing devices as defined in the State of Missouri Rules for Radiation Protection, 19 CSR 20-10.030(4).

Director of Environmental Health and Safety and Risk Management

The Chancellor has delegated to the Director of Environmental Health and Safety and Risk Management ("EHS") the overall responsibility to ensure that all campus activities comply with regulatory agency requirements concerning environmental health and safety conditions existing at the University. This includes authorization to immediately stop activities or conditions that would constitute an urgent or serious health risk to members of the campus community or to the environment.

Radiation Safety Officer (RSO)

The Radiation Safety Officer (RSO) is an individual, qualified by training and experience in radiation protection, who is available for advice and assistance on radiation safety matters. The RSO is appointed by the Chancellor with the recommendation of the Radiation Safety Committee, but requires review and approval by the United States Nuclear Regulatory Commission to serve as RSO specifically for UMKC’s radioactive materials license.

The Radiation Safety Officer is delegated the authority necessary to meet the responsibilities for ensuring the safe use of radiation on campus through implementing the policies established by the Radiation Safety Committee. The RSO is also responsible for stopping unsafe activities and ensuring compliance with regulations, including prohibiting the use of byproduct material by employees who do not meet the necessary requirements and shutting down operations where justified by radiation safety.

(See Figure 1. Organization Chart, UMKC’s Radiation Safety Program)
II. Personnel Duties and Responsibilities

Chancellor

Provost

Vice Chancellor for Research & Econ Development

Associate Vice Chancellor for Research - INSTITUTIONAL OFFICIAL

Research Compliance

Vice Chancellor Finance and Administration

Associate Vice Chancellor, Administration

Director, Environmental Health & Safety

Radiation Safety Committee

Radiation Safety Officer
Responsibilities:
- Ensure adequate support for the operation of the radiation safety program
- Ensure that the radiation safety program has the proper management to achieve safe and compliant operations
- Periodically monitor the status of the radiation safety program

Specific Duties:
- Appoint Institutional Official,
- Ensure that Radiation Safety Committee members and Radiation Safety Officer are appointed appropriately and delegated responsibility and authority to achieve compliance with radiation protection regulations
- Review safety program audit information with Institutional Official annually or as needed
- Delegate responsibility and authorities to achieve compliance with environmental health and safety regulations to Director of Environmental Health and Safety and Risk Management

Institutional Official

Responsibilities:
Through the Radiation Safety Committee and existing management systems:
- Ensure adequate support for the operation of the radiation safety program
- Provide consistent compliance with the regulations
- Provide reasonable assurance that licensed activities will be conducted safely

Specific Duties:
- Facilitate selection and assignment of qualified individuals to serve on the Radiation Safety Committee, including a voting member designated as a representative of management (i.e. administration and finance)
- Ensure the presence of a qualified individual to serve as the Radiation Safety Officer
- Review the status of the Radiation Safety program with the Chancellor through audit information annually or as needed
- Report to Chancellor concerning activities of the Radiation Safety Committee and UMKC’s Radiation Safety Program.

Radiation Safety Committee

Responsibilities:
- Advises the Chancellor on matters relating to radiation safety from all hazardous radiation sources
- Ensures that radiation safety is maintained adequately on the campus
- Holds primary responsibility to maintain all radiation safety matters in compliance
- Acts promptly upon evidence of a noncompliance
- Corrects causes of the noncompliance by committee action
- When previously available radiation safety coverage is lacking, suspend authorizations until radiation safety coverage is restored at an acceptable level
- Develops and implements the general policy for conduct of experiments or other uses of radiation sources as these uses relate to risk of hazardous exposure to personnel, to property or to the residents of the community in which UMKC conducts its programs.

Specific Duties:
- Establish safety program policies
- Provide overall guidance for program
- Review applications to use radioactive materials to ensure that appropriate measures will be taken to maintain exposures ALARA.
- Review each existing radioactive materials permit at least once every three years
- Review quarterly ALARA reports prepared by the RSO for the materials license
- Meet at least quarterly to conduct Committee business
- review the performance of the Radiation Safety Officer (RSO) and the Radiation Safety Office to maintain adequate control of radiation risks
- use a formal annual audit process to make recommendations to the Chancellor on the continued maintenance of these activities
- Provide an appropriate summation of audit findings to the Institutional Official and Chancellor.
- Support the Radiation Safety Officer as needed
• Review justification for and approve or disapprove all revisions of investigational levels pertaining to the materials license
• Take appropriate action when radiation/contamination guides are exceeded to ensure compliance with the ALARA concept.

Office of Research Compliance

The Office of Research Compliance assists the Radiation Safety Committee in implementing its designated responsibilities in accordance with regulatory guidance for the University’s radioactive materials license as well as the Committee’s charge from the Chancellor to ensure University compliance with State regulations addressing the use of ionizing radiation-producing devices. The Office of Research Compliance facilitates Radiation Safety Committee interactions with other University compliance committees where these committees may have joint interests and/or concerns with certain research activities and applications.

Director of Environmental Health and Safety and Risk Management

Responsibilities
• develop and oversee an integrated program that ensures campus activities are in compliance with all applicable regulatory agency requirements concerning environmental health and safety at the University, per University of Missouri Systems’ Policies;

Specific Duties
• supervision of the safety professionals associated with day to day operational safety activities on UMKC campuses, including Radiation Safety;
• periodic compliance assessment of university safety programs;
• prepare an Annual Environmental Compliance Report for the Vice Chancellor of Administration, detailing the status of compliance, recommended program modifications, and significant regulatory changes

Radiation Safety Officer

Responsibilities
• Provide technical expertise to UMKC’s radiation safety program
• Implement policies and procedures developed by the RSC
• Manage day-to-day operations of the radiation safety program
• Maintain records pertaining to the radiation safety program
• Assist with regulatory compliance

Specific Duties
Regulatory technical liaison:
• Serve as routine point of contact with regulatory agencies
• Work with Institutional Official as technical representative
• Notify management if staff do not cooperate and do not address radiation safety issues
• Ensure compliance with regulations

Radiation Safety Committee:
• Serve as a member of the Radiation Safety Committee
• Draft general radiation safety guidelines or procedures for committee review at request of RSC
• Keep the RSC informed about the current status of each authorization including any special problems that may arise
• Coordinate the RSC’s safety evaluations of all proposed user applications and uses of radioactive material to ensure compatibility with appropriate materials license conditions, rules and regulations
• Prepare reports for the RSC on a quarterly basis that include ALARA performance based indicators

Program Management:
• Supervise Radiation Safety Office operations;
• Provide consultation and ensure that training programs are available and conducted in accordance with regulatory requirements and the ALARA philosophy on all aspects of ionizing radiation safety for personnel at all levels of responsibility
• Identify radiation protection problems
• Initiate, recommend or provide corrective actions
• Verify implementation of corrective actions
• Stop unsafe activities
• Develop and assist in maintaining uniform methods, standards and procedures and the quality thereof for radiation safety coverage throughout UMKC

**Radiation Safety Office**

The Radiation Safety Office is constituted in accordance with regulatory guidance addressing the radioactive materials license portion of the radiation safety program. Licensees should provide sufficient staff to assist the Radiation Safety Officer in implementing the radiation safety program. The UMKC Radiation Safety Office (RSOF) is the administrative group at UMKC that is the contact point for day-to-day operational radiation safety matters. The USNRC is also interested in assuring the presence of qualified individuals capable of filling in for the RSO when the RSO will be away for short period of time for professional conferences, vacation, or illness. This should not occur for extended or indefinite periods of time. (NUREG 1556, v.II)

The Radiation Safety Office assists the Radiation Safety Officer in implementing the portion of the radiation safety program that ensures compliance with State and Federal regulations addressing the use of ionizing radiation-producing devices.

**Authorized User**

An Authorized User is an associate of the University authorized by the Radiation Safety Committee to use a radiation source under the UMKC radiation safety program. The AU shall be a technically trained individual who is competently aware of the radiation hazards associated with their particular work application and of the means to minimize them.

**Responsibilities**

- ensure that workers under their supervision comply with, and are informed of safety rules, regulations, policies and procedures
- ensure that their radiation workers meet the training requirements set forth by the Radiation Safety Committee
- provide appropriate training for radiation workers under their supervision in safe use of specific radiation sources for the AU’s approved experimental protocols.

**Specific Duties**

**Radioactive Materials AU:**

- develop appropriate laboratory procedures for the receipt, use, storage and disposal of radioactive materials authorized under the AU’s permit,
- keep appropriate records, so that they can at any time calculate the amount of radioactive material in their possession, including waste,
- ensure proper disposal of wastes generated in the course of activities in the lab,
- ensure that radioactive materials under their control are used only in the specific locations and areas they have requested. The AU shall not move to a new location without the approval of the Radiation Safety Officer and the Radiation Safety Committee, and finally,
- ensure security of radioactive materials, including waste, under the AU’s control.

**Radiation-Producing Devices AU:**

- develop appropriate laboratory safety procedures for the safe use of the ionizing radiation-producing device authorized under the AU’s permit,
- keep appropriate records concerning the device on file with the DRS to facilitate compliance with state registration regulations, as follows:
  - AU responsible for overall administration of use of unit
  - acquisition (and disposal) of unit
  - physical location of unit
  - training and experience of individuals allowed to use the unit unsupervised
- ensure proper disposal of the unit through current University property management procedures
- ensure security of radiation producing device under the AU’s control.

**Radiation Worker**

A radiation worker is a worker certified to use a radiation source in the UMKC radiation safety program under the supervision of an Authorized User.

**Responsibilities**
• to be aware of the radiation hazards in their work environment,
• know methods to minimize those hazards to themselves, their co-workers and the general public, and
• implement those methods in their work.

Specific Duties:
• meet the training requirements currently in force at the time of their certification for their particular work
  application,
• be aware of and comply with rules, regulations and institutional policies and procedures addressing the safe
  use of radiation sources,
• work to ensure the security of radioactive materials.

Ancillary Worker

An ancillary worker is a member of the UMKC community whose work duties may require them to access areas and
equipment controlled for the purposes of ensuring radiation safety, or who may involve other duties impacting the use of
radiation sources. Examples: employees in Campus Facilities Maintenance, UMKC Police Department, some business
office or purchasing personnel within schools or divisions. Note: the level of training and duties assigned are based upon
an analysis of the potential hazard in their work area and their job duties. Training is usually to a "General Awareness"
level. It is task-specific.

Responsibilities
• to be aware of the potential radiation hazards in their work environment,
• know methods to minimize those hazards to themselves, their co-workers and the general public, and
• implement those methods in their work.

Specific Duties:
• meet the training requirements currently in force at the time of their certification for their particular work
  application,
• be aware of and comply with rules, regulations and institutional policies and procedures addressing the safe
  use of radiation sources as explained in training requirements,
• work to ensure the security of radioactive materials.

III. Specific Policy Statements

Security

UMKC Unsecured Radioactive Materials Laboratory Policy

• If a Radiation Safety Office staff member finds an open, unattended radioactive materials laboratory, the
  laboratory will be closed and locked upon exiting. A verbal notice of the occurrence will be given to the AU via
  voice mail which will state the date and time of the unsecured laboratory observation.

• If a Radiation Safety Office staff member observes the same radioactive materials laboratory open and
  unattended a second time during the term of the Authorized User's authorization (three years), a written notice will
  be given to the Authorized User which will again state the date and time of the unsecured laboratory observation.
  The laboratory will be closed and locked upon exiting. A copy of the written notice will be sent to the Authorized
  User's supervisor.

• Should there be a third observance of an unsecured laboratory after the written notice, the radioactive materials
  shall be removed from the laboratory by the Radiation Safety Office staff member and held for retrieval by the
  Authorized User. Written notice of the action taken will be left at the time of the removal of the radioactive
  materials. Procedures for regaining possession of the material will be outlined in the written notice. A copy of this
  written notice will be sent to the Authorized User's supervisor.

• If another occurrence of an unsecured laboratory is observed during the term of the authorization, the Radiation
  Safety Committee may impose sanctions upon the Authorized User, which may include probation for a time not to
  exceed one month, during which radioactive materials may not be obtained or used. Further occurrences may
  result in permanent termination of the authorization to use radioactive materials at UMKC.
A quarterly report of unsecured laboratories will be made to the Radiation Safety Committee. The Committee may request that the Authorized User present a plan to the Committee, in person or in writing, to ensure the security of radioactive materials in the laboratory.

(Note: Written may be hard copy or in traceable electronic format such as University email.)

Pregnant Workers

UMKC Declaration of Pregnancy Policy

The RSC has approved the following policy with regard to pregnancy of authorized users and radiation workers:

- Authorized users and radiation workers will be informed of this policy at site-specific orientation lectures and at retraining sessions.
- Pregnant radiation workers have the option of declaring their pregnancy. To do so the radiation worker must contact the office of radiation safety and fill out a Declaration of Pregnancy Form.
- Upon completion of the form, a review of the past exposure history and current working procedures will be conducted with the radiation worker by the Radiation Safety Officer or a trained staff member of the Radiation Safety Office staff.
- Any decision made requiring modifications of work procedures or assignments on the basis of health and safety concerns will be reviewed by the RSO.
- If it is determined that the radiation worker can continue to work safely without exceeding the limits for fetal exposure in 10 CFR 20 and NRC Regulatory Guide 8.13, Instructions Concerning Prenatal Radiation Exposure, the laboratory supervisor may require the radiation worker to continue to work with radioactive materials, or other radiation sources.
- At any time during the pregnancy, the radiation worker has the option of undeclaring the pregnancy. At that time the exposure limits become the same as for any radiation worker.

Emergency

UMKC Emergency Policy:

* Incidents are off-normal events deviating from established, set procedures for approval or use of any radiation source on site that may or may not be a hazard and/or a compliance issue.

The term “emergency” is taken to mean any unplanned incident resulting from the use of radioactive materials or other ionizing radiation source that presents an internal or external hazard to personnel and/or property. Such an incident may vary in magnitude from a simple spill of low-level radioactivity in a laboratory that is relatively easy to clean to a fire or explosion that disperses quantities of radioactive material over a wide area. Materials involved could be solids, liquids or gases.

* In each case the Radiation Safety Office shall be notified. For EMERGENCIES occurring during normal work hours, a Radiation Safety Office staff member may be contacted directly through regular work numbers, but the UMKC Police Dispatch system can also be used. Off-hours emergencies will be responded to through UMKC Police Dispatch at (816)235-1515.

Radiation Producing Devices

UMKC Radiation Producing Device Policy

In order to ensure compliance with State of Missouri Radiation Protection regulations addressing registration of radiation producing devices, (10 CSR 20-10.030), Environmental Health and Safety (EHS) shall maintain the registrations for radiation producing devices used on University property, and provide monitoring as required by the specific device and use for UMKC employees. EHS shall be contacted prior to installation of the equipment for any possible exceptions to these criteria.

The Radiation Safety Committee shall periodically review and approve all uses of radiation sources, including radiation-producing device usage on campus.[10 CSR 20-10.030 (4)].

IV. General Procedures
General Administration

Records and Record Retention Procedures

Most records required by State or Federal regulations are maintained by the RSO. Some required records, however, must be maintained at the point of use of the radiation source. These records will be available for audits and USNRC inspections. To satisfy the Federal and State regulations, UMKC must have available for inspection a current record of all sources on campus and their locations as well as a listing of the individuals approved and trained to use the sources.

A. Records of RAM Authorized Users and Radiation Workers.

UMKC is required to maintain a record of individuals authorized to use radioactive materials as well as the specific materials and procedures that have been approved for each users’ permit. The RSOF will maintain these records on each permit that the RSC approves as working files. A copy of the issued permit will be maintained in the Office of Research Protections as well.

Training records for Authorized Users and Radiation Workers are also required to be kept on file, as well as records of surveys and audits. Training is a joint effort between the Authorized users and the Radiation Safety Office. The Radiation Safety Office provides site-specific safety training, the Authorized User is required to provide lab-specific (or application-specific) training. The Radiation Safety Office will provide E-certificates for Blackboard, Lab/Demo and Refresher training. This information is needed in to be kept in the labs for current radiation workers.

The RSOF will keep copies of historical as well as current workers on the license.

The RAM Authorized User is required to keep the following minimum documentation in the location of use of radioactive materials, in inspectable form:

- Authorization & supporting documentation: indefinitely
- Personnel records: copies of RadSafe forms for all current users in the lab
- Lab safety training records: copies for all current users in the lab
- Survey records: last three years
- Inventory records: current inventory, to include lab waste. “The individual user shall keep such a record of the receipt, use, storage and disposal of radioactive materials so that he can, at any time, calculate the amount on hand.”

B. RAM Inventory Records.

UMKC is required to maintain a record of the quantity of material authorized by the RSC and possessed by the users. UMKC is authorized to possess and use specific quantities of these materials with the aggregate of all such materials not to exceed a specific limit. The current inventory of each radionuclide and the aggregate sum of these individual items must not exceed the limits set by the license. This aggregate sum includes those radionuclides being held as waste.

The RSOF also maintains a listing of the quantities of each radionuclide which have been authorized by the RSC for use by individual users. This record ensures that excesses of the maximum amounts are not authorized by the RSC without an opportunity to seek an amendment to the license from the NRC to increase the possession limit for the specific radionuclide.

The Radiation Safety Office (RSOF) will maintain records of bills of lading, inspection and delivery forms for radioactive materials. These records will be available for audits and USNRC inspections.

Internal Transfers: If an Authorized User is transferring radioactive material to another AU internally, a record must be kept of the transfer. The new custodian of RAM is obliged to keep track of the material from that point on. Meanwhile, the dispensing agent may have had several such transfers from a single shipment, and he must be prepared to show what has happened to the entire amount, including what has been lost by radioactive decay and what has been disposed of as radioactive waste. All transfers of radioactive materials from one authorized user to another must be done with RSOF approval. Authorized Users remain responsible for maintaining their own inventory records of receipt, use, transfer or disposal of all RAMs in their possession. These AU records are subject to inspection by the RSOF and any outside regulatory agency.

Sealed Sources: Authorized Users must keep a record of the receipt, use, storage, and disposal of radioactive materials so that they can, at any time, calculate the amount on hand. For those users using a sealed source, an adequate inventory need only be an accessible record of the date of receipt of the material with a reasonably accurate assay of the
quantity. An estimate of the quantity remaining at any future time by a simple decay calculation using the physical half-life of the radionuclide.

C. Records of Audits and Surveys.

The RSOF routinely audits working labs on a quarterly basis to verify continued safe work practices in the lab and perform contamination surveys in unsealed source labs. UMKC is also required to do a six-month physical inventory of all radioactive sources; this task is usually performed as part of the quarterly Radiation Safety Office audits. As a computerized records system has been implemented for Radiation Safety records that includes inventory tracking, this task is considerably easier than it used to be. Quarterly reports of the total University inventory are provided to the Radiation Safety Committee.

D. Records and Security.

An Authorized User may dispose of records not required as stated earlier, or not needed for research purposes. Records that are to be destroyed may be a security concern. They should be shredded, and directly recycled, or destroyed according to procedures recommended by the Departmental Records clerk for sensitive records.

- Put nothing in the wastebasket or recycling in a state that could easily indicate:
  - where radioactive materials are stored or
  - how much Radioactive material is present at any time or
  - who has access to the material

It is easy enough already for someone to find this information out without leaving a map—literally—to radiation sources in the trash can or to someone (or someone’s identity).

**Permit Application Procedures**

The Curators of the University of Missouri, as the designated responsible party in several byproduct, source, and special nuclear materials licenses, must ensure that such materials as procured for use under these materials licenses are used in a manner that is completely safe and without hazard to personnel or property. The curators delegate this responsibility to the UMKC Chancellor, who in turn has delegated to the RSC the authority to control the issuance of authorizations for the use of radiation sources covered by the UMKC materials license as well as those covered by State regulations. Before a radiation source can be used, an application must be approved by the RSC and an authorization for such use must be issued in the name of RSC by the RSO.

The USNRC materials license issued to the University authorizes the use of radioactive materials by UMKC personnel. Control of these uses is dictated by the Federal regulations and by the conditions of use placed upon the materials license. Use of other sources of radiation is authorized in a general sense by the Missouri Division of Health. Licenses are not issued by the State, but use is controlled by the Missouri Radiation Protection Regulations. Applications for use of radiation sources by UMKC personnel shall be reviewed and approved by the RSC. Radioactive materials, including general license and otherwise exempt quantities, shall not be used within UMKC without prior approval.

Applications are submitted to the Chairperson of the RSC through the RSO. If the application is denied by the RSC, it is returned to the applicant with a statement of the reasons for denial. The applicant can choose to modify the application according to the recommendations of the RSC, drop the application entirely, or appeal the denial to the Chancellor. Upon appeal, the Chancellor has the option of requesting that the RSC reconsider its action upon receipt and evaluation of supplementary information, or can uphold the denial.

The RSC is responsible for ensuring that radiation safety is maintained adequately on the campus. In its review of applications, the RSC shall determine that radiation safety coverage is available for the use proposed. If radiation safety coverage is not available or cannot be provided, the RSC shall either deny the use or request the campus administration to provide the radiation safety coverage deemed necessary. This is the key step in the review process to ensure that no radiation sources are authorized for use without adequate radiation safety coverage. Also, when previously available radiation safety coverage is lacking, authorizations shall be suspended by the RSC until radiation safety coverage is restored at an acceptable level.

**Guidelines for All Applications**

Criteria used by the RSC and RSO for approving new users and new uses:

PERMIT HOLDER AU (Radioactive Materials Authorized User)
A Permit Holder AU is an associate of the University authorized by the Radiation Safety Committee to use or supervise the use of a radiation source under the UMKC radiation safety program. The Permit Holder shall be a technically trained individual who is competently aware of the radiation hazards associated with their particular work application and of the means to minimize them.

The Permit Holder must complete an application form that:

- provides evidence of University association,
- requests specific ionizing radiation source(s),
- documents training and experience in using the ionizing radiation source they are requesting,
- indicates a suitable location for use of the source(s) and
- provides the specific experimental protocol(s) for use.

The prospective Radioactive Materials Permit Holder AU (RAM AU) is required to complete UMKC’s institution-specific training program. This training program reviews standard radiation safety procedures as well as site-specific protocols for ordering, using, and disposing of radioactive materials. The permit holder is also responsible for ensuring that radiation workers and lab workers under their supervision comply with, and are informed of, safety rules, regulations, policies and procedures and meet the training requirements set forth by the RSC. The RAM AU is responsible for providing appropriate training for workers under their supervision in the safe use of specific radiation sources for their approved experimental protocols.

A critical step in the review process is the determination that the training and experience of the applicant are adequate to conduct the proposed investigation in a safe manner. Such a determination is critically dependent upon the proposed use, since the kind and quantity of radioactive material or a radiation source coupled with the way it is to be used specifies the degree of the hazard. What the applicant hopes to accomplish by use of licensed materials in his/her experiment is not an issue in the evaluation of the application; the degree of hazard and safety features employed in the use of radioactive materials is.

Each application for an authorization to use a radiation source must contain a complete statement of the applicant's training and experience in addition to the statement of the kind, quantity, and proposed use of the source. The RSC in its review of the application determines whether or not the statement of training and experience is consistent with the use of the source that the applicant has specified. In view of this consideration, it is to the applicant's advantage to limit the proposed use to the smallest quantity and simplest form possible to accomplish the desired result.

Qualifications of associates are also of concern to the RSC performing the review of the application. Each person who will be in direct contact with the radiation source being requested needs to be qualified by appropriate training and experience to handle it safely. A review of the application by the RSC will include a consideration of the qualifications of associates.

Training sufficient for the proposed use may be obtained by the applicant from a formal training course, from a preceptorship arrangement by which the training is acquired by working under the supervision of an experienced person, or from collaboration with an experienced person by whom applicable experience from another technique may be expanded to include the safe use of a radiation source. All of these methods of acquiring training and experience are available to interested UMKC personnel. The necessary ingredients of acceptable training are the following:

- Principles and practices of radiation safety
- Radioactivity measurements, standardization, and monitoring techniques
- Calculations basic to the use and measurement of radioactivity
- Biological effects of radiation.

The applicant must also show that sufficient experience has been acquired in the safe handling of the radiation source for which application is made.

Results of the RSC review of the applicant's training and experience may take many forms. The most obvious case is that the applicant has had acceptable training and experience in the same or very similar type of use as is proposed, and the application can be approved without reservation. Another common situation is one in which the applicant has had training and experience suitable for a large variety of problems but not enough for the use which is proposed. This application can be approved with the condition that another authorized user supervise the use of the radiation source on a temporary basis. The preceptor must have had acceptable training and experience for the proposed use, and assumed the responsibility for ensuring the safe use of the radiation source. This responsibility continues until the preceptor can report to the RSC that, in his/her judgment, the applicant can proceed without further supervision. In preparation of the application, the user should name the preceptor, with whom previous arrangements have been made, so that approval of
the application will not be delayed for the purpose of naming someone. This authorization will be issued in the name of the applicant with a preceptor named in a condition of the authorization.

For the situation in which a graduate student will utilize a radiation source in his research project, the application should be submitted in the name of the faculty advisor of the work, and the authorization will be issued to the faculty advisor. Of course, the faculty advisor must be qualified by training and experience. Thus, the responsibility for safe handling of the radiation source to be used in graduate research will be vested in the faculty advisor of the project; or if the faculty advisor is not qualified by training and experience, the responsibility will be vested in a third party named in the application who has agreed to supervise this portion of the research. If the graduate student has the requisite training and experience, he/she can file the application in his/her own names with the authorization issued to him/her, but it is preferred that the authorization be issued to a faculty or staff member.

At times it may be convenient for the RSC to identify a group of users as a single entity and issue an authorization for the entire group in the name of a single responsible person. For such a situation to remain in conformance with the conditions of the license and UMKC regulations, each user within the group must submit his credentials for participation to the RSC for review and approval. In this way each individual of the group is authorized to use a part of or the full complement of the radiation sources assigned to the group. When an application is submitted in the name of the group, the names of the members to use the sources are to be identified, but the authorization will be issued to the individual who has been named as the responsible person.

Applications for the use of any of these sources undergo an initial safety evaluation by the RSO. Application forms are available through the Office of Research Protections or through the RSOF, but are first routed through the RSO.

Applications for amendments to existing authorizations are also routed first through the RSO before presentation to the RSC.

Upon receipt of the completed application, the RSO will make an initial evaluation of the content to establish that resources are available to support the radiation safety aspects of the experiment, that no conditions of the license will be compromised by the experiment, and that the applicant has satisfied the intent of the UMKC regulations to safeguard health and property. At a meeting of an RSC quorum, the application and a recommendation regarding radiation safety considerations prepared by the RSO will be reviewed. If disapproved by the RSC, the application will be returned to the applicant with an explanation of the action including a recommendation as to corrective action needed. When approved by the RSC, the application will be signed and dated by the chairperson and forwarded to the RSO for issuance of an authorization.

For the situation in which the applicant is assisted in a significant way by one or more associates, the qualifications of these associates to handle the sources safety shall be described as a part of the application. Upon receipt of the application from the applicant, the RSO will review these statements of qualifications of the associates, and he will include his appraisal of them with his recommendations to the RSC. Any uncertainties about these evaluations shall be resolved by the RSC. When the submitted application is approved by the RSC, the applicant will be notified by the RSO and, subsequently, will receive an Authorization for Possession and Use of Radiation Sources Permit. Usually, the applicant is authorized to possess and use the radioactive materials requested. Occasionally, in the interest of radiation safety, the RSC will add restrictions on the use to ensure compliance with current Federal and State regulations. The RSC bears the responsibility to ensure that approval of an application will not compromise UMKC's commitment to the radiation safety program. The RSO will review each approved application before issuing the authorization to ensure that no commitment is compromised. This review step may result in an amendment to the action taken by the RSC.

**Training Procedures**

A tiered system of minimum training and experience criteria has been developed for individuals working in or frequenting restricted areas or having mission-critical tasks as part of their University job description. Three distinct levels of radiation workers exist at UMKC:

1. Authorized Users and Supervisory Research personnel (“P.I.”s or principal investigators using radioactive materials in their research or teaching)
2. Research technicians and radiation worker trainees (“radiation workers”)
3. Ancillary personnel. (Individuals not using a radiation source, but who may in the course of their job work in restricted areas or deal with ordering or receiving radioactive materials; e.g. custodial, physical plant and police staff; or mail room employees, storekeepers or administrative assistants who have been directed to have a role in obtaining radioactive materials.)

Progressive training and levels of experience will allow radiation workers to increase their ability to work unsupervised without compromising safety.
Training topics include:

- applicable USNRC regulations and license conditions,
- The UMKC Handbook and general UMKC policies and procedures,
- ALARA, Safety-Conscious Work Environment, and Safety Culture concepts,
- notices and instructions to workers,
- occupational exposure limits and personnel monitoring,
- basic radiation safety fundamentals and contamination limits,
- security and identifying possible areas of use for radioactive materials,
- safety procedures appropriate and specific to their task(s) in the program, and
- emergency procedures.

Training responsibilities will be shared by the RSO, the authorized users and supervisory personnel. The RSO will provide training in regulatory and license requirements, in radiation safety fundamentals and site-specific practices UMKC authorized users, radiation workers and ancillary personnel. The authorized users and supervisory personnel will provide training for the radiation workers under their supervision in specific safe use of radioactive materials for their experimental protocols.

The current process used to revise and develop the radiation safety training program is as follows:

The Radiation Safety Committee reviews, critiques and approves proposed new training materials or refresher training materials identified by or developed by the Radiation Safety Officer. This also includes new presentation formats, such as the development of on-line materials. The materials are developed and presented to the RSC either at a Committee meeting or as an on-line request to all Committee members in between quarterly committee meetings. Suggestions for training topics and materials, if made by other University members, are required to be reviewed and approved by the Committee for use in the materials program. The committee approves materials prior to general distribution; usually by voice vote in a Committee meeting. The review of new materials and sections of existing training materials is a specific RSC annual audit assignment, as an ongoing evaluation of the radiation safety training program by the Committee.

Minimum acceptable training and experience criteria shall be formulated by the RSO and approved by the RSC in accordance with NRC Regulatory Guides and licensing practices for materials licensees. Various training criteria will be established for radiation workers and for ancillary personnel. Prior training and experience will be verified during the safety evaluation of new applications to use radionuclides. Training will be provided by the RSO, the authorized users and supervisory personnel. Training must be completed prior to work assignments in a restricted area. Worker understanding of training topics must be demonstrated to the satisfaction of the RSO before the worker will be allowed to work in a restricted area. Refresher training sessions will also be conducted annually or as necessary to keep personnel in each worker category up to date with changes in the NRC regulations and/or UKMC procedures.

The current training steps for Radiation Workers and Radioactive Materials Authorized Users (an investigator who holds a permit to use radioactive materials on UMKC's US Nuclear Regulatory Commission license) are as follows:

1. Successfully complete all site-specific training module quizzes on an on-line computer course website with a 100% score. Retakes on the quizzes are allowed. All of the answers to the quiz questions appear in the text files in the modules. We just expect radiation workers to be very familiar with this material, as we also review radiation safety concepts and procedures.

2. An Authorized User (RAM Permit Holder) must designate as a radiation worker in his or her lab. There is a specific form to complete and submit to the Radiation Safety Office. (RadSafe Form 3). Both you and your supervising permit holder must sign it.

If the new radiation worker successfully completes this on-line computer course, and has a RadSafe Form 3(Worker Training and Experience) form on file with Radiation Safety, the Radioactive Materials AU can train the radiation worker to accept radioactive materials deliveries in their laboratory.

The prospective worker cannot perform an experiment using radiotracers until they complete the last two steps:

3. Attend a Lab/Demo session (a one-time 2-3 hour session) with the Radiation Safety Office staff. This session works on practical safety skills useful in a radioactive materials lab as well as showing some equipment that may be used in a radiotracer experiment, and further discuss the safety system in the United States. This is also a good time to ask questions of the Radiation safety staff. If a radiation worker has questions concerning the computer program material that they haven't asked before, now is an excellent time to do so.
4. A Radiation Worker Observation. Finally, the radiation worker shows that he or she can work safely with radioactive materials by learning the safety procedures associated with a specific experiment in a radioactive materials laboratory, and demonstrating this to a member of the Radiation Safety Office staff. This is lab-Specific training delivered by your laboratory permit holder or someone in the lab that your permit holder designates. The AU will know the appropriate safety procedures the RSOF staff will be expecting to see.

**Personnel Monitoring Procedures**

Persons who receive or are likely to receive a dose of radiation shall be monitored in accordance with the requirements in 10 CFR 20 and the State of Missouri Radiation protection regulations. The following categories of UMKC personnel who meet this description are:

1. Individuals occupationally exposed to radiation sources
2. Individuals handling radiation sources on a regular basis and
3. Individuals exposed to radiation sources on an occasional basis.

Appropriate dosimeters will be assigned to provide an estimation of the radiation dose received in the individuals’ work at UMKC. Dosimeters used and assigned will be in accordance with the requirements of 10 CFR 20, the State of Missouri radiation protection regulations, and the professional discretion of the RSO based upon an evaluation of the workers’ exposure history and job hazard analysis.

Dosimeters will not be assigned to personnel working with radiations below the energy response or sensitivity of the dosimeter. For example, personnel who use only H-3 would not be issued a dosimeter. It may be necessary to conduct bioassays depending upon the use and amounts of H3 used.

Dosimeters will not be assigned when it can be demonstrated by calculation and documented that the dose will not exceed the limit specified in 10 CFR 20 or, in the case of radiation-producing machine users, in the State of Missouri Radiation Protection regulations. Dosimeters may be withdrawn from use if documentation or circumstance over a period of three to six months indicates minimal radiation dose and area radiation and contamination surveys are background levels and the experimental protocol will not change. Appropriate dosimeters will be assigned to any individual less than 18 years of age as per regulatory requirements. Personnel will receive training in the proper use and care of dosimeters assigned to them.

Monitoring devices issued to personnel shall be changed at regular time intervals and processed by a dosimetry processor who meets the requirements of 10 CFR 20. Records for the dose equivalent received by personnel shall be maintained by the Radiation Safety Office.

The RSO will review the monitoring report when it is initially received and report this to the Radiation Safety Committee at the quarterly meetings. The records will be maintained and reported on an annual basis to the persons monitored. Monitored personnel may request a summary of their documented exposure history at any time from the Radiation Safety Office.

Requests for monitoring service shall be addressed to the Radiation Safety Office. The individual monitored shall provide the name, social security number, birthdate and sex in order to set up their account. A dosimeter request form is available with the required information needed to set up a monitoring account for the individual.

**Pregnancy Declaration Procedures**

Pregnant radiation workers have the option of declaring their pregnancy, as outlined in the Pregnant Workers General Policy.

When a radiation worker declares her pregnancy in writing, the Radiation Safety Officer or a trained RSOF staff member will review the worker’s past exposure history and current working procedures with the worker. Any modifications of work procedures or assignments on the basis of health and safety concern will be reviewed by the RSO.

If it is determined that the radiation worker can continue to work safely without exceeding the limits for fetal exposure in 10 CFR 20 and NRC Regulatory Guide 8.13, “Instruction Concerning Prenatal Radiation Exposure,” or the corresponding State of Missouri regulations for pregnant workers using radiation producing devices, the laboratory supervisor may require the radiation worker to continue to work with the radiation source.

A special dosimeter may be issued to demonstrate that the radiation worker is not exceeding the limits for fetal exposure. At any time during the pregnancy, the radiation worker has the option of undeclaring the pregnancy and then the exposure limits become the same as for any radiation worker.
Medical Examinations and Bioassay Procedures

A medical examination or special bioassay procedure may be ordered for individuals who will be working with materials or equipment producing ionizing radiation when it is required by Federal or State regulations or when deemed necessary by the Radiation Safety Committee. Any question of the need for a special physical examination should be brought to the attention of the RSO. The RSO will assess the potential hazard of the radiation environment, so that this assessment can be presented to the RSC at the same time as the report of the clinical problem. The RSC can then evaluate the clinical problem in terms of the radiation environment to be experienced. The RSC will identify the workers who are to receive subsequent physical examinations. Records maintained of radiation dose equivalent will assist the RSC in its evaluation of examination needs.

Bioassay procedures are performed for personnel when they have been exposed to significant quantities of uncontained (unsealed) radioactive materials. The type of bioassay performed is determined by the radionuclide, the critical organ involved and the biological metabolism and turnover of the radionuclide in the body.

In general, bioassays are performed for tritium and most beta emitters by liquid scintillation analyses of urine specimens. Gamma emitter bioassay methods are by external measurement techniques. In some instances, urinalyses can be used to support, confirm or deny the external measurement results. The preferred bioassay method(s) will be determined by the RSO in accordance with published analytical procedures. Normally bioassay procedures are performed after a delay of at least six hours after exposure, unless there is reason to expect a significant uptake. The bioassay trigger levels, the frequency and the action level for follow-up procedures, if required, are based upon the appropriate USNRC Regulatory Guides.

When tritium is used in uncontained form, a bioassay of a urine specimen is required for each person involved in the handling of the material under the following conditions:

1. For tritium in uncontained form, of quantities greater than 10 millicuries, processed in an open room, a bioassay shall be performed within one week of single contact or weekly for continuous contact (2).
2. For tritium in uncontained form, of quantities greater than 100 millicuries, processed in an approved, functioning fume hood, a bioassay shall be performed within one week for a single contact or weekly for continuous contact.
3. For tritium when there may have been absorption, ingestion or other accidental deposition in the body of a quantity greater than 250 microcuries, a bioassay shall be performed immediately in order that medical intervention might be considered if a significant uptake has occurred.

When iodine is used in uncontained form, a bioassay will be performed using a gamma sensitive detector placed close to the thyroid gland. The bioassay will be performed six hours or more after the contact, but within ten days of the contact, for each person involved in the handling of the material under the following conditions:

1. For iodine (I-125 or -131) in uncontained form, of quantities greater than one millicurie processed in an open room, a bioassay shall be performed after six hours of contact but within ten days for a single contact and weekly for continuous contact.
2. For iodine (I-125 or -131) in uncontained form, of quantities greater than ten millicuries processed in an approved, functioning fume hood, a bioassay shall be performed after six hours of contact but within ten days for a single contact and weekly for continuous contact.
3. For iodine (I-125 or -131) when there may have been absorption, ingestion or other accidental deposition in the body of a quantity greater than 0.1 microcurie, a bioassay shall be performed immediately in order that medical intervention might be considered if a significant uptake has occurred.

Action levels for these common bioassay procedures have been established and are available in the Radiation Safety Office.

Each investigator for whom these bioassay requirements apply is urged to reduce his individual contacts with uncontained tritium and iodine-125 or -131 to minimize the number of bioassay procedures to be performed. For example, an investigator who keeps a supply of more than one curie of tritium as HTO but uses only 50 or so millicuries for each experiment can at one time divide the more than one curie into aliquots of less than one curie each requiring but one
bioassay. More than avoiding bioassays, this practice will also reduce the risk of hazardous exposure, and it is recommended on that basis.

Additional bioassays may be required by the RSO when large quantities of other radioactive materials are handled in an uncontained form.

**Ordering and Purchasing Procedures**

Each laboratory is responsible for ordering radioactive materials. The Radiation Safety staff will not place orders for radioactive materials. Each laboratory follows the procedures for their Department or School. Purchases of radioactive materials are approved through Radiation Safety, but the Authorized User/Permit Holder is responsible for ensuring that radioactive materials are properly ordered.

Radiation Safety approves and accepts all shipments of radioactive materials that are to be delivered to UMKC. This includes shipments that are being purchased and any replacement or other types of “free” shipment of radioactive materials. There are three methods of approval for the purchase of radioactive materials.

1. Approval of single order purchase requisition.
2. Approval of blanket order purchase requisition.
3. Approval of credit card purchases.

Radiation Safety shall be informed of ALL packages of radioactive material that are expected to arrive at UMKC prior to the packages being shipped. This includes complimentary, replacement or collaborative shipments from other institutions. The notification of Radiation Safety is to be by phone message or in person, unless prior arrangements are made with Radiation Safety. Routine E-mail notifications are not always sufficient because Radiation Safety personnel may not be in their office to receive the e-mail message before a package is delivered. Many radioactive materials purchases for UMKC are shipped overnight once the RAM AU places an order. Phone messages can be checked frequently and can be picked up from any phone. All radioactive material purchases are handled using the same general procedures, whether the material is a vial of labeled chemical or a general educational check source.

Routine orders for radioactive materials are generally purchased using a university credit card. A RAM Permit Holder using a credit card is asked to complete a form indicating that they will use a university credit card and what shipping address will be used. This form is usually completed after purchasing has issued a university credit card. After an approved Permit holder or radiation worker has placed an order for radioactive materials, CALL Radiation Safety and inform them of what has been ordered. The information needed is:

A. The name of the person calling
B. The name of the Authorized User
C. The isotope that has been ordered
D. The activity (amount) that has been ordered
E. The chemical form
F. The name of the company
G. The expected date of delivery

There are two addresses for the delivery of radioactive material. The correct delivery address is based upon the physical location of the laboratory in which the radioactive material will be used.

For Hospital Hill locations, (Medical School, Dental School, or Health Science Building) the delivery address is:
- Radiation Safety ext. 5289
- UMKC Medical School
- 2411 Holmes
- Kansas City, MO  64108

For the Volker Campus, the delivery address is:
- UMKC Environmental Health & Safety
- Office of Radiation Safety  x-5289
- 4747 Troost Ave, Room 003
- Kansas City, MO  64110

It is the Authorized User’s responsibility to ensure that the proper shipping address is used. If there are any problems with the company in using the appropriate address, do not order the material. Call Radiation Safety for help.

When one is setting up an account with the vendor, understand that they will need the University’s USNRC license number and license information, not the individual user's permit number under UMKC's license. The Radiation Safety
Office will be able to facilitate the information a vendor may need for a new account.

When placing your order for radioactivity, make sure you give the proper billing address. The billing address is your University mailing address. A generic University address or the address for the purchasing department could result in the invoice of your purchase being sent to an unknown address. This delay in receiving of the invoice could create problems with your credit card bill.

If an Authorized User wishes to transfer radioactive material to another Authorized User, Radiation Safety must be contacted. Appropriate arrangements are to be made with Radiation Safety. Radiation Safety personnel will perform the transfer and/or the transportation of the radioactive material. Non-Radiation Safety personnel are not permitted to transport radioactive materials from one campus to another.

Package Receipt Procedures

Details of the State and Federal regulations pertaining to receipt, storage, and use of radioactive materials are available for review in the Radiation Safety Office. If the statements to follow are not sufficiently clear or adequately detailed to provide guidance and if the actual regulation does not indicate what to do, the user should consult with the RSO to establish a proper interpretation of the regulation.

The Federal regulations require among other things that "Each licensee shall establish and maintain procedures for safely opening packages in which licensed material is received, and shall assure that such procedures are followed and that due consideration is given to special instructions for the type of package being opened."

Radiation Safety is notified when a package of radioactive material arrives at the proper campus delivery location. Radiation Safety will pick up the package, perform a check-in procedure that meets or exceeds transportation safety regulatory requirements, and adds the materials to the University and the permit holder’s inventory. Radiation Safety staff or approved EHS staff will then deliver the order to the laboratory.

The package must be signed for by the Authorized User or by an authorized individual in the laboratory. An authorized individual is an individual who has successfully completed the computer-based training module and has a current radiation worker form on file with Radiation Safety. The radiation worker form can be found on the EHS website or by contacting Radiation Safety. To complete the computer training module successfully, the individual must pass EACH section with a final score of 100%.

Regardless of experience or academic standing, if the individual in the laboratory does not fulfill this requirement, the package of radioactive material will be retained by Radiation Safety until someone properly authorized is able to sign for the package. Special arrangements can be made with another Authorized User or user group to accept a package of radioactive material, but this must be documented and the letter of understanding on file in Radiation Safety before a package is accepted. It must be signed by all Authorized Users/Permit Holders involved and on file with Radiation Safety.

If a package of radioactive material is delivered to the laboratory by any means other than by a Radiation Safety or Environmental Health & Safety staff member, do not open the package. Notify Radiation Safety immediately. Radiation Safety will come to the laboratory to inspect the package and check it in. If necessary, the package may be placed in a refrigerator until Radiation Safety arrives. **No weekend or after hour deliveries of radioactive materials will be accepted.**

Procedures for Opening Packages Containing Radioactive Material

Radiation Safety Staff will:

1. With protective covers on the hands, inspect the package for integrity and evidence of leakage.

2. Monitor external surfaces for contamination and exposure rates. The limits for contamination and exposure rates are those given in **10 CFR 20** and **49 CFR 172**.

3. Check labels and shipping papers to ensure the shipment is to the correct address and contains the ordered radionuclide and activity.

4. Open the outer container and inspect the next container for integrity and evidence of leakage. (We will not open stock vials.)

5. Monitor packing material and inner container for contamination.
6. Dispose of uncontaminated packing materials as ordinary waste after removing or obliterating the radiation labels on packing materials to be discarded at this point, and ensuring that no contamination exists.

7. Handle contaminated packing materials as radioactive wastes.

8. Record the receipt of the shipment and results of the survey. Generate an inventory sheet for the item and complete the isotope delivery form up to the transfer signature section.

9. If everything is in order, deliver the package to the user.

The user will:

1. Sign for the package upon delivery to the laboratory. Verify contents.

2. Check for contamination before disposing of any packing materials delivered with the shipment.

3. Handle contaminated packing materials as radioactive wastes.

4. Obliterate or remove any radiation labels on packaging materials prior to disposal.

5. Record the receipt of the shipment.

Storage

Access to ionizing radiation sources at UMKC shall be controlled at all times. For radioactive materials, storage locations for stock materials as well as radioactive waste containers shall be secured. Storage locations will be evaluated in accordance with the UMKC security policy as well as the basic requirements for appropriate and safe storage of the materials themselves.

Radiation-producing devices also come under this controlled access requirement. Adequacy of storage locations will be evaluated on a case-by-case basis as part of commissioning a use area for an ionizing radiation source. Contact the Radiation Safety Office for further guidance.

General Use

The goal of the UMKC Radiation Safety Program is to keep radiation exposure As Low As Reasonably Achievable (ALARA) and still be able to use the hazard to gain the benefits its use provides. Occupational workers using radioactive materials or ionizing radiation-producing devices accept the fact that they may be exposed to ionizing radiation in the course of their employment, but one can still work safely with the hazard. The exposure limit for occupational workers is higher than for the public. Many times, it is doing the "little" things that will reduce the radiation exposure. This is why training is required of occupational workers, since radiation safety training focuses on how to work safely and in compliance with occupational exposure limits.

This little extra effort of learning appropriate work procedures when using a hazard that enhance worker safety is part of the implementation of a radiation safety principle called ALARA, (As Low As Reasonably Achievable). This basic principle tells us that even though we are within regulatory limits of radiation exposure, we need to take extra and reasonable steps to reduce our exposure. For example, spending $100 for a safety shield to reduce radiation exposure by 50% would be reasonable under ALARA. Spending $1000 on lead bricks that will reduce radiation exposure by less than 2% might not be considered reasonable.

Procedures for Use of Ionizing Radiation Sources.

Know Your Radiation Source

It all starts with knowledge—does the worker know the radiation source(s) to be used? Is it a radiation-producing device or radioactive materials? What are the characteristics of the source itself? Are safety precautions or aids already built in to, or inherent to the source? In what physical situation will you be using the source?

Know where the source is—areas of use are posted and ionizing radiation sources are labelled. Warning signs and labels are used in a radiation safety program to indicate the presence of a radiation hazard, since sources are not detectable otherwise—i.e. one cannot see, hear, touch, smell or taste ionizing radiation with our existing senses.
Radiation Safety Office staff are responsible for posting an area which has been approved for radioactive materials use. The sign on the door is an indication that a room (or area) has been through a formal evaluation and that appropriate procedures are in place for safe use of a source. Radiation Safety is also responsible for removing this type of warning sign, since the removal of the sign will indicate that the area has been surveyed to ensure that the hazard is no longer present.

Authorized Users/Permit Holders and their staff—the users of the area and the sources—are responsible for labeling use areas and sources within the posted area.

Plan Ahead.

Build appropriate safety procedures into your experiments. Learn and practice procedures that are new to you without the hazard.

Control Exposures

Radiation hazards may be generally classified as being an external exposure hazard, and internal exposure hazard, or, in some cases, both. When we say know your radiation source, this is part of what we mean, as this will dictate the safety procedures chosen.

External Exposure Control Procedures: Time, Distance, Shielding

External exposure to radiation can be limited by using time, distance and shielding techniques. Exposures from radiation-producing devices are external exposures only. The Radiation-Producing Devices on campus are like light bulbs—they only produce ionizing radiation when they are attached to a source of electricity and are activated. If an x-ray unit is not turned on, it will not produce ionizing radiation. RPD users only need to consider methods of controlling external exposure, but they do need to be very good at using these methods.

Time: Limit the time spent around the ionizing radiation source to decrease radiation exposure.

Don't turn on the xray source when the xrays aren't needed. Reduce the amount of time around a radioactive material in an experiment. This can be done by being proficient in the techniques used in the experiment, doing other tasks in an area away from the radioactive materials experiment, or modifying the experimental protocol to reduce the time spent near the radioactive material.

Distance: Increase the distance from the ionizing radiation source to decrease radiation exposure.

For radiation-producing devices used here at UMKC, the “six foot” rule minimizes exposure to scatter radiation and controls radiation exposure very effectively. Avoiding being in the primary beam, even at a distance, is also a good way of reducing exposure. This is why most dental x-ray units have a long cord attached to the “on” switch, or if the unit is installed in a fixed location, the “on” button is mounted at least six feet away from the x-ray tube. The placement of the “on” button is set so that the operator is forced to practice good safety procedures when working with a radiation hazard.

The same concept also works with radioactive materials. With radioactive materials, though, the source is always “on” so the user must be aware of where the source is at all times. In addition, depending upon the radioisotope, different types of radiation are emitted. This requires that the user knows which procedure is more effective for a specific source. The same type of distance procedures can be used for gamma emitting radioisotopes as for x-ray radiation. Gamma and x-rays are both photons, so one can use similar procedures to control external exposure. Some radioisotopes emit beta radiation, which is a particulate radiation. The beta particles produced are of varying energies, and is radioisotope-dependent. The higher the energy of the beta particle, the farther it will travel in the air. For example, H-3 emits a very low energy beta particle, which will travel less than an inch. On the other hand, P-32 emits a very high-energy beta particle. This high-energy particle will travel up to 20 feet in the air. If the dose rate in close proximity to a P-32 source is 100 mrem/hr, then as you increase your distance, the dose rate will decrease. The beta radiation from the P-32 will be absorbed by the air at about 20 feet.

Shielding: Place an appropriate barrier around the radiation source, or between the radiation source and a worker will reduce radiation exposure.
The amount and kind of shielding needed will depend upon whether the radiation is a photon source or a particulate source, the maximum energy associated with the source and, for radioactive materials, the amount of material present. For beta emitting isotopes, the best shielding is made from a low “Z” material such as plastic. A ¾-inch thick Plexiglas shield is usually enough to protect you from the quantity of P-32 used in experiments performed at UMKC. The energy level of the beta particle that is emitted from the isotope H-3 is so low that it is unable to penetrate the wall of a test tube or disposable gloves.

For x-rays and gamma emitting isotopes, the best type of shielding is made from a high “Z” material such as lead. For x-ray sources, some shielding is already built into the device itself—usually some lead. Many x-ray sources are installed in rooms with shielding in the walls, and x-ray tube housings have shields built into the device itself. In the case of gamma emitting radionuclides, it depends very much upon the amount of material present. For a low energy gamma emitter such as I-125, a 10 uCi RIA kit could be safely used on an open bench top. However, a 1 mCi reaction with I-125 may require two-inch thick lead bricks to provide sufficient protection.

Time and distance should also be used with shielding techniques to reduce external radiation exposure. Never assume that because shielding is present, no radiation exposure is present outside of the shield.

Internal Exposure Control Procedures

Internal Exposure is only a consideration with radioactive materials, and is a result of internal radioactive contamination. What is radioactive contamination? A simple, qualitative definition for radioactive contamination is “radioactive materials where one doesn’t want them.” Therefore, internal contamination is radioactive material taken up internally when you don’t want radioactive materials internally.

Most handling techniques discussed with radioactive materials use can be classified as engineering controls (equipment), procedure controls, or personal protective equipment. If we consider how radioactive material can enter the body, we can describe many of the general safety procedures in the UMKC radiation safety program through this classification scheme.

There are four ways for radioactive material to enter the body: ingestion, inhalation, absorption, and directly through a break in the skin (such as a wound or cut.)

Ingestion:

Engineering Controls (Equipment) and associated procedures:
Rubber bulbs, syringes, or other mechanical devices shall be available for use. No Mouth pipetting!
Double containers should be used for liquid radioactive material storage and transport
Use lipped trays and absorbent paper for waste container storage areas and work areas.

Procedure Controls:
No eating or drinking or storage of foods, drinks, or eating utensils in laboratories posted with a “Caution Radioactive Materials” sign.
Refrigerators or freezers shall not be used for common storage of food and radioactive material.
Any food or drink item in a posted laboratory for lab animal use that can normally be considered for human consumption must be clearly marked “animal use only”.

An important thing to remember is, regardless of how well this rule is followed, contamination can occur in the laboratory. Work areas or objects in the lab that are not used for radioactive work can become contaminated. It is then possible for foods or eating utensils to get contaminated and radioactive material to be ingested if this rule is not followed. Also, does anyone in the lab chew on a pencil or pen? Be aware of these little habits that may lead to inadvertent ingestion!

Inhalation:

Engineering Controls (Equipment) and associated procedures:
Chemical fume hoods--in some experiments, a chemical reaction may occur that produces a radioactive gas. Some chemicals are volatile. Therefore, the experiment should be conducted in a fume hood with the sash being partially down. The radioactive gases are released in the fume hood and carried away instead of being released into the laboratory environment. Transfers and dilutions shall be performed in operating fume hoods or glove boxes, unless it is completely safe to do otherwise.

Absorption (through skin or eyes):
Engineering Controls (Equipment) and associated procedures:
Work area shielding. In some instances work area shielding (such as when using plexiglas shielding with liquid P-32 materials) not only reduces external exposure, it also serves as a convenient "spatter shield" to protect a workers' face, eyes, and torso.

Procedure Controls:
No application of cosmetics in the laboratory. (Exception: hand lotion or hand cream for use after washing hands. Unbroken skin is the last barrier to internal contamination—keep it in good condition!)

Personal Protective Equipment
Gloves, lab coat, goggles, safety shields, closed-toe shoes, shoe covers. Ensure that the appropriate personal protective apparel is available and used properly. Is a specific type of glove available to protect against the type of chemicals that are being used? Are goggles or safety shields needed to protect the face and eyes?

Have you any habits you need to be aware of, such as touching your skin or face with your fingers, even if they have gloves on? Stop that!

Directly, through a cut or wound:

Personal Protective Equipment:
Open wounds below the wrists should be properly bandaged prior to donning gloves.
Keep fingernails short and clean, to minimize puncturing gloves.
Double glove.

Cuts or puncture wounds that occur while working with radioactive materials need to be cleaned under running water with a mild detergent. Objects do fall unto the floor and liquids are spilled. These things could be contaminated with radioactive material. Contact the Radiation Safety Office immediately if this occurs to ensure that exposure is minimized.

General Personal Protective Equipment Comments:
Protective apparel includes laboratory coats, coveralls, gloves, shoe covers, safety glasses, and respirators. In most cases a laboratory coat and gloves will provide adequate protection.

Laboratory coats intended for use while working with radioactive materials are to be used under the following conditions:

Protective apparel should be buttoned up when worn
Protective apparel should not be worn out of the laboratory area
Protective apparel shall not be stored with street clothes
Protective apparel shall be monitored periodically and always prior to being laundered

Open-toed shoes or sandals shall not be worn in the laboratory while working with radioactive materials because of possible skin contamination.

General Good Lab Safety Practices:
The laboratory should be kept neat and clean. Equipment or material not being used should be stored in a place away from the work area.

General work surfaces for unsealed sources should be made of impervious materials or sealed.

Using disposable coverings on work surfaces will further facilitate cleanup and decontamination procedures at the end of an experiment with unsealed sources.

Items necessary to the safe conduct of the experiment should be checked to ensure their availability and operational status before the experiment is started.
If at all possible, dedicate equipment used with unsealed sources to use in radiation use areas to minimize the possibility of cross-contamination—especially unsuspected cross-contamination-- in the laboratory. If equipment must be shared, periodically survey the equipment to ensure it is not contaminated before using in a non-radioactive experiment. This includes glassware, pipettes, gloves, and other laboratory apparatus. Label this equipment and store it in a cabinet or location away from or separate from any 'clean' area. This type of equipment shall not be returned to stock or for general use outside of the Permit Holder's control without a confirmatory contamination survey by a Radiation Safety Office staff member.

Don’t put hands inside trash cans or waste containers.

Wash hands with soap & water when leaving.

If something “doesn’t look right” in a posted area, use emergency procedures.

Use UL approved safety cans with antiflashback screens for flammable liquids such as ether, benzene, or acetone. Use flammable liquids only in a properly vented enclosure. Flammable liquids shall not be permitted in a laboratory where radioactive materials are used or stored unless they are handled in this fashion.

Pressure bottles or tanks containing counting or laboratory gases shall not be used or stored in the laboratory where radioactive materials are used or stored unless they are securely mounted to the wall, a bench, the floor or other rigid system to prevent them from becoming hazardous missiles.

Items of equipment intended to provide safety features shall be evaluated periodically to ensure that they are providing the safety feature intended. For example, a fume hood in which radioactive materials are handled shall provide a uniform air flow through the openings of the hood of at least 100 linear feet per minute with the sash one-half open.

Maintain regular safety eyewash stations and safety showers as appropriate to the type of safety equipment. What works for hazardous chemical emergencies will also work for radioactive materials spills or spatters in small emergencies.

Animal and other Combined Hazard Use Procedures

Radioactive materials use in animals especially requires careful preplanning in order to satisfy both radiation safety and lab animal regulations. Most of the work at UMKC involving the use of animals in experimental studies with radioactive material is conducted with small animals. A permit holder must be approved to use radioactive materials in animals. A draft protocol may be submitted as part of the application for possession and use of radiation sources, including the animal worksheets appearing in the Forms section, but an up-to-date protocol approved by the Institutional Animal Care and Use Committee must be on file with the Radiation Safety Office before radiotracer animal work can begin. Special guidelines for handling and disposal of radioactive items associated with radiotracer experiments in animals appear in the standard operating procedures appendix of this Handbook. The permit holder should contact the RSO to assist in the resolution of any problem not covered by these guidelines.

Appendix F, Guidelines and Standard Operating Procedures for Radioactive Materials Use in Animals provides guidelines and a Standard Operating Procedure to help researchers who will be using radiotracers in animals.

Radioactive Materials Security Procedures

In the mid 1990’s, intentional contamination incidents to laboratory personnel increased the USNRC’s requirement for all radioactive material to be accounted for and secured from unauthorized removal. Since the attack in New York on 9/11/2001, requirements for ensuring the security of radioactive materials have increased. Information about any missing radioactive material that is reported to the USNRC is passed on to the FBI and other government agencies. UMKC, at the present time, does not possess any radioactive material that would be of value in the making of a “dirty bomb.” However, UMKC does possess the same type of radioactive material that was used in the mid 1990’s that was involved in the intentional contamination of property and laboratory personnel. As a result of this situation, UMKC’s Radiation Safety Committee promulgated the security policy and associated procedure for laboratories and work spaces at UMKC.

The Security Policy also emphasizes being mindful of your surroundings at all times. This includes acknowledging people entering your laboratory who are not part of your laboratory group with a verbal challenge. This verbal challenge can be as simple as a “hello” or “can I help you” greeting. The USNRC expects radiation workers to be aware of who is coming and going from the laboratory. This should be done even if you recognize the individual. Some laboratory personnel have had personal items stolen or had laboratory equipment "borrowed" by people that they have recognized.
Procedures:

The RAM Authorized User / Permit Holder is responsible for security of radioactive materials, laboratory personnel and their assigned laboratory(s). It is the responsibility of the RAM Permit Holder to see to it that all individuals in the laboratory are aware of and adhere to this security policy.

1. The permit holder assigned to a specific laboratory or work space must be able to control access to the workspace—i.e. doors and locks must be arranged so that the lab access can be positively controlled by the assigned permit holder.
2. All posted laboratory doors must be closed and locked when unoccupied, not just the doors used to enter from a public hallway.
3. If a worker will not be able to acknowledge an individual not assigned to a work space or laboratory, the lab must also be secured.
4. If a radiation worker will be present to provide security during use of radioactive materials, and the storage area for radioactive materials will be secured with a lock at all times (except when accessing the storage area), the storage area only may be posted. Consult the Radiation Safety Office prior to implementing this aspect of the procedure.
5. Security checks will be performed periodically and randomly by Radiation Safety Office personnel.
   a. If an unsecured—including unattended—laboratory or storage area is found, a verbal warning is given, and noted by radiation safety,
   b. A second unattended work or storage area observation within a year from the first offense will result in a written (or emailed) warning,
   c. If a third offense is noted within a year from the first recorded offense, removal of radioactive material from the laboratory by Radiation Safety is an option in addition to the immediate notification of the Permit Holder and the Permit Holder’s supervisor.
   d. If radioactive material is removed, the permit holder will be notified, and the Authorized User Permit Holder must make arrangements to have it returned. This is the Permit Holder’s responsibility, not a worker in the laboratory.
6. A report on the results of security checks will be made quarterly to the Radiation Safety Committee, unless a third offense is noted and the Radiation Safety Officer deems that radioactive materials must be removed from the laboratory. In this case, an immediate notification to the RSC Chair will be made.
7. Continued failure to adhere to the “closed door” policy at UMKC could result in the temporary suspension or the cancellation of the authorization to possess and use radioactive materials. The radioactive materials will be impounded and the Authorized User would have to make a new application to the Radiation Safety Committee for use of radioactive materials.

Waste Disposal Procedures

The types of radioactive wastes generated at UMKC include a variety of solids and chemical and biological solutions. All radioactive wastes resulting from the use of radioactive materials in UMKC laboratories shall be disposed of in a manner to prevent the occurrence of a hazard to the health of personnel, to the value of property, or to the welfare of the community.

Anything that is to be disposed and contains radioactive material, regardless of form or chemical content, is to be processed through the radiation safety program. For example, uranium and thorium salts are usually used as “normal” chemicals, but due to their natural occurring radioactive properties, they are processed and disposed of through the radioactive waste program.

Some radioactive wastes may contain chemically hazardous components that may be highly flammable and/or toxic. This type of radioactive waste is referred to as “Mixed Waste”. Mixed waste is a mixture of radioactive material and hazardous chemicals. It is not a combination of different isotopes. Radioactive and mixed wastes are NOT permitted to be disposed of or stored for decay within the laboratory.

Some types of equipment may contain a radioactive source. For example, liquid scintillation counters and some gas chromatographs will contain a sealed radioactive source. These pieces of equipment are not to be disposed of without contacting Radiation Safety. Once the radioactive source has been removed, the equipment may be disposed of.

At UMKC, Radiation Safety will provide the drums and drum liners for the scintillation vials and the solid waste. If the laboratory wishes to use plexiglas waste containers with a cardboard box insert, Radiation Safety will provide bags for the boxes. Radiation Safety will not replace the boxes with new ones in the event of damage or contamination to the box. The cost and replacement of the box inserts is the responsibility of the laboratory. The individual laboratories supply their own plastic jugs with screw on caps for the liquid waste. Used milk jugs are not acceptable. A plastic bottle which
previously contained a non-hazardous chemical may be used, as long as the bottle is compatible with the waste that is being placed in it. If the constituents of the waste are such that a glass bottle is required, inform Radiation Safety as to the necessity of the glass container.

Regardless of the type of container used, all radioactive material shall be placed in a secondary container. In the event a leak occurs, the secondary container will help prevent the spread of contamination. Regardless of whether the radioactive material is being transported across the laboratory or down the hallway to a different room, the material shall be in a secondary container. Leaks and spills have been known to occur when moving radioactive liquids from one part of the laboratory to another. A proper secondary container can help prevent lost research time due to decontaminating the laboratory floor or bench. But if a leak or a spill does occur, call Radiation Safety.

**Waste Segregation**

Short physical half-life ("decayable") waste should be kept separate from non-decayable waste. Decayable waste is waste which contains isotopes with a physical half-life of less than or equal to 120 days. At UMKC, these isotopes are P-32, P-33, S-35 and I-125. If possible, the longer decayable waste like S-35 (87 day half-life) should be kept separate from the shorter decayable waste like P-32 (14 day half-life). A small amount of S-35 waste, if placed with P-32, can turn a drum of P-32 waste into a drum of S-35 waste. Even though the volume of S-35 may be small, the fact that the S-35 would have to decay away prior to disposal would turn a P-32 drum of waste into an S-35 drum of waste. On the other hand, a small volume of P-32 waste would have little effect on a drum of S-35 waste. The P-32 would decay away in a relatively short period of time and leave only the original S-35 still in the drum. NO decay-in-storage of radioactive waste is allowed in the laboratory.

Scintillation vials are to be kept separate from solid waste. The mixing of scintillation vials and solid waste can increase YOUR disposal costs, even if the scintillation fluid is non-hazardous. The mixing of scintillation vials with solid waste can cause the waste pickup to be postponed until the vials have been removed from the solid waste container. There are several different kinds of scintillation counting cocktails. They range from the very chemically hazardous to the chemically non-hazardous. The type of scintillation cocktail that is used is up to the discretion of the authorized user. However, cheap flammable scintillation cocktail can be very expensive to dispose of since it will be considered mixed waste. It is recommended that you first contact Radiation Safety about your options prior to purchasing your scintillation cocktail.

Contaminated items such as needles or broken glass are to be placed in a puncture resistant container prior to being placed in the solid waste container. If they are contaminated with a biological material, the items should be soaked in a bleach solution prior to placing them in the radioactive waste container.

Animals that are injected with radioactive materials and sacrificed are to be kept frozen prior to disposal. Each animal carcass is to be double wrapped, and labeled as radioactive. The information that is to be written on each carcass includes the isotope, the amount of activity injected and the weight of the carcass in grams.

**Labelling radioactive waste in the laboratory**

All radioactive waste containers must be labeled with the isotope and hazardous chemical content. Each container that is in use should have a "Caution Radioactive Material" tag or tape on it. The hazardous chemical content should be indicated as well as the radioactive material content. A separate label, or waste log with the appropriate information, can be placed on the waste container, or tags that will eventually be used in the waste pickup process can be requested, and the hazardous chemicals indicated on the back of the "Caution Radioactive Material" tag. The chemical content percentage should be the final concentration in the container, not the initial concentration of the working solutions. An example of this could be as follows:
The chemical information located above, could be written on the back of the tag. The isotopes that are in the waste container are to be written on the "Isotope" line. No other information should be written on the tag until the container is picked up by Environmental Health & Safety.

If possible, keep the liquid waste segregated as to hazardous chemical composition. A small amount of the wrong chemical can turn a gallon of non-hazardous, drain disposable liquid into an expensive commercial disposal bill.

Scintillation vials must also be segregated from solid waste, as well as according to half-life of the isotopes in the vials. If the laboratory is reusing scintillation vials, DO NOT put scintillation fluid in a container with other liquid wastes. Scintillation fluid must be kept separate from other liquid wastes.

No liquid waste disposal in the laboratory by means of the sanitary sewer is allowed. The NRC has set strict criteria for liquid waste disposal. Not only is the radioactive material in the liquid regulated, but the chemical content may also be regulated by the EPA. Radioactive liquid waste is processed though Environmental Health and Safety. This saves the individual laboratories additional record keeping and helps to protect the laboratory and the University from improper waste disposal.

The liquid waste that is generated and at least the first rinse of a container are collected in an appropriate plastic container with a screw on cap. Depending upon the activity of the residue, additional rinses may have to be collected as well. Liquid waste is to be doubly contained. The secondary container should be chemically compatible with the contents of the primary container. The size of the collection bottles should also be appropriate size for the waste that is being generated. If it is going to take an extended period of time to fill a one gallon jug, a smaller size should be used.

Safe and compliant disposal of radioactive wastes are performed through Environmental Health and Safety. Waste disposal charges are dependent upon the isotope and the form (liquid, solid, scintillation vials) involved, and should be considered when budgeting for a series of experiments. Researchers will be charged at the time of waste pickup, based upon previous waste disposal charges, and not, in the case of off-site shipments, at the time of an off-site waste shipment. Current waste charge rates are available from the Radiation Safety Office and the EHS Division of Hazardous Waste.

**Emergency Procedures**

The term "emergency" is taken to mean any incident resulting from the use of radioactive materials that presents or may have the potential to present an internal or external hazard to personnel. Such an incident may vary in magnitude from a simple spill of low-level activity in a laboratory that is relatively easy to clean to a fire or explosion that disperses quantities of radioactive material over a wide area. The materials involved could be solids, liquids or gases.

It could also be an incident in a posted laboratory even if it doesn’t include radioactive material, such as a water leak occurring as the result of a bad faucet or perhaps from a disconnected hose from a water purifying system. The water may cover a portion of the floor or bench in which the areas where radioactive materials are used or stored are not involved. Even if this is the case, the NRC still expects Radiation Safety to be informed of the incident when the problem is discovered so that Radiation Safety may verify that no radiation hazard exists to lab personnel or to ancillary workers who may be involved in the cleanup operation.
Two classifications of spills are considered here. A “minor” spill would be an incident in which the affected area is small and the radiation hazard is low. This could be a small beaker of liquid waste being knocked over on a bench or a contaminated pipette tip landing on the floor. A “major” spill would be an incident that affects a relatively large area or presents a radiation hazard. This could include liquid waste spilling on the floor or spilling radioactive stock material on the bench.

In the event of a “major” spill, the UMKC police should be contacted and if possible, the spill should be covered to prevent its spread and keep everyone away from the spill area. The UMKC Police Dispatch number is 816-235-1515. The Office of EHS, Radiation Safety, shall be called regardless of the size of the spill. Radiation Safety staff members are not a radioactive janitorial service and WILL NOT clean up a spill. The Radiation Safety staff will oversee and assist in the cleanup of a spill. The cleanup of a spill is the ultimate responsibility of the Authorized User. After the spill has been cleaned, the Authorized User and his laboratory staff are responsible for surveying and recording the results in the appropriate records. This is in addition to any confirmatory surveys that Radiation Safety may do.

The NRC considers it important for Radiation Safety to be informed of any spill that occurs in a posted radioactive laboratory. Universities have been fined for not informing their local radiation safety department when spills occurred. During one NRC inspection, the inspector discovered that Ca-45 had been spilled on a bench top. The laboratory staff cleaned up the spill but because they did not inform their radiation safety department, the university was fined $2500. The fine was not for the spill but for the failure to notify the radiation safety department of the spill.

In the event of a “major” spill, keep the following points in mind.

UMKC General Emergency Procedures

%Call UMKC Police dispatch: 816-235-1515

%State your name
%Location of incident
%Location of where you are calling from
%Description of emergency (e.g. what spilled)
%Stay near the telephone unless dangerous

It is important, if possible, to keep all individuals that were involved in the incident together and near to the incident location. This is so the individuals involved may be checked for possible contamination and be decontaminated if necessary. This will also help prevent the possible spread of contamination from people walking around or leaving the area.

It is better to contact your safety specialists and find out you didn’t need to, than to not call and discover you should have!

General Notification and First Response Procedure

The general procedure for a radiation worker to follow in their lab in an emergency is:

- For minor or major spills of radioactive materials, if fire is involved, call the UMKC Police Department immediately. The Police Department will make the necessary contacts, including contacting Radiation Safety. They can also assist in contacting your Permit Holder if you cannot.
For **minor** spills of radioactive liquid:

- Use absorbent material to limit the spread
- If contamination is airborne, close windows, doors, vents and turn off ventilation
- Minimize radiation exposure to personnel by evacuating them from the area involved to an isolated area, but keep them there until they can be checked for contamination
- Notify the laboratory supervisor
- Notify Radiation Safety
- Post warning signs and allow no one to enter the contaminated area unaware; carefully clean up the area; insert all cleanup materials into a plastic bag and dispose of it in the radioactive waste container
- Survey the area around the spill, your hands and clothing for contamination.

For **major** spills of radioactive liquid:

- Evacuate the laboratory. Notify all persons not involved in the spill to vacate the area

- Use absorbent material to limit the spread
- If contamination is airborne, close windows, doors, vents and turn off ventilation
- Vacate and lock the laboratory to prevent entry
- Post warning signs and allow no one to enter the contaminated area unaware
- Notify the laboratory supervisor
- Notify the Radiation Safety Office
- Minimize radiation exposure to personnel by evacuating them from the area involved to an isolated area, but keep them there until they can be checked for contamination
- If possible, the spill should be shielded, but only if it can be done without further contamination or without significantly increasing your radiation exposure
- Clean up the spill with supervision by the RSOf.

After any emergency is over and all hazards are under control, prepare the University Fire Report and Accident Forms if appropriate. These emergency procedures can be extracted from the text, modified by the addition of appropriate names and telephone numbers, expanded with special instructions and posted in each laboratory authorized to use radioactive materials.

Alternatively, the University has prepared a posting that can be used in a laboratory for a general emergency plan. This does include instructions for radioactive materials incidents.

**UMKC Police Department Assistance in an Emergency**

Personnel of the UMKC Police Department have the authority to, the capability to, and will provide facility and area access control and security in the event of a radiological emergency. They also have an internal personnel call up schedule for all types of emergencies including radioactive material/radiation, and an external notification system linked to the Kansas City Police and Fire Departments. They can also summon medical emergency assistance as required. For major life threatening medical emergencies, patients are transported to the nearest medical facility.

**Decontamination Procedures**

**Personnel Decontamination Procedures**
Contact the Radiation Safety Office immediately for guidance when personnel may be contaminated. The incident may require monitoring and dose assessment as well as a report to the appropriate regulatory agency. Persons splashed with radioactive solutions should wash or be washed immediately with ample quantities of water. Mild, pure soap should be used on the affected area. Normal lab safety equipment such as eyewash stations and safety showers also work for radioactive materials contamination events. Before using a safety shower, recall that careful, prompt removal of a layer of clothing can remove 85% of personal contamination. Remember that an ounce of prevention is worth a pound of cure. If one wears a lab coat and other personal protective equipment to start with, this will obviously facilitate any necessary personnel decontamination.

When an individual is injured as a result of a laboratory accident, the first consideration should be to seek medical attention for the victim. If the individual has been contaminated with radioactive material as a result of the accident, the following steps may be taken while awaiting the arrival of a physician to administer to the needs of the injured victim:

The attending physician or the EMT should be informed upon arrival of the likelihood of ingestion or inhalation of radioactive materials as they can be hazardous to the patient when taken internally. The medical responder should also be advised if the patient represents a significant radiation source.

Area Decontamination Procedures

Decontamination shall be accomplished by laboratory personnel under the supervision of the Radiation Safety Office. This means that the laboratory needing decontamination assistance provides the labor and the expense of special materials and services to implement the decontamination. The Radiation Safety Office provides confirmation that decontamination has been accomplished.

VI. Radiation Safety Committee Procedures:

Duties and Responsibilities

Principal Responsibilities:

- Advises the Chancellor on matters relating to radiation safety from all hazardous ionizing radiation sources
- Develops and oversees implementation of general policies for uses of radiation sources as these uses relate to risk of hazardous exposure to personnel, property or the residents of the community in which UMKC conducts its programs
- Ensures that radiation safety is maintained adequately on the campus;
- Has primary responsibility to maintain all radiation safety matters in compliance
- Reviews the performance of the RSO to maintain adequate control of radiation risks and make recommendations to the Chancellor on the continued maintenance of these activities

Specific Duties:

- Establish safety program policies & provide overall guidance for program
- Meet at least quarterly to conduct Committee business
- Review applications to use radioactive materials to ensure that appropriate measures will be taken to maintain exposures ALARA and review each existing permit every three years
- Review quarterly ALARA reports prepared by the RSO for the materials license including Radiation Safety Office surveys of permit holders and facilities
- Review justification for and approve or disapprove all revisions of investigational levels pertaining to the materials license
- Take appropriate action when radiation/contamination guides are exceeded to ensure compliance with the ALARA concept
- Review results of USNRC inspections
- Review, through a formal annual audit process, the performance of the Radiation Safety Officer (RSO) and the Radiation Safety Office to maintain adequate control of radiation risks; support the RSO as needed
- Provide an appropriate summation of annual audit findings to the Institutional Official and Chancellor and make recommendations to the Chancellor on the continued maintenance of these activities
- Act promptly upon evidence of a noncompliance
- Correct causes of the noncompliance by committee action
- When previously available radiation safety coverage is lacking, suspend authorizations until radiation safety coverage is restored at an acceptable level

Criteria used for selecting members to the RSC, including what members and number of members constitutes a quorum.
The Radiation Safety Committee membership includes a Management Representative, the Radiation Safety Officer, and a majority of persons trained and experienced in the safe use of radioactive materials and ionizing radiation sources such as radiation-producing devices. A majority of those selected shall have experience specifically in the safe use of radioactive materials and be radioactive materials permit holder in good standing at the time of the appointment. Because the safe, effective and efficient use of ionizing radiation is an interdisciplinary activity, representation from academic disciplines providing expertise in Law, Business Management and Environmental Science may also be sought in addition to individuals using ionizing radiation sources in research and instruction.

An effort is made to recruit at least one member from every UMKC academic division utilizing ionizing radiation sources in research and/or teaching. Most members (except for the Administrative Representative and the Radiation Safety Officer) are appointed for three year (renewable) terms on a rotating schedule, with input from the Institutional Official and the existing RSC members.

Quorum System
The RSC conducts business using a multi quorum system. A full quorum to conduct committee business is a simple majority of the members of the RSC, and must include the Chairperson, the RSO and a Management Representative. This quorum must meet to conduct committee business at least once each calendar quarter.
Committee business topics conducted by the full quorum include the annual program audit, review of authorization requests and amendments to existing authorizations, and review of any work assigned to a subcommittee, such as applications review or investigations.
All new requests and significant changes to existing authorizations, e.g., potential increase in personnel exposure, increase in limits on contamination, and/or release to unrestricted areas, shall be reviewed by the RSC prior to granting authorization.

Subcommittees
The Chairperson can constitute subcommittees of the full committee, either standing or temporary, to complete tasks for which the RSC is responsible. These subcommittees are to report to the full committee at the regularly scheduled quarterly meeting.
The full Committee and subcommittees will meet as often as necessary to conduct the business of the RSC.

Applications Review Subcommittee
A quorum of at least four members of the RSC can be used to review applications for the use of radioactive materials. This group consists of at least four members of the RSC including the Chairperson, the RSO, a representative of management and at least one member with expertise in the subject area being reviewed. Temporary approvals may be granted, contingent upon approval by the full committee at the next regularly scheduled quarterly meeting.

Investigations Subcommittee
Three members of the RSC, to include the RSO, can be constituted as an investigations subcommittee under situations where an individual on campus has raised a formal radiation safety issue or concern. The Chair of the RSC can be included in this group at his or her discretion. Other safety specialists can be invited to participate as a member of the investigations subcommittee as needed by the nature of the investigation.
In any case, the investigation shall remain confidential while it is being conducted. Results of the investigation, or a progress report, as the situation warrants, shall be presented to the full Committee at the next regular meeting. Depending upon the findings, the complete results may be released to the Committee members, who will decide as to the level of confidentiality needed.
In the case of an overexposure investigation, the RSO is required to be the lead on the investigation, and to complete any appropriate notifications to regulatory bodies.

Human Use Subcommittee
At present UMKC does not use radioactive materials in humans. The license in force does not allow radioactive materials use in humans. If such use is contemplated, a section for the special conditions of use of radioactive materials in humans will be written and an amendment requested of the USNRC for such use.

Animal Use:
At UMKC, a Permit Holder requesting permission to use radioactive materials in animal studies must provide training and experience documentation in the technique and file the specific protocol with their initial application to use radioactive materials in animal studies. Researchers using radiotracers in animals must also complete UMKC’s animal research training requirements and have their protocols approved through UMKC’s Institutional Animal Care and Use Committee.
The Radiation Safety Officer is not a member of IACUC, but is asked to review specific animal research protocols that require radioactive materials use in animals. As radiation worker training requires a final practical safety observation of the worker using a specific protocol, the worker must demonstrate their ability to perform experimental animal procedures safely prior to their working with radioactive materials in an animal experiment.

Program Changes.

Program changes are made through the Radiation Safety Committee, which reviews and approves of permitted program and procedural changes prior to implementation. Proposed general program and procedural changes to the Radiation Safety Program are presented and discussed at RSC Meetings, either the regularly convened quarterly meeting of the Committee or at a special meeting. In some cases on-line requests and polling of the members are employed, but any on-line actions are treated as a subcommittee which requires ratification at a meeting of a full quorum. The initial presentation to the Committee includes the reason for the change or action. In some cases, the proposed changes will require several meetings for the Committee to reach agreement. The discussions and final disposition (approval or rejection of proposed changes by vote), are summarized and recorded in the Committee meeting minutes. Changes are adopted by a majority vote of those members present at a meeting according to described voting procedures.

Implementation of program and procedural changes.

The RSC shall meet upon due notice by its Chairperson as often as necessary to conduct the business of the RSC. The RSC Administrator, Secretary of the RSC or an individual or member appointed by the Chairperson shall advise the members of the time and place of the meeting and shall arrange with the Chairperson for a different time of the meeting if the original time is not convenient for a quorum of the members. If the Chairperson does not call a meeting and if pending business of the RSC needs to be resolved, a meeting can be called by any three of the regularly appointed members of the RSC. With this license, historically, most of the changes proposed have come from the Radiation Safety Officer, and generally assists with Radiation Safety Office operational efficiency or facilitates overall compliance with regulations and the University's radiation safety program. These changes are presented, usually as part of the oral RSO report, documented in committee minutes, discussed as the committee sees fit, and reviewed as part of the next annual audit. Other changes, such as the switching of personnel dosimetry vendors, are reported to the RSC at a committee meeting prior to implementation of changes, are observable by committee members, and reported as part of the quarterly RSO report.

Meeting Minutes

Minutes will be taken that record discussions, deliberations and actions taken by the full RSC and the application review subcommittee and maintained on file for review. The minutes of each meeting will include the following: date of the meeting, members present and absent, and a summary of each issue acted upon. If a change of procedure is involved, the reason for the change and radiation safety matters considered prior to approval of the change will be discussed and read into the minutes. The minutes of each meeting will be provided to members of the Committee. Each member is invited to review the minutes and to discuss any corrections to the minutes at the next meeting. Corrections adopted will be noted in the minutes of the meeting. Minutes of each meeting will be maintained on file by the RSO, at the Office of Research Protections, and circulated to personnel of UMKC having a specific interest in the proceedings or who request copies from the Chairperson.

Procedure for Conduct of Meetings

The meetings of the RSC shall be conducted according to Robert's Rules of Order as they apply to such meetings. The Chairperson shall use them as a guide at the request of any individual member. The following order of business shall be used as a guide in the conduct of RSC business:

- Approval of minutes of the previous meeting
- RSO report
- Announcements
- Old business
- New business.

Voting Procedures:

- Approval by a simple majority of a quorum is required for endorsement of motions made and seconded
- Mail ballots, including e-mail, may be used to resolve matters brought before the RSC when it is inconvenient to convene a meeting and the matters can be explained adequately by supplementary documentation. However,
decisions made under this provision shall be reported and ratified at the next regular meeting of the RSC. A mail ballot or email ballot does not constitute a meeting.

Procedure for Review of Applications for Use of Radioactive Material

Applications are submitted to the Chairperson of the RSC through the RSO. If the application is denied by the RSC, it is returned to the applicant with a statement of the reasons for denial. The applicant can choose to modify the application according to the recommendations of the RSC, drop the application entirely, or appeal the denial to the Chancellor. Upon appeal, the Chancellor has the option of requesting that the RSC reconsider its action upon receipt and evaluation of supplementary information, or can uphold the denial.

Criteria used by the RSC and RSO for approving new users and new uses:

RAM AU Permit Holder (Radioactive Materials Authorized User)

A Permit Holder AU is an associate of the University authorized by the Radiation Safety Committee to use or supervise the use of a radiation source under the UMKC radiation safety program. The Permit Holder shall be a technically trained individual who is competently aware of the radiation hazards associated with their particular work application and of the means to minimize them.

The Permit Holder must complete an application form that:

- provides evidence of University association,
- requests specific ionizing radiation source(s),
- documents training and experience in using the ionizing radiation source they are requesting,
- indicates a suitable location for use of the source(s) and
- provides the specific experimental protocol(s) for use.

The prospective Radioactive Materials Permit Holder AU (RAM AU) is required to complete UMKC's institution-specific training program. This training program reviews standard radiation safety procedures as well as site-specific protocols for ordering, using, and disposing of radioactive materials. The permit holder is also responsible for ensuring that radiation workers and lab workers under their supervision comply with, and are informed of, safety rules, regulations, policies and procedures and meet the training requirements set forth by the RSC. The RAM AU is responsible for providing appropriate training for workers under their supervision in the safe use of specific radiation sources for their approved experimental protocols.

The RSC is responsible for ensuring that radiation safety is maintained adequately on the campus. In its review of applications, the RSC shall determine that radiation safety coverage is available for the use proposed. If radiation safety coverage is not available or cannot be provided, the RSC shall either deny the use or request the campus administration to provide the radiation safety coverage deemed necessary. This is the key step in the review process to ensure that no radiation sources are authorized for use without adequate radiation safety coverage. Also, when previously available radiation safety coverage is lacking, authorizations shall be suspended by the RSC until radiation safety coverage is restored at an acceptable level.

Audit Procedures for licensed operations

The Radiation Safety Committee performs a formal annual audit of the Radiation Safety Office. A report is written and sent to the Chancellor and the Institutional Official. The Director of EHS also receives a copy. Any changes in the Radiation Safety Office procedures, etc. as a result of the audit are noted, and often reviewed at the next audit.

Procedures for taking appropriate actions when noncompliance is identified.

Depending upon the noncompliance, if the Radiation Safety Officer cannot resolve the issue satisfactorily, according to existing procedures, the Radiation Safety Committee Chair is notified. If discussions with the Chair, as Committee representative, do not produce an appropriate resolution, the matter is taken to the full Committee. If the Radiation Safety Officer believes that a situation exists that is immediately dangerous to life and health, and a lab is required to be shut down, the Director of EHS and the RSC Chair are informed, and appropriate actions are instigated. The incident report will be presented at the next RSC meeting.

The RSC bears the primary responsibility to maintain all radiation safety matters in compliance. Evidence of a noncompliance must be acted upon promptly, and the cause of the noncompliance must be corrected by action of the RSC.
APPENDICES

A. Definitions

B. Radiation/Contamination Guides and Action Levels

C. General Health Physics Data on Common Radionuclides

D. Posting Information:
   a. NRC Form 3
   b. Emergency Procedures
   c. User Contact List
   d. Postings for RPD areas:
      i. State of Missouri
      ii. State of Kansas

E. Guidelines and Standard Operating Procedures For Radiotracer Use in Animals

F. Forms
   a. AU Checklists
   b. Standard use forms
Appendix A. DEFINITIONS

This section contains some of the Definitions of words used in Radiation Safety and in the Handbook of Radiological Operations. Note: definitions in *serifed italic font* are found in the State of Missouri radiation protection regulations and apply specifically to the Radiation-Producing Device division of the University’s radiation safety program.

DEFINITIONS:

Absorbed Dose: The energy imparted by ionizing radiation per unit mass of irradiated material. The units of absorbed dose are the rad and the SI unit, the gray (Gy)

Activity: The rate of disintegration of radioactive material. The units of activity are the Curie (Ci) and the SI unit, the becquerel (Bq)

Adult: An individual 18 or more years of age

ALARA: Means making every reasonable effort to maintain exposures to ionizing radiation as far below the permissible dose limits as is practical consistent with the purpose for which the licensed material is being used

AU: An individual who is approved by the RSC to acquire, possess and use radiation sources. An AU is responsible for the safety of any individuals who use the radiation sources under his/her supervision RAM AU—permit holder for Radioactive Materials RPD AU—individual designated as a user of and/or a contact person for a radiation producing device registered through UMKC

Background Radiation: Radiation from natural sources, e.g., cosmic radiation and naturally occurring RAMS, and from man made sources, e.g., medical and dental radiation, fallout, etc. Background radiation does not include radiation from regulated byproduct, source or special nuclear materials

Becquerel: SI unit of activity equal to 1 dps

Bioassay: The determination of radionuclides, activities or concentrations, and in some cases, locations of RAM in the human body, whether by direct measurement (*in vivo* counting) or by analysis and evaluation of materials excreted or removed from the human body

Byproduct Material: Any RAM (except special nuclear) made radioactive by exposure to the radiation incident to the operation of a nuclear reactor

Controlled area is an area in which the occupational exposure of personnel to radiation or to radioactive material is under the supervision of an individual in charge of radiation protection. (This means that a controlled area is one that requires control of access, occupancy and working conditions for radiation protection purposes.) [5]

Curie: Unit of activity equal to 37 billion dps

Declared Pregnancy: When a woman has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception and delivery

Dose Equivalent: The product of the absorbed dose in tissue and a quality factor. The units of dose equivalent are the rem and the SI unit, the sievert (Sv)

Dose Limit: The upper bound of dose equivalent permitted by regulation. Dose limit includes the sum of the external and internal dose equivalents

Emergency: Any incident resulting from the use of radiation sources that presents an external or internal hazard to personnel. Common incidents are spills, fires in laboratories or loss or theft of RAM
Exposure: Condition of being exposed to x or γ radiation. The unit for exposure is the Roentgen (R) and the SI unit, the Coulomb/kg

External Dose: That portion of the dose equivalent received from radiation sources outside the body

Extremity: The arm including from the elbow to the hand and the leg including from the knee to the foot

Eye Dose: External dose equivalent to the lens of the eye at a tissue depth of 0.3 cm

Gray: SI unit of absorbed dose. One gray is equal to 100 rads (1 Joule/kg)

Institutional Official: (of the Radiation Safety Program)—individual designated by the Chancellor to ensure the operation and appropriate support of the Radiation Safety Committee and Radiation Safety Operations at UMKC; reports directly to the Chancellor for the Safety Program.

Internal Dose: That portion of the dose equivalent received from RAM inside the body

Lab Supervisor: An individual approved to possess and use hazardous chemicals in accordance with the Chemical Management Plan

Licensed Material: RAM received, possessed, used, transferred or disposed of under a general or specific license issued by the NRC or an Agreement State

Licensee: The holder of a materials license. For UMKC, it is officially the “Curators of the University of Missouri”

Member of the Public: Any individual not occupationally exposed to radiation sources

Minor: An individual less than 18 years of age

Mixed Waste: Waste that contains both RAM and hazardous chemicals

Monitoring: Radiation protection monitoring is the measurement of radiation and contamination levels and the use of the results to evaluate potential hazards or exposures

Occupational Dose: The dose equivalent received by an individual in the course of employment in which the individual's assigned duties involve exposure to radiation sources. Occupational dose does not include doses received from background radiation, from medical procedures or from voluntary participation in medical research programs or as a member of the public

Personnel monitoring is the determination of the radiation dose received by an individual during the specified period. [15]

Qualified expert is an individual fitted by training and experience to perform dependable radiation surveys, to oversee radiation monitoring and to estimate the degree of radiation hazard. If the ability of a qualified expert is questioned, the department shall be the judge of his/her qualifications, in regard to which it may consider the testimony of other persons whom it deems expert. (17)(DHHS)

Rad: Unit of absorbed dose. One rad is equal to an absorbed dose of 100 ergs/g or 0.01 Gy

Radiation: Ionizing: Alpha and beta particles, gamma rays, x-rays, neutrons, high-speed electrons and protons, and other particles capable of producing ionizations nonionizing radiation such as radio- or microwaves, visible, infrared or ultraviolet light from State of Missouri regulations[19 CSR 20-10.010(19) ] is gamma rays and X-rays, alpha and beta particles, high-speed electrons, neutrons protons, other nuclear particles and other ionizing radiation but not sound or radio waves or visible infrared or ultraviolet light.
Radiation Area: An area, accessible by individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 5 mrem in one hour at 30 cm from the radiation source or from any surface that the radiation penetrates.

Radiation hazard is any condition that might result in the exposure of individuals to excessive radiation dose. (20)

Radiation machine is any device that produces radiation when in operation. (21)

Radioactive material is any material, solid, liquid or gas, that emits radiation spontaneously. (22)

Registration, Registrant: Declaration of possession of a radiation producing device to the State of Missouri according to processes defined in State radiation protection regulations; an individual or entity so declaring possession of a radiation producing device in the State of Missouri.

RPD: Radiation Producing Device; an apparatus producing ionizing radiation.

Radiation Safety Officer: An individual qualified by training and experience in radiation protection and is available to give advice and assistance on radiation safety matters to employees of a licensee.

Radiation Sources: Any material or device that produces ionizing or non-ionizing radiation.

Radiation Worker: An individual using radiation sources under an AU’s supervision. This individual must meet certain educational, training and experience requirements.

rem: Unit of dose equivalent. One rem is equal to the product of the absorbed dose in rads and a quality factor. One rem is equal to 0.01 Sv.

Sealed Source: Any radioactive material that is encased in a capsule designed to prevent leakage or escape of the RAM, and having a safety evaluation already on file with a regulatory agency in the United States (As opposed to encapsulated source, in which the evaluation is not on file).

sievert: SI unit of dose equivalent. One sievert is equal to the product of the absorbed dose in grays and a quality factor. One Sv is equal to 100 rem.

Source (of radiation) is a radiation machine or a quantity of radioactive materials.

Survey: An evaluation of the radiological conditions and potential hazards incident to the use, transfer, release, disposal or presence of RAM or other radiation sources.

Survey(2) is the evaluation of actual or potential radiation or contamination hazards by or under the supervision of a qualified expert. (28)

User is a person having administrative control over one (1) or more sources. (32)
Appendix D. Posting information.

a. NRC Form 3
b. Emergency Procedures
c. User Contact List
Appendix E. Guidelines and Standard Operating Procedures For Radiotracer Use in Animals

These Guidelines and Procedures for use of radioactive tracers in animals are not expected to cover every instance. Please contact the Radiation Safety Office for assistance when developing your specific procedures.

The following procedure may be used when preparing an IACUC protocol application in which LARC equipment such as animal cages are removed from the LARC facility for use in a radioactive tracer animal experiment in an approved radioactive materials laboratory at UMKC. It may also be used as part of the radioactive materials use permit application for that particular use.

Procedure for Returning Cages or Other Equipment to the Lab Animal Research Core for Routine Sanitation and Normal Use

Specific Application: Returning cages or other equipment to the LARC which has been in contact with animals that have had radionuclides internally administered as part of an approved IACUCC protocol.

Procedure:

1. Clean the cages or other equipment in the posted radioactive materials use area. (Either wash or use cleaning wipes)
2. Wipe test each initially cleaned cage or piece of equipment as part of the required end-of-day-of-use contamination surveys.
   a. If results are over UMKC Radiation Safety Program release limits, clean again.
   b. Retest.
   c. Repeat until equipment meets UMKC release limits.
3. When wipe tests meet release limits, contact Radiation Safety to schedule confirmatory equipment surveys.
4. When you receive the email from UMKC Radiation Safety releasing the equipment for general use, bag the items and attach a label with the following information:
   - PI Name
   - Contact phone number
   - Lab location where items were used
   - What hazardous material was involved?
   - Cleared by Radiation Safety on_____ (date email notification sent from Radiation Safety)
   - Date returned to LARC

NOTE: Do not return equipment to the LARC until Radiation Safety has provided an email notification of clean survey results to LARC and to the laboratory.

Radiation Safety emails will state the date of the survey, the PI, the lab location, a list of the items tested (i.e. 4 cages and tops) and the statement “Survey results were indistinguishable from background; items released for general use.”

A description of the instrument used for analysis (make model, serial number and calibration date), and the background reading in CPM or DPM may also be included, but is not required for this email communication.

Guidelines for Waste from Animal Experiments Containing Radioactive Material

General guidelines to be used when planning for animal carcass disposal:

1. The plan for disposal of animal carcasses and wastes must be approved by the Radiation Safety Office (RSOf) prior to the start of the experiments.
2. The permit holder must have enough appropriate freezer or refrigerator space available to store the animal carcasses from the experimental run prior to transfer to EHS for disposal.
3. If the radioactive material is concentrated within a single organ or localized system, the organ or system may be removed and kept in refrigerated storage to reduce the amount of radioactively contaminated waste; however, this must be approved by Radiation Safety.
4. If such removal can be accomplished, two pairs of rubber gloves should be worn and removed tissue handled with forceps. The removed tissue shall be stored in an appropriately shielded and secured storage location.
5. The remainder of the carcass shall have a documented survey performed and on file for the presence of residual radioactivity.
6. If no significant radioactivity remains, this portion of the carcass may be treated using the currently approved regular animal carcass disposal procedures.
The guidelines given above are not expected to cover every instance of the need for disposal of carcasses containing radioactive material. The user is requested to contact the RSO to assist in the resolution of any disposal problem not covered by these guidelines.

Disposal of Animal Excreta Containing Radioactive Material

This complex problem of radioactive waste disposal results from the use of radioactive material for in vivo experiments with animals. The complexity derives from the uncertainty of the quantity and the rate of elimination from the animal, in fact, determining this may be part of the experiment proposed. Because of these uncertainties, the user must be prepared to collect, dispose of, and record the quantity of radioactive material contained in all excreta of experimental animals to which radioactive materials have been administered.

The methods to be used to do this are part of the application to use radioactive materials in animal experiments. Without attempting to specify the methods to be employed in every case, the following general guidelines will serve to outline what needs to be done. The forms available to be used as an attachment to the application form for use of radioactive materials are designed to help the permit holder through this thought process.

1. An estimate shall be made of the portion of the administered quantity of radioactive material that is expected to be eliminated by the animal.
2. From this estimate, the significance in terms of potential hazard to personnel or property of the eliminated material can be evaluated. As a rule-of-thumb, if the total quantity eliminated per day from the entire group of experimental animals is <10% of the values listed for the particular radionuclide in Appendix C, 10 CFR 20, the elimination will not constitute a significant hazard to personnel or property.
3. If the evaluation of the potential hazard indicates that a significant quantity is to be eliminated, an adequate method of collection of all excreta must be developed. If a significant activity cannot be excreted, the material may be disposed of through normal channels after an evaluation confirms that the excreta are not radioactive.
4. The user may elect to hold the material in an appropriate isolated storage area until a special waste pickup can be arranged.

Disposal of Gaseous-Form Radioactive Wastes

A few experiments require the maintenance of a breathing environment for plants or animals containing a radioactive material in gaseous form. In all instances, such experiments shall be designed so that the gaseous form, radioactive material is contained within an enclosure exhausted to the atmosphere at concentrations less than the maximum permissible amounts specified in 10 CFR 20. If several radionuclides are released, the limit for the combination may be derived by determining the ratio between the quantity present in the combination and the limit allowable when it is the sole constituent. The sum of the ratios determined in this matter for each of the constituents may not exceed unity. Records of all releases to air shall be maintained. If a release has, or may have, exceeded the limits specified above, the RSO shall be promptly notified so he may make a determination as to whether a notification is required to be sent to the NRC, and if so, to submit all necessary information in a report within the time limits specified by NRC.

Notes

1. Draft procedure for clearing equipment for general use taken from Revision 0 of this procedure prepared on Sept. 16, 2011 for the Lab Animal Research Core and UMKC’s IACUC.
2. Significant contamination is defined as: removable beta or gamma activity >100 pCi/100 cm² or removable alpha activity >10 pCi/100 cm².
Appendix F. Forms

a. AU Checklists
   a.

b. Standard Forms List:

RadSafe 1A RAM Application
RadSafe 1B RPD Application
Radsafe 2 Amendment to Authorizations
RadSafe 3 Authorization Renewal

RadSafe 4 reserved

RadSafe 5 Worker Training & Experience
RadSafe 6 Worker Dosimeter Request
RadSafe 7 PG Declaration
RadSafe 8 Lab Worker Orient. Checklist
RadSafe 9 RW Checklist
RadSafe 10 Lab Survey Audit Report
RadSafe 11 Sealed Source Report
RadSafe 12 Special Survey Report
RadSafe 13 Incident Report

RadSafe 14 reserved

RadSAfe 15 RAM rct form
RadSafe 16 RAM Use Log
RadSafe 17 Internal Transfer
RadSafe 18 RAM Waste Pickup
RadSafe 19 Animal Disposal Form
RadSafe 20 Animal Use Worksheet
RadSafe 21 Room Evaluation/Activation Checklist
RadSafe 22 Room Closeout/Deactivation/Decommissioning Checklist

RadSafe 23 reserved
RadSafe 24 reserved
RadSafe 25 reserved
RadSafe 1A APPLICATION FOR POSSESSION AND USE OF RADIOACTIVE MATERIALS

This form must be typed or printed neatly with black ink.

1. Applicant Name ___________________________ Date: ____________

Degree, Certifications Held: ___________________________

UMKC Position: Full time__Other__-

Department ___________________________ School ___________________________

Preferred Notification: ☐ Email at: ___________________________

☐ Office Phone#: ___________________________

☐ Campus Mail at: ___________________________

2. Designated Backup

AU (optional): ___________________________

Backup AU signature: ___________________________

3. Location(s) of use of source(s): ___________________________

Lab phone: ___________________________

4. Source(s) to be used: A. Radioactive Materials: ____

<table>
<thead>
<tr>
<th>4 A a. Radionuclide requested</th>
<th>4 A b. Form</th>
<th>Ac. Possession Limit (mCi)</th>
<th>In lab at any one time</th>
<th>Radiation Safety Committee Review:</th>
</tr>
</thead>
<tbody>
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<td></td>
<td>Date Received: ____________</td>
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<td></td>
<td>Date Approved: _______________</td>
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<td></td>
<td></td>
<td>Health Physics Evaluation:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Date Received: ____________</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Date evaluated: ____________</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Risk-level : ______________</td>
</tr>
</tbody>
</table>

6. Proposed use and plan of investigation. Attach protocol(s) ____

Summarize maximum quantity per experiment per radionuclide, and experiments per day:

Protocol 1: Radionuclide: _____ Amount per experiment _____ uCi _____ experiments/day

Protocol 2: Radionuclide: _____ Amount per experiment _____ uCi _____ experiments/day

Protocol 3: Radionuclide: _____ Amount per experiment _____ uCi _____ experiments/day

Protocol 4: Radionuclide: _____ Amount per experiment _____ uCi _____ experiments/day

Protocol 5: Radionuclide: _____ Amount per experiment _____ uCi _____ experiments/day

5. SIGNATURES

________________________ /________________________

Health Physicist / RSO

________________________

Committee Chairman

________________________ /________________________

Applicant/Date

________________________

Department Chairman
- As per Handbook Procedures
- Other:

Special considerations: □ Biohazard □ Blood borne Pathogens □ Animal use
Indicate the following for each protocol using animals: approved IACUC protocol number (if known at time of this application) animal used, estimated number of animals, average weight (gms) uCi administered per animal of what Radionuclide, over what time period. e.g. Protocol #XXXX uses 250 gm rats, 5 microcuries of H-3 per animal, up to 50 animals over 10 months.

□ Mixed waste: hazardous chemicals + radioactive isotopes. (List hazardous chemicals that make your waste mixed waste.)

List other chemical constituents appearing in your liquid waste:

<table>
<thead>
<tr>
<th>8. Plan for personnel monitoring and radiation protection:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- As per Handbook Procedures</td>
</tr>
<tr>
<td>- Special Procedures:</td>
</tr>
</tbody>
</table>

9. Radiation Detection Instrumentation available: indicate if you own it or share it.
Type of Instrument  manufacturer  model number  serial number  location  own or share with....

9a. Calibration certificates for detection devices attached?
- no meters used
- meter(s):

10. Describe any other special safety equipment available: (fume hoods, beta shields, shielded storage facilities, lead aprons, etc.)

11. Shipping Address to be used for radioactive materials:
- UMKC Env. Hlth. & Safety
  Radiation Safety X 5289 or X 6096
  4747 Troost Bldg. Room 3
  Kansas City, MO 64110-2499
- UMKC School of Medicine
  EHS-Radiation Safety X5289 or X6096
  2411 Holmes St.
  Kansas City, MO 64108

- Other__________________________________________
12. Straight line ruler sketch of laboratory:
RadSafe 1B APPLICATION FOR POSSESSION AND USE OF RADIATION PRODUCING DEVICES

This form must be typed or printed neatly with black ink.

1. Applicant Name
   
   Date:
   
   Degree, Certifications Held:
   
   UMKC Position: Full time__Other__-
   
   Department
   
   School
   
   Preferred Notification: [ ] Email at:
   
   [ ] Office Phone#:_
   
   [ ] Campus Mail at:
   
   2. Designated Backup
      
      AU (optional):
      
      Backup AU signature:
      
   3. Location(s) of use of source(s):
      
      Lab phone:
      
   4. Device(s) to be used: Human Use: 1746__NONhuman Use: 846__1746__
      
      NONHUMAN USE: (MO846)
      
      __xray diffraction, teaching/instruction
      
      __xray diffraction, research
      
      __electron microscope, teaching/instruction
      
      __electron microscope, research
      
      __xray photoemission spectrometer, research
      
      __Dental intraoral, Teaching/instruction
      
      __other:
      
      Health Physics Evaluation:
      
      Date Received:______________
      
      Date Evaluated:____________
      
      Registered:_____________
      
      Quarter reported to RSC:_____________
      
      NONHUMAN/Veterinary use: (MO846)
      
      ____Vet/ CT
      
      ____ Bone densitometer (Piximus)
      
      ____Cabinet Xray location:___________
      
      ____Cabinet Xray location:___________
      
      ____RS2000 irradiator
      
      HUMAN USE: (MO 1746)
      
      __Bone Densitometer (DEXA unit) Research
      
      Dental intraoral __Clinical
      
      __clinical instruction
      
      __Research
      
      Dental panoramic__clinical
      
      __clinical instruction
      
      __Research
      
      Dental CBCT, ____Clinical
      
      ____Research
      
      ____Clinical Handheld Dental intraoral
      
      ____State of KS handheld intraoral
      
   5. SIGNATURES
      
      ____________________________
      
      Other Reviewer(s)
      
      ____________________________
      
      Health Physicist / RSO
      
      ____________________________
      
      Applicant/Date
      
      ____________________________
      
      Department Chairman or responsible user
6. Radiation-Producing Devices:
If your device doesn't appear on the list in Section 4, please provide a description of the device (Manufacturer & model; serial number if you have the equipment) and current or proposed location:

<table>
<thead>
<tr>
<th>Type of Instrument</th>
<th>Manufacturer</th>
<th>Model Number</th>
<th>Serial Number</th>
<th>Location</th>
<th>Own or Share with</th>
</tr>
</thead>
</table>

7. Plan for personnel monitoring and radiation protection:
- As per Handbook Procedures
- Special Procedures:

8. Radiation Detection Instrumentation available: indicate if you own it or share it.
Type of Instrument | manufacturer | model number | serial number | location | own or share with |

9. Calibration certificates for detection devices attached?
- no meters used
- meter(s)

10. Describe any other special safety equipment available: (fume hoods, beta shields, shielded storage facilities, lead aprons, etc.)

11. Purchasing Method(s) to be used (radioactive materials):
- Credit Card: Approval Form attached? Y N
- Purchase Requisition
- Other

12. Straight line ruler sketch of laboratory:
RadSafe 2   AMENDMENT TO PERMIT FOR POSSESSION AND USE
OF RADIATION SOURCES

Authorized User:_________________________        Authorization No._______________
Department:_________________________    Contact Information:________________________

This form must be typed or printed neatly with black ink

<table>
<thead>
<tr>
<th>1. Room change:</th>
<th>Add room     Room(s)_________</th>
<th>Remove Room     _____________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other:</td>
<td>Please indicate if room is shared, &amp; with whom:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Possession Limit</th>
<th>Increase________ from________ to________ mCi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change:</td>
<td>Decrease________ from________ to________ mCi</td>
</tr>
<tr>
<td>Reason:</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>3. Radionuclide</th>
<th>Add:________________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change:</td>
<td>Remove:____________________</td>
</tr>
<tr>
<td>Reason:</td>
<td>protocol addition or change:_______  no longer using:_______ other:</td>
</tr>
</tbody>
</table>

Protocol Addition

**Proposed use and plan of investigation.**  *Attach a copy of the protocol.*
Summarize maximum quantity per experiment per radionuclide, and experiments per day:

Radionuclide:________ max. mCi/ experiment:_______ Experiments/day:_______

Plan for personnel monitoring and radiation protection:  
- no change necessary from existing permit
- As per Handbook  
- Special Procedures:

Plan for disposing of radioactive wastes  
- No change necessary from existing permit
- As per Handbook  
- Special considerations:

Other changes to authorization:

Radiation Safety Committee Review:
Date Received:______________
Date Approved:______________
Health Physics Evaluation:
Date Received:______________
Date evaluated:______________
Risk-level :________

5. SIGNATURES

________________________
Health Physicist / RSO

________________________
Committee Chairman

5. SIGNATURES

________________________/
Applicant/Date

________________________
Department Chairman
UMKC’s USNRC License for source, special nuclear, and byproduct materials has a definite date when it expires unless it is renewed in a timely manner. Each University permit is also issued for a set date, usually for a three year period. If a permit is placed in timely renewal, work can continue under the expiring permit conditions until the University Safety Committee reviews the permit and acts on the renewal request.

The permit identified above is nearing the expiration date. The following actions have been taken to place this permit in timely renewal status:

- The Authorized User has reviewed the existing permit for completeness and accuracy,
- The Authorized User has completed and signed this form,
- The form has been returned to the Division of Radiation Safety for a safety review on or before the expiration date on the permit. (August 31, 2012)

The Radiation Safety Committee will review the permit at the September meeting. Failure to respond will cancel your authorization on the expiration date.

This form must be completed neatly in black or blue ink.

- [ ] I wish to renew my permit without change. (See attached permit.)
- [ ] I wish to terminate this authorization with the understanding that it may be renewed at a future time.
- [ ] I wish to reduce the type, form and/or quantity of radioactive material for which I have been authorized according to the attached amendment request (RadSafe 2). All radioactive material for which I will no longer be authorized has been disposed of in accordance with University and NRC regulations. I understand that the permit for the remaining material will be reviewed for renewal.

- [ ] I wish to modify my authorization according to the attached RadSafe 2. Modifications for room, laboratory protective equipment, and protocols must be approved prior to implementing changes.

Comments:

______________________                                       ____________________________________________
Date                                                                                                             Signature of Authorized User

_____________________                                        ________________________                     __________
Date                                                                                                             Signature of Reviewer       Initials, RSO
**STATEMENT OF TRAINING AND EXPERIENCE FOR USE OF RADIATION SOURCES: AUTHORIZED USERS & RADIATION WORKERS**

<table>
<thead>
<tr>
<th>Name of Applicant:</th>
<th>Date:</th>
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</table>

<table>
<thead>
<tr>
<th>Date of Birth:</th>
<th>UMKC EMPLID #:</th>
<th>Sex:</th>
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<tbody>
<tr>
<td>(MM/DD/YYYY)</td>
<td></td>
<td>M___ F___</td>
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</table>

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<thead>
<tr>
<th>Topic &amp; Type of Training</th>
<th>Where Trained</th>
<th>Duration of Training</th>
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</thead>
<tbody>
<tr>
<td>1. Principles of Radiation Protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Formal Course</td>
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</tr>
<tr>
<td>- On-the-job</td>
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<tr>
<td>2. Radioactive measurements techniques and instrumentation</td>
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<td>- Formal Course</td>
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<tr>
<td>- On-the-job</td>
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<td>3. Math Basic to Radioactivity</td>
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<td>- Formal Course</td>
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<tr>
<td>- On-the-job</td>
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<td>4. Biological Effects</td>
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<tr>
<td>- Formal Course</td>
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</tr>
<tr>
<td>- On-the-job</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Experience with Radiation Sources: A. Radioactive Materials**

<table>
<thead>
<tr>
<th>Radionuclide, amount form</th>
<th>use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
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<tr>
<td>3.</td>
<td></td>
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<tr>
<td>4.</td>
<td></td>
</tr>
</tbody>
</table>

**B. Radiation-Producing Devices—type and use (i.e. research, clinical)**

<table>
<thead>
<tr>
<th>Type and use</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
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<tr>
<td>2.</td>
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<td>3.</td>
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<td>4.</td>
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</table>

**Experience with Radiation Detection Instruments:**

<table>
<thead>
<tr>
<th>Type of Instrument</th>
<th>Radiation Detected</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
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<tr>
<td>2.</td>
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<tr>
<td>3.</td>
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</tbody>
</table>

**Source(s) to be used: A. Radioactive Materials B. Radiation Producing Devices**

<table>
<thead>
<tr>
<th>Worker Location:</th>
<th>Worker Signature:</th>
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<tbody>
<tr>
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<table>
<thead>
<tr>
<th>Worker Phone:</th>
<th>Worker Email:</th>
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<table>
<thead>
<tr>
<th>AU Department:</th>
<th>AU Signature:</th>
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**RSOf:**

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<th>Date:</th>
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**RSOf Notes:**

<table>
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<th>OTHER NOTES:</th>
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<table>
<thead>
<tr>
<th>On Blackboard:</th>
<th>Moved to Active:</th>
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<table>
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<tr>
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<th>Worker Phone:</th>
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<tr>
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<th>OTHER NOTES:</th>
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<tr>
<th>RSOf:</th>
<th>Date:</th>
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</table>
Name: ___________________________________________   Supervisor/AU: _______________________________________

Email address: ___________________________ Phone: ______________________________

SSN __________-_______-_____________ Date of Birth (MM/DD/YYYY): ______/_______/___________

Campus Location: __________________________________________________

Authorization for Release of Exposure History:
Check box if no previous exposure monitoring has been done: ☐

I, _____________________________________________, authorize the following institutions to release my
exposure history to the Division of Radiation Safety, University of Missouri - Kansas City.

<table>
<thead>
<tr>
<th>Institution and address</th>
<th>Employment Dates</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

Signature: ____________________________________________ Date ________________________________

RSOffice Use Only

Date Received: ______________________ Date Evaluated: ______________________ By: __________________________

Bioassays needed?  Y  ____  N__________

Permanent Badge setup date: ______________________ Part. Number: ____________________

Temporary Badge issuance notes: (date, badge number) ________________________________

Notes:
This is to officially inform the University of Missouri-Kansas City Radiation Safety Office that I am pregnant. The following information is being provided to assist in determining if additional monitoring or precautions are necessary.

Radiation Worker: ____________________________ SSN _____-____-_______

AU: ____________________________  Worker’s Telephone: ___________________

Radionuclides that have been used or will be used during pregnancy: ______________________________

Radionuclides that are present in the laboratory I frequent, but are not used by me:

___________________

Radiation Producing Devices that have been used or will be used during pregnancy:

__________________

Estimated conception date: _____ / _______ Estimated delivery date: _______ / __________

month        year                                                     month               year

I understand that upon declaration of pregnancy, I may speak with a member of the Radiation Safety staff about my radiation exposure.

I understand that the Radiation Safety Officer recommends that an appointment to speak to a Radiation Safety staff person be made as soon as possible.

I understand that my occupational radiation dose during my entire pregnancy will not be allowed to exceed 0.5 rem (5 millisieverts), unless that dose has already been exceeded between the time of conception and submitting this letter. I also understand that meeting the lower dose limit may require a change in job or job responsibilities during my pregnancy.

If I find out that I am not pregnant, or if my pregnancy is terminated, I will promptly inform Radiation Safety in writing that my pregnancy has ended.

Name: ____________________________      _____________________________________

(print or type)     (signature)

Date: _____________________

Radiation Safety Use Only

Date Received:

Does the individual have a badge?  □ Yes   Badge Number: ____________

□ No

Fetal Monitor  Badge number, if issued: __________

Notes:

Consultation Date:                              By RSOf Staff:
Worker name: ____________________________________  AU: ______________________

Lab Location: ____________________________________

1. General Use(s) of Laboratory: _____________________________________________
__________________________________________________________________________

2. Radioactive Material Use in Laboratory:  Describe RAM used (type of emitter, chemical form and general procedures):__________________________________________

Check the following, if reviewed, or NA=not applicable:
___ Security procedures ___ NRC Form 3 location  ___ RAM labeling procedures
___ Lab locations: ___ RAM storage ___ RAM use ___ RAM waste storage
___ Recordkeeping ___ location of paperwork ___ who’s responsible for paperwork in lab

3. Safety Precautions (check if reviewed, or NA = Not Applicable)
___ gloves ___ lab coats ___ shoes ___ safety glasses ___ other:_____________
___ areas of use defined ___ absorbent paper ___ trays ___ other :_____________
___ shielding used ___ hood use ___ other:_____________________
___ wipe tests ___ meter surveys ___ personnel monitoring
___ no mouth pipetting ___ no eating, drinking, smoking, gum chewing ___ no cosmetics application

Other lab-specific safety precautions:________________________________________
_________________________________________________________________________

4. Emergency Procedures (check if reviewed, or NA = Not Applicable)
___ General Procedures ___ Fire ___ Minor Spills ___ Major Spills
___ Notifications ___ Emergency Procedure Posted ___ Incident Reporting Requirements

Other notes:_________________________________________________________________


Worker:______________________________________  Date:_______________________

Trainer:____________________________________  Date:_______________________
Worker ___________________________________ AU __________________ Date:__________________

I. Radiation Worker can talk through and/or demonstrate the protocol:  Y   N
   Knows where RAM is introduced into system:  OK   Needs Improvement
   Knows how much RAM is introduced into system:  OK   Needs Improvement
   Describe equipment and work area(s):  OK   Needs Improvement
   *Demonstrates "plan ahead" concept:  OK   Needs Improvement

What precautions are being taken?
   Protective clothing   OK   Needs Improvement
   Dedicated equipment/work area   OK   Needs Improvement
   Shielding: Not Required   OK   OK
   Survey meter: NA   OK
   Double containment for storage   OK   transport   waste

What precautions are being taken?
   Protective clothing   OK
   Dedicated equipment/work area   OK
   Shielding: Not Required   OK
   Survey meter: NA   OK
   Double containment for storage   OK

Other: ________________________________________________________

II. Can Radiation Worker describe or demonstrate:
   □ specific lab procedure for ordering
   □ state requirements for Radiation Safety approval for order
   Inventory procedures: knows how to log  □ receipt  □ use  □ waste disposal
   Q: What do you do when your waste container is full?

III. Can Radiation Worker describe/perform:
   □ type of radiation, half-life
   □ use of survey meter (or is aware of "NA" for isotopes in use)
   □ wipe test after use  □ explain where wipes are taken and why
   □ counting systems-efficiency known?
   □ contamination limits known for laboratory?

IV. General observations :

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

V. Worker Approved for: Radionuclide(s):_____________________________

                                      Procedures: ___________________________________________________________

DRS Only:

Signature_________________________________ Date:______

_
RadSafe 13  REPORT OF INCIDENT RESPONSE--

<table>
<thead>
<tr>
<th>Incident location:</th>
<th>Date:</th>
<th>Time:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substance:</td>
<td>Quantity:</td>
<td>Person reporting incident:</td>
</tr>
<tr>
<td>Responsible Lab Supervisor:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact number:</td>
<td>HazMat Manager:</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name injured:</th>
<th>Medical attention:</th>
<th>accepted</th>
<th>denied</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name injured:</td>
<td>Medical attention:</td>
<td>accepted</td>
<td>denied</td>
</tr>
<tr>
<td>Name injured:</td>
<td>Medical attention:</td>
<td>accepted</td>
<td>denied</td>
</tr>
</tbody>
</table>

**Description of incident:**

_____________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

**Equipment and material used:**

__________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

**Disposal method:**

_______________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

**Difficulties:**

_________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

**Damage to property or environment:**

______________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

___________________________________________________________________________

**EH&S personnel involved:**

________________________________________________________

________________________________________________________________________________________

Filed by EH&S:  

<table>
<thead>
<tr>
<th>Date:</th>
<th>Time:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Delivery Date_________ Receiver:_______________________

Date DRS rc'd.__________ ORS Signature_________________

Pkg : Surface:________mR/hr @1m________ mR/hr

Container:__________mR/hr contamination=____ dpm/100cm²

Survey meter cal. date __________ Bkg. rdg __________
____Ludlum 2241-2 S/N148360 __________Ludlum Model 2241-2 S/N112692
____Ludlum 2241-2 S/N198267 __________Ludlum Model 2241-2 S/N 188158
____Ludlum 2241-2 S/N 237754 __________Ludlum Model 14C S/N 188343

Other:____________________________

Wipe Test:________________________
____Beckman LSC S/N 7071352 _______Tennelec Series 5 XLB 43787

__ Other:___________________________
____Net cpm= _____ cpm wipe - _____ cpm inst bkg
____ DPM= net cpm/efficiency; efficiency=_____%

Delivery Date_________ Receiver:_______________________

Date DRS rc'd.__________ ORS Signature_________________

Pkg : Surface:________mR/hr @1m________ mR/hr

Container:__________mR/hr contamination=____ dpm/100cm²

Survey meter cal. date __________ Bkg. rdg __________
____Ludlum 2241-2 S/N148360 __________Ludlum Model 2241-2 S/N112692
____Ludlum 2241-2 S/N198267 __________Ludlum Model 2241-2 S/N 188158
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Other:____________________________

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____Beckman LSC S/N 7071352 _______Tennelec Series 5 XLB 43787

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Other:____________________________

Wipe Test:________________________
____Beckman LSC S/N 7071352 _______Tennelec Series 5 XLB 43787

__ Other:___________________________
____Net cpm= _____ cpm wipe - _____ cpm inst bkg
____ DPM= net cpm/efficiency; efficiency=_____%
Indicate when waste is transferred to EH&S by summing items in the appropriate columns, (liquid, SV, dry) and record the pickup date, amount and form transferred.

**OTHER INVENTORY NOTES:**
RadSafe 17  UMKC RADIOACTIVE MATERIALS
INTERNAL TRANSFER REQUEST

Date: ___________________________

AU Receiving & Permit #: ____________________________________________

AU Transferring: & Permit #: ___________________________________________

Isotope: ___________________ Activity: ____________________________

Compound __________________________________________________________

Comments: __________________________________________________________

____________________________________________________________________

<table>
<thead>
<tr>
<th>Signatures</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>AU Transferring:</td>
<td></td>
</tr>
<tr>
<td>RSOf:</td>
<td></td>
</tr>
<tr>
<td>AU Receiving:</td>
<td></td>
</tr>
</tbody>
</table>
Send completed forms to Hazardous Waste Div. , 4747 Troost Bldg. Rm. 003

Date:__________________Department /School Name__________________________________________________

Authorized User's Name & Permit #:______________________________________________phone_______________

Print name of person authorizing charges  Signature of person authorizing charges and
and pick up:           pick up:

______________________________________________________________________________________

Location of waste for pick up: Bldg. ___________Room:______________ Other: _________________

If waste requires immediate attention, please explain:

<table>
<thead>
<tr>
<th>Container Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isotope</td>
</tr>
<tr>
<td>microCi</td>
</tr>
</tbody>
</table>

Dose Rate @ Surface

Disposal Date

Disposal Mode

Hazardous Chemicals Present (include chemical names and % by weight (kg) or volume (L):

______________________________________________________________________________________

______________________________________________________________________________________

Comments: _____________________________________________________________________ _______

Picked up by_____________________________ Date _______________________________
RadSafe 19 Animal Waste Disposal Record:  

Pickup Number: ________________

Form RW-A1  

AU: ____________________________

Item Description:  radionuclide_______  Amount: ___________________

<table>
<thead>
<tr>
<th>Tissue type:</th>
<th>Weight:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Disposal Method</th>
<th>Date received</th>
<th>Storage location</th>
<th>Date disposed</th>
<th>By: (initials)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decay –in Storage (Biohaz)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-decayable RAM Offsite ship</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 CFR 20.2005 Disposal (Biohaz)*</td>
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</tbody>
</table>

Notes/checklist: (RSOF use only)

Short-lived isotopes:  P-32,____, P-33____, S-35____ other______

Survey: ___ meter : ___Bkg, Y/N ___ LSC analysis: _________ cpm/wipe

☐ Labels removed

Item transferred to: ____________________________  

(Biohaz. broker name)

Non-Decayable:

Offsite shipment transferred on: ________________ to: ____________________  

(date) (RAM waste broker name)

*H-3 or C-14 ONLY 10 CFR 20.2005 disposal method

(a)(2) .05 uCi (1.85 kBq) or less, of H-3 or C-14 per gram of animal tissue, averaged over weight of entire animal

(b)…no disposal of tissue in a manner that would permit its use either as food for humans or as animal feed.

Calculations supporting this method:

_____ uCi = ________ uCi/gm tissue

_______ gm (animal weight)

_____ Biohaz. Disposal allowed (<.05 uCi/gm)

_____ Disposal routed to offsite ship. > .05 uCi/gm

Calculations Reviewed by: __________________ date: _________________
Security
Control:
Who has primary control of the lab?

Is this a common use lab, such as Core facilities?

Does more than one research group share the lab? Y____N____

Notes:____________________________________________

Access:
In what part of the building is the lab?

What rooms are located around the lab, as well as above and below? What are their purposes? E. g. Class rooms, below ground, mechanical room, offices, laboratory, etc)

Does the lab have direct access to an uncontrolled area(e.g. hallway)?________

Is it inside another lab that is not controlled for use of RAM?_______

Does the room have lockable doors at every entrance into the lab?

If not, who has primary control of the areas having access to the lab?

Notes:____________________________________________

General Lab Safety Concerns
What kind of work will be done in the lab? (High activity, sealed source, animal, RIA, etc)

What kind of floor is in the lab? (Tile, sealed concrete, unsealed concrete etc.)

Is a fume hood needed? Y___N___ If so, is a chemical fume hood available? Y___N___

Other types of hoods present?(e.g. tissue culture/biosafety)

Notes:

Are the following available? :___Safety shower ___Eyewash ___Fire extinguishers___

How many room exits?_____ Are they kept unblocked?_____

Appropriate lighting ___ enough electrical outlets___Telephone or other emergency communications device?

Notes:

Equipment
Does the lab contain the equipment needed to carry out all phases of the experiment? Y    N

If not, where is the equipment to be used located? _______________________

Who else has access to this equipment?________________________________

Will the equipment be locked/secured?________________________________

Is this equipment dedicated to radioactive materials work? Y___N___

Storage
Where will radioactive materials be stored? ________________________________

Where will the waste be stored? ________________________________

Are the storage locations securable? (i.e. at least one lock between the materials and the public) Y___ N___

Other:

_____________________________________________________

Date Evaluated:___________ By:___________ Recheck needed?Y__N__ Date:________

Recommendations:

Date Activated:____________ By___________ Postings: Caution RAM:___ NRC Form 3 ___Emerg. ___Users:__