



**Office of Radiation Safety**

# **Radiation Safety Manual**

**UNM RADIATION SAFETY**

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# RADIATION SAFETY MANUAL

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## INTRODUCTION

The safe use of radioactive materials (RAM) and ionizing radiation sources in education, research, and medicine is encouraged at the University of New Mexico (UNM). The President of the University has delegated responsibility for oversight of radiation sources at UNM to the Radiation Control Committee (RCC). Rules and procedures are established to provide as much flexibility and freedom as is consistent with industry standards of practice and relevant regulations to ensure the safety of students, employees, and the general public. Established procedures, and the guidelines of this manual, may be preceded by the word shall or must, which means it is a mandatory action unless an exception is made by an appropriate authority. If the word should is used, a procedure or action is recommended as best practice.

It is imperative that individuals who have been authorized by the RCC to possess and use radioactive materials or radiation-producing machines, understand the regulations, all applicable radiation safety policies and procedures, and implement the safety precautions that apply to their specific use scenario. Failure to follow the established rules of practice places the University at risk of regulatory violations and possible suspension of the UNM license to use radiation sources.

It is not the intent of this Radiation Safety Manual (RSM) to duplicate all State and Federal rules and regulations that govern radiation use; however, these documents are available and shall be followed at UNM while using ionizing radiation sources. The purpose of this RSM is to highlight and summarize the key requirements for individuals authorized to use radiation sources. The RCC, with the Radiation Safety Officer (RSO), is responsible to develop and implement any additional rules and guidelines deemed necessary to support a safe radiological environment at UNM. The RSM is applicable to all Authorized Users, Permit Holders, and radiation workers operating on the UNM campus or at any other UNM-affiliated facility for which the RCC and RSO have oversight.

This RSM applies to both human and non-human use situations, including the use of x-ray machines under the regulation of the New Mexico Environment Department (NMED), and certain other uses licensed by the Nuclear Regulatory Commission (NRC) such as with the use of special nuclear and source material at the UNM research reactor. The manual references State and Federal regulations as both types of licensing activities occur at UNM. The State of New Mexico defers to the NRC regulations in certain instances. Authorized Users must therefore follow applicable regulations for their specific operation. New Mexico is an "Agreement State", which means that the State has entered into an agreement with the NRC to regulate most radiation sources and machines directly through the State Radiation Control Bureau (RCB), with the exception of nuclear power and special nuclear and source material.

When the requirements of this RSM are more restrictive than the applicable regulation, this constitutes internal UNM policy and must be followed. A violation of the more restrictive rules (or any regulation) becomes a matter for RCC review and may also be citable by the licensing and inspection agency, due to certain policies being conditionally linked to the UNM Radioactive Materials License (RAML).

As conditions or regulations change, this RSM will be revised to reflect current conventions and best practice. UNM Radiation Safety staff is available to answer questions and provide consultation regarding radiation safety at any time. A "Radiation Safety Contact List" is posted in all areas where radiation sources are used and stored. A current copy of the Radiation Safety contact list is available by contacting UNM Radiation Safety.

*All Permit Holders, Authorized Users, and supervised radiation workers shall review the Radiation Safety Manual initially and following any revision. Documentation of understanding of the requirements of the Radiation Safety Manual shall be maintained in the Laboratory Notebook or the equivalent.*

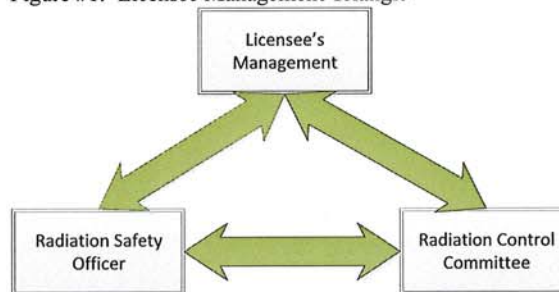


## I. BYLAWS OF THE RADIATION CONTROL COMMITTEE (RCC):

### A) Authorized Purpose of the RCC:

- 1) The President delegates to Licensee Management and the Radiation Control Committee (RCC) the responsibility for ensuring that all ionizing radiation sources, including radiation-producing machines and radioactive materials, are used safely on the UNM campus and in any other UNM-affiliated location that employs University faculty and staff.
- 2) The RCC and Licensee Management shall establish guidelines, rules, and regulations as needed to meet this responsibility. The RCC shall also be responsible for meeting all requirements regarding the Broad Scope radioactive materials license issued to UNM by the NMED RCB, and provide oversight to all additional specific radioactive materials licenses that may be issued to any UNM entity or affiliate.
- 3) The RCC shall report directly to the Vice Chancellor for Research, who represents "Licensee Management", and both, together with the RSO, make up the Management Triangle responsible for oversight of all radiation safety activities (see Section I.G).

Figure #1: Licensee Management Triangle



### B) Organizational Details of the RCC:

- 1) The name of this committee is the Radiation Control Committee, abbreviated "RCC".
- 2) Membership:
  - (i) The membership of the RCC shall consist of no fewer than five permanent members. In accordance with the New Mexico Administrative Code the RCC membership must include an authorized user of each type of use permitted by the license, the RSO, a representative of the nursing service, and a representative of Licensee Management who is neither an authorized user, nor an RSO. The members shall be knowledgeable in the field of radiation control and safety, or, have some special interest that may enhance the committee membership, and shall be members of the UNM faculty or staff, or retained for special UNM services. One member shall be a representative from the Office of the Vice Chancellor for Research. The Committee may designate non-voting ex-officio members. See Attachment B for suggested RCC representation.
  - (ii) Appointments to membership will be made by the Vice Chancellor for Research for a three-year term. The Committee shall make recommendations for appointment to the Vice Chancellor for Research. Terms are staggered so that approximately one-third of the membership retires each year. A member may be reappointed for more than one term.

3) Chair:

- (i) One regular member of the RCC will be appointed as Chair and one member appointed as Vice-Chair by the Vice Chancellor for Research.
- (ii) The Chair of the RCC serves as the administrative officer in promulgating the policies, procedures, standards, and rulings of the Committee.
- (iii) The Chair shall preside over RCC meetings and shall have the power to call special committee meetings. The Vice-Chair shall preside over meetings when the Chair is absent.
- (iv) In the absence of the Chairman and the co-Chairman for a meeting, one of the regular members of the Committee shall serve as Acting Chairman. The selection of the member to serve as Acting Chairman shall be made by majority vote of the regular members present, and shall be duly recorded in the minutes.

4) Quorum:

- (i) A quorum will consist of one-half of the members, to include the Chair or Vice-Chair, RSO and the Licensee Management representative (or designee).

5) Meeting Frequency:

- (i) The RCC shall meet at least once each calendar quarter and more frequently if necessary. Dates, times, and places of regular meetings will be set by the Chair.

6) Authorized Representation Between Meetings:

- (i) The Chair or Vice-Chair is authorized to act for the Committee between meetings in cases of required, time sensitive modifications and approvals to existing programs, upon the recommendation of the RSO. Examples of such actions include adding a radionuclide, modifying the possession limit for an already-approved radionuclide, or expanding a research project. Such actions will be reported to the RCC at the next meeting.
- (ii) The RSO is delegated authority to act for the RCC between meetings in routine matters of follow-through on conditionally approved programs or approve administrative changes to permits.

7) Authorized Subcommittees:

- (i) A Human Use Subcommittee (HUS), comprised of voting and ex officio members of the RCC, shall review any proposed human subjects research involving the use of ionizing radiation, and appropriately advise the UNM Institutional Review Board (IRB) upon conclusion of the assessment. See item D of this subsection.
- (ii) The RCC shall establish additional subcommittees as necessary to more effectively fulfill its responsibility.

C) Responsibilities of the Radiation Control Committee:

- 1) In fulfilling its authorized purpose, the RCC is charged with the following responsibilities:



- (i) Jointly with Licensee Management, review and approve or disapprove, with the advice of the RSO, special conditions, requirements, and restrictions as may be deemed necessary to minimize hazards arising from the operation or use of sources of ionizing radiation on the University campus and other UNM-operated properties or locations where radioactive materials are used under the University license(s).
- (ii) Jointly with Licensee Management, review and approve or disapprove Authorized Users, Authorized Nuclear Pharmacists, the RSO, and Authorized Medical Physicists.
- (iii) Jointly with Licensee Management, review and approve or disapprove proposals for the use of radiation sources in UNM programs relative to good radiation safety practice and compliance.
- (iv) Jointly with Licensee Management, review and approve or disapprove, with the advice and consent of the RSO, radiation safety program changes prior to submittal to NMED for licensing action.
- (v) Review quarterly records of the radiation protection program indicating non-ALARA occurrences and all incidents, medical events, and violations as well as proposed solution(s) to prevent recurrence. This includes suggesting solutions or modification of proposed solution(s).
- (vi) Review annually, with the assistance of the RSO, the radiation protection program.
- (vii) Retain a written record of actions taken by the RCC in fulfilling its authorized purpose.

D) Human Use Oversight: (NMAC 20.3.7.700)

- 1) The RCC has established a Subcommittee called the Human Use Subcommittee (the "HUS") consisting of the Committee Chair or designee, the RSO, a Medical Physicist, and an Authorized User who specializes in the relevant "radiation" area of the research protocol. All protocols involving radiation exposure to normal subjects, and/or to clinical human subjects when the exposure is not considered standard-of-care must be referred to the HUS for review. If appropriate, the HUS may approve the protocol, or it may refer the protocol to the full RCC for more extensive review.
- 2) Examples of procedures which must be reviewed and approved by the HUS include, but are not limited to:
  - (i) Any radiation exposures to normal subjects;
  - (ii) Any use of an investigational radiation device;
  - (iii) Any use of an investigational radiopharmaceutical or investigational implant/seed;
  - (iv) Any use of an investigational contrast medium with radiation;
  - (v) Any use of imaging **where it is the subject of the investigation**, such as special CT sequences to guide a new surgical procedure.
- 3) Examples of procedures which do not need Subcommittee approval include, when standard-of-care:
  - (i) Routine chest X-rays
  - (ii) Routine X-rays of fractures
  - (iii) Routine diagnostic nuclear medicine tests
  - (iv) Radioiodine therapy for hyperthyroidism



(v) Radiation therapy for cancer

E) Appeals to Actions Taken by the Committee:

- 1) An individual, department, or applicable division may appeal actions taken by the RCC to the President of the University (via the Vice Chancellor for Research) for final decision, with the knowledge and consent of the Dean or Director of the College, School or Department involved.
- 2) Complaints regarding radiological practices can be made to any committee member who shall then bring the complaint to the full committee for consideration and possible action. Complaints shall be considered as confidential if so requested by the complainant.

F) Annual Reviews by the RCC:

- 1) The RCC shall review the Bylaws annually and make recommendations for revisions to the Vice Chancellor for Research.
- 2) The RCC shall review the RSM annually and make recommendations for revisions to the Vice Chancellor for Research.

G) Role of "Licensee Management": (10 CFR 35.2; NMAC 20.3.7.7M)

- 1) Licensee Management is defined as the CEO (Chief Executive Officer) or other individual having the authority to manage, direct, or administer the licensee's activities, or that person's delegate or delegates. This role is currently delegated to the Vice Chancellor for Research.
- 2) Responsibilities of Licensee Management: (NMAC 20.3.7.702E)
  - (i) Radiation protection, security, and control of RAM, and compliance with regulations;
  - (ii) Completeness and accuracy of the radiation protection records in compliance with regulations and all information provided to the NRC and NMED;
  - (iii) Knowledge about the contents of the license application;
  - (iv) Compliance with current NRC, NMED, and US DOT regulations and the licensee's operating and emergency procedures;
  - (v) Provision of adequate financial and other resources (including space, equipment, personnel, time, and if needed, contractors) to the radiation protection program to ensure that patients, the public, and workers are protected from radiation hazards;
  - (vi) Jointly with the RCC, appointment of the RSO;
  - (vii) Jointly with the RCC, approval of qualified individuals to serve as the Authorized Medical Physicists, Authorized Nuclear Pharmacists, and Authorized Users.
- 3) Licensee or Licensee Management must approve:
  - (i) Requests for a license applications, renewal, or amendment, before submission to NMED;

- (ii) Authorized Users, Authorized Nuclear Pharmacists & Medical Physicists, jointly with the RCC;
- (iii) Changes made to the radiation safety program that do not require a license amendment, if:
  - (a) The revision comports with the current license;
  - (b) The revision was approved by both the RSO and Licensee Management;
  - (c) The individuals affected by the revision are instructed on the revised program before the changes are implemented.

## **II. RADIATION SAFETY OFFICER (RSO):**

- A) The UNM radiation safety program is managed by the RSO, who operates under the oversight of the Health Sciences Center (HSC) Vice Chancellor for Research. The RSO is a member of the HSC Office of Research and is designated by name and position on the UNM Radioactive Materials licenses, making this role a condition of licensure. By regulation, the RSO serves as a member of the RCC. Jointly with Licensee Management, the RSO is responsible for approval of changes to the radiation safety program not requiring a license amendment. The RSO supports and reviews the operational aspects of the radiation safety program on a day-to-day basis and provides technical guidance and information to the RCC.
- B) The RSO's responsibilities include, but are not limited to:
  - 1) Informing Principal Investigators (PIs) or Supervisors of the health and safety requirements pertaining to radiation related work, and assisting with the selection of appropriate safety controls, including laboratory and workplace practices, engineering controls, training, etc.
  - 2) Establish and oversee operating safety, emergency, and ALARA procedures, and to review them at least annually to ensure that the procedures are current and conform to applicable state and federal regulations;
  - 3) Oversee and approve all phases of operational training programs to ensure that appropriate and effective radiation protection practices are taught;
  - 4) Ensure that required radiation surveys and leak tests are performed and documented in accordance with the rules, including corrective measures when levels of radiation exceed established limits;
  - 5) Ensure that personnel monitoring is used properly by occupationally-exposed personnel, that records are kept of the monitoring results, and that timely notifications are made as required by applicable state and federal regulations;
  - 6) Submit a report to NMED for each known case of radiation exposure to an individual or radiation levels in excess of established limits or a theft or loss of a radiation source. Such events shall be investigated to determine the cause(s) and steps taken to minimize a recurrence;
  - 7) Investigate and submit a report to NMED for each known or suspected case of release of radioactive material(s) to the environment in excess of established limits;
  - 8) Have knowledge of management policies and administrative procedures relative to the UNM radioactive materials licenses;



- 9) Assume control and have the authority to institute corrective actions, including shutdown of operations when necessary in emergency situations or unsafe conditions;
- 10) Ensure that records are maintained as required by applicable state and federal regulations;
- 11) Ensure the proper storing, labeling, transport, security, and use of sources of radiation;
- 12) Ensure that inventories are performed as dictated by the license and supporting materials;
- 13) Ensure that personnel are complying with the rules and conditions of the license, and all operating, safety, and emergency procedures linked to the license;
- 14) Supervise the radioactive waste disposal program, ensuring compliance with all applicable regulations; and
- 15) Prepare reports on the function of the radiation safety program for presentation to the RCC at quarterly meetings. The RSO will document and present an annual audit of radiation safety program activities to the RCC. Copies or summaries of this audit will also be forwarded to Licensee Management for review and maintained for inspection.

### **III. RESPONSIBILITIES OF PERMIT HOLDERS AND AUTHORIZED USERS:**

- A) A Permit Holder (PH) is an individual UNM faculty member, UNM physician, or other qualified individual who has made application to the RSO and RCC and has been approved to use radiation sources in specific protocols, with possession limits set for all approved radioactive materials. Once approved, a "Radiation Permit of Use" (hereafter referred to as Permit) is then issued to the applicant for a specified term and includes a list of all approved radiation sources, the possession limit of each, authorized use locations, and conditions of use.
- B) An Authorized User (AU) is a UNM physician who has made application to the RSO and RCC and has been approved to use radiation sources in specific human use medical imaging or therapeutic procedures, both standard-of-care and human research related, with possession limits set for all approved radiation sources. Approval is based on the applicant meeting the training and experience criteria specified for the category of use, as defined by NMAC. Once approved, a Permit is then issued to the applicant for a specified term and includes a list of all approved radiation sources, the possession limit of each, authorized use locations, and conditions of use. An Authorized User may be an official Permit Holder, or may be grouped to operate under a single related Permit, such as in Nuclear Medicine and Radiation Oncology.
- C) Other related specialty areas that follow the AU methodology are Authorized Nuclear Pharmacist (ANP) and Authorized Medical Physicist (AMP), each with their own set of conditions for approval as specified by NMED and NRC. ANPs and AMPs also become Permit Holders.
- D) Responsibilities of Permit Holders and Authorized Users include but are not limited to:
  - 1) Assure that radiation survey instruments are readily available, are sensitive to the types and quantities of radiation in use, in good operating condition, and calibrated at the appropriate frequency. The PH or AU shall ensure that anyone allowed to use radiation sources under their supervision are trained in the proper use of radiation survey instruments and understand when and how to conduct surveys using these instruments;
  - 2) Enforce the use of personnel monitoring devices as assigned whenever working with radiation sources or working in radiation use areas;
  - 3) Make available all of the equipment, instruments, and protective devices necessary to ensure radiation safety in the laboratory;



- 4) Perform area and contamination surveys at the required frequency, with records maintained;
- 5) Instruct all supervised workers in the safe use and handling of radiation sources, lab safety rules, and the specific work functions that apply to the RCC-approved protocols being performed. The Permit Holder is responsible to ensure that all supervised workers have completed function-specific initial and annual radiation safety training;
- 6) If supervised individuals are allowed to receive or ship radioactive material packages, or prepare radioactive material packages for transfer, the PH or AU is responsible to ensure that the workers successfully complete the Department of Transportation (DOT) Hazardous Material Training program initially and every 3 years thereafter, and to ensure that documentation of this training is maintained in the Laboratory Notebook or the equivalent for review by State and Federal inspectors;
- 7) Follow applicable rules, regulations, guidelines, and recommendations for procurement, use, possession, storage, inventory, transfer, posting and labeling, and disposition of radioactive materials and sources of ionizing radiation;
- 8) Assure that all personnel who work in posted radiation areas or with radioactive materials are at least 18 years of age, are aware of all potential radiation hazards in their work environment, and understand the necessary precautions. Exception may be made for minors working on non-radiological projects in a posted laboratory. These exceptions must be requested in writing and be approved by the RCC prior to the minor beginning work;
- 9) Maintain strict security and control measures to prevent unauthorized individuals from entering restricted radiation areas and removing radiation sources;
- 10) Notify the RSO or designee immediately in the event of a radiation incident such as a major spill (see section XIV), fire, contamination event, accidental release to the environment, or theft / loss of radioactive materials. Any known or suspected overexposure of personnel to ionizing radiation shall be immediately reported to the RSO;
- 11) Notify the named "Alternate Permit Holder", as defined in section V of this RSM, in the event that the Permit Holder will be gone from the UNM campus for an extended period to ensure that radiation-related activities are continuously supervised.; and
- 12) Maintain required records in auditable format in the Laboratory Notebook or the equivalent record.

#### **IV. REGULATIONS AND LICENSES:**

A) Regulations are available on-line (<http://www.env.nm.gov/rcb/regulations>) and are available in physical form from UNM Radiation Safety as follows:

1) **The State of New Mexico Administrative Code (NMAC) :**

- (i) Title 20 (Environmental Protection), Chapter 3 (Radiation Protection), Parts:
  - (a) 1: General Provisions
  - (b) 2: X-ray Registration
  - (c) 3: Radioactive Material Licensing
  - (d) 4: Standards for Protection Against Radiation
  - (e) 6: X-Ray in the Healing Arts
  - (f) 7: Medical Use of Byproduct Material

- (g) 8: Analytical X-Ray Equipment
  - (h) 10: Instructions and Reports to Workers
  - (i) 11: Cabinet X-Ray Systems
  - (j) 15: Irradiators
  - (k) 20: Radiologic Technologist Certification
- 2) **US Nuclear Regulatory Commission (NRC) Regulations:**
- (i) Title 10 CFR (Energy) regulations are at [www.nrc.gov](http://www.nrc.gov).
  - (a) Applicable Byproduct Material Parts are 19, 20, 30, 33, 34, 35, 36, 37, and 71.
  - (b) Applicable Parts for Research Reactors, Source, and Special Nuclear Material are 37, 40, 50, 55, 70, 73, and 74.
- 3) **Radioactive Materials Licenses at UNM:**
- (i) NMED BM233-xxx Broad Scope Type A License
  - (ii) NMED RP479-xx Commercial Translational Radiopharmacy License
  - (iii) NRC AGN-201M Research Reactor License #R-102

## V. **NEW PROPOSALS FOR THE USE OF IONIZING RADIATION SOURCES:**

### A) **Application for a Radiation Permit of Use (Permit):**

- 1) A new applicant who wishes to initiate a protocol involving radiation shall submit a written proposal to UNM Radiation Safety using Form RSF-01-1 (see Attachment E). Applicants are generally UNM faculty members. The RSO or designee will review the application, ensure it is complete and that the proposed radiation safety plan is sound, and work with the applicant to obtain any additional information required. Once complete, the RSO will present the application to the RCC for approval.
- 2) The proposed protocol may not be initiated or radioactive materials procured until approved by the RCC, and an official Permit issued to the applicant. An in-between-committee approval process with mail ballot may be used to expedite protocol requests, and formally acted upon at the next scheduled meeting.
- 3) The application process includes all amounts of radioactive material, including those identified in the regulations as “exempt”.
- 4) **The application materials must include the following information:**
  - (i) Form RSF-01. Attach copies of all protocols being requested.
  - (ii) Types, forms, and quantities of radioactive materials to be used or generated, including both sealed and unsealed radionuclides. For sealed sources, include the manufacturer, model number, radionuclide, source configuration, and activity. Also include the SDR (sealed source and device registry) papers if available, expected exposure rate outside the source, and safe handling techniques.
  - (iii) Location(s) of use by building and room number, and also the location within the room. Describe how these locations are to be secured and controlled.



- (iv) Detailed description of how the radiation sources will be used and stored, including a justification for the use of each radiation source. Describe how the benefit from the use of the radiation source will outweigh the risk.
  - (v) Training, education, and experience related to the types of sources and protocols being requested. If the applicant was ever named as a Permit Holder or Authorized User on a previous license, attach a copy of the confirming documents. It is recommended that a CV be attached to the Permit Holder's Training and Experience form (RSF-60-1).
  - (vi) Identify the instruments to be used to detect and measure radiation and contamination.
  - (vii) A complete description of the radiation safety program that will be put into place must be provided. This should include shielding, protective clothing and tools, handling techniques, posting and labeling, security and control, radioactive waste management, and training.
  - (viii) A detailed list of all categories of radioactive waste to be generated must be provided. A statement that mixed waste will not be generated is specifically required. The applicant also must provide a statement that commits to radioactive waste minimization, and also that all rules of waste segregation will be followed.
  - (ix) Provide the names and titles of all personnel who will work with radiation sources under the protocol. Acknowledge that each person has completed or will complete a Training and Experience Form (RSF-60-1) and Rules Acknowledgement (RSF-60-2B) and has or will complete Radiation Safety Training.
  - (x) The applicant must name an "Alternate", who is another faculty member with radiation use experience, who has agreed to step in and supervise the safe use and storage of all radiation sources during times of absence of the Permit Holder, upon request by the Permit Holder. The Alternate must sign the applicants Rules Acknowledgment documenting that they are willing to act in that capacity.
- 5) If the proposal involves a radiation-producing machine, Form RSF-01x must be submitted. This includes medical devices, cabinet x-ray units, analytical devices, electron microscopes, and any other device with an x-ray tube or equivalent configuration that produces radiation when energized. Information to be submitted for radiation-producing systems includes:
- (i) The machine specifications, such as maximum kVp, mA, timer settings, HVL, beam dimensions, SID and SSD if applicable, etc.
  - (ii) Description of associated equipment and tools for safety (exhaust, vacuum systems, etc.).
  - (iii) Proposed use, storage, and description of target(s).
  - (iv) Handling and exchange of target protocols as applicable.
  - (v) Routine preventative maintenance.
  - (vi) Interlocks and monitoring systems.
  - (vii) Shielding design and construction, shown on a facility diagram.
  - (viii) Administrative controls to minimize radiation exposure.
  - (ix) Any other relevant information to assist the RSO and RCC in determining safety.
- 6) If the protocol involves animal use, holding areas for radioactive animals must have adequate ventilation to assure that occupied areas outside of the animal area are not subjected to concentrations of radionuclides in excess of the levels listed in Subpart 4, Appendix B, of NMED Regulations. The proposal must also meet all the standards of and be approved by the UNM Institutional Animal Care and Use Committee (IACUC). The Permit Holder shall commit to providing radiation safety instructions to animal caretakers.



- 7) If the protocol involves radionuclides that may be dispersed into the air, the applicant shall provide calculations of concentrations that could possibly be released during experiments, radionuclide exhalation rates if animals are involved, and procedures and equipment employed to assure that authorized concentrations/limits are not exceeded.
- 8) Permits can be transferred in part or in whole only to another authorized individual who possesses the necessary training and experience and has been approved by the RCC.
- 9) If an approved Permit Holder wishes to discontinue operations involving radiation, the RSO must be notified, all radiation sources properly disposed or transferred according to UNM policy, a laboratory close out survey conducted by the RSO or designee, and the Radiation Permit closed.
- 10) Radioactive material is not transferable between Permit Holders without the express approval of the RSO and completion of the required documentation in advance of the transfer. Loaning or borrowing radioactive material between laboratories is not allowed without prior RSO approval. A memo, signed by both the transferor and transferee, must be submitted to UNM Radiation Safety. Include the radionuclide, activity, purpose, location and other applicable information. UNM Radiation Safety then completes a transfer on Form RSF-10-3. Interim approval by phone is acceptable. This procedure applies to transfers to and from non-University areas, transfers between Permit Holders at the University, and for radioactive materials personally transported to the University.
- 11) Permit Holders may only use and possess radioactive material up to the quantities authorized for each radionuclide on the Permit.
- 12) Permits are valid for four (4) years plus the time to reach the next scheduled RCC meeting. Expiration dates will be identified on the Permit. Prior to the expiration date, a renewal form will be sent, and the signed "letter of intent" requesting renewal to the RCC returned to the RSO. The Alternate must also sign the renewal request. With receipt of the letter of intent, the expiration date is extended until the RCC can act on the request.
- 13) Changes to an existing Permit may be requested in writing to the RSO. The change should be clearly identified, along with all support information to justify the change, how it will impact the radiation safety program, and the steps that will be taken to ensure radiation safety. Examples of Permit changes include modifying the possession limit of an existing radionuclide, adding or deleting a radionuclide, or adding a new protocol (this latter item does not apply to established protocols in the clinical setting; new clinical protocols need only be submitted when they involve a new type of radionuclide imaging or therapy or machine that requires licensing action, such as those regulated under 10 CFR 35.1000).

## **VI. STORAGE OF RADIOACTIVE MATERIALS:**

- A) Storage facilities for radioactive materials shall be constructed to meet the following criteria:
  - 1) Shielding or distance shall be such that radiation levels in uncontrolled (unrestricted) areas capable of being occupied are not in excess of 2 mrem in any one hour, such that an individual who was continuously present would not exceed a total annual effective dose equivalent (TEDE) of 100 mrem. In addition, shielding or distance must be adequate to keep exposures to personnel in both unrestricted and restricted areas ALARA (as low as reasonably achievable).

- 2) Areas inside laboratories designated as restricted radiation areas shall be secured from unauthorized access at all times. Further, radioactive materials shall be stored in such a way as to allow removal only by those individuals specifically authorized to handle and use them.
- 3) Unsealed radioactive materials, such as liquids, shall be stored in closed unbreakable containers to prevent spillage or escape. Secondary containment shall be used to contain the entire contents in the event the primary container ruptures.
- 4) Any radioactive material capable of producing off-gases, fumes, vapors, or any amount of airborne particulate matter shall be evaluated for the need for engineering controls, i.e. a certified fume hood with adequate filtration and designed for that purpose. Ventilation and airflow rates shall be confirmed annually and shall comply with industry standards. Negative pressure shall be confirmed for rooms in which these types of materials are used or stored. For  $^{133}\text{Xe}$  use and storage areas, gas clearance times shall be calculated at least semi-annually and posted in a visible location.
- 5) Sealed sources shall be stored with appropriate shielding, e.g. lead pigs or acrylic box, to minimize external radiation fields. The Permit Holder shall ensure that a physical inventory is in place to track sealed sources at any point in time. A log showing removal date and time, worker initials, and return date and time is recommended. The RSO must be notified if a sealed source is lost or missing.
- 6) Sources considered radioactive materials in quantities of concern (RAMQC) shall be stored in accordance with UNM policies and procedures

B) Animal Use and Storage:

- 1) Radioactive biological waste such as animal carcasses and bedding must be sealed in suitable containers and refrigerated (if stored for only a few days). Longer storage times require freezing the waste. UNM Radiation Safety also maintains facilities for freezing biological waste.
- 2) Animals injected with radioactive material shall be housed in cages separate from other non-radioactive animals. The cages shall bear the standard "Caution-Radioactive Materials" signs. Identifying labels shall indicate the radionuclide, activity, date, and the responsible lab.

C) Radioactive Waste Storage (see also Section X):

- 1) Permit Holders are responsible to provide adequate storage space for radioactive waste.
- 2) Containers holding radioactive waste shall have a plastic liner, maintained separately from non-radioactive waste, and clearly labeled to show the waste form allowed in the container. Containers shall be specifically designated for radioactive materials and approved by UNM Radiation Safety.
- 3) Radioactive waste shall be stored in an appropriate covered or sealed container sufficient to hold the contents, prevent leakage, and minimize exposure to others. The container should not be vulnerable to puncturing or breakage.
- 4) When waste containers become filled to the maximum level allowed by UNM Radiation Safety, the RSO or designee should be contacted to arrange for collection and transfer to the radioactive waste facility.
- 5) Radioactive waste storage areas shall be convenient to radioactive material use areas but isolated enough to prevent potential exposure or contamination to personnel working in the lab.



## VII. PROCUREMENT AND RECEIPT OF RADIOACTIVE MATERIAL:

### A) Purchasing Radioactive Material:

- 1) UNM Radiation Safety maintains a list of approved radioactive material vendors and suppliers. The vendors are required to maintain a current copy of the UNM Radioactive Materials License. The RSO must be contacted prior to placing an order with a new vendor and provided the name, address, contact number, and email address for the record.
- 2) All purchases of RAM must be done with the prior approval of UNM Radiation Safety. This includes ALL activities, even those labeled as “exempt quantity”. RAM packages must be delivered to UNM Radiation Safety receiving located at the physical address below:
  - (i) UNM Health Science Center - Office of Research  
Radiation Safety Office; BMSB Room B-89  
2425 Camino de Salud, Albuquerque, NM 87131
  - (i) See exception section below.
- 3) The phone numbers to call to obtain approval and authorization codes for RAM purchases are:
  - (i) (505) 272-4607 or email [HSC-radiationsafety@salud.unm.edu](mailto:HSC-radiationsafety@salud.unm.edu)
  - (ii) (505) 925-0743
  - (iii) (505) 277-0418
- 4) RAM orders must be scheduled to arrive at UNM Monday - Friday during normal business hours, 8:00 AM - 5:00 PM. If a RAM package must arrive during non-business hours in a special case situation, arrangements must be made in advance with the RSO for accepting and securing the package. If there is a need for a routine exemption, a request may be made to the RCC to grant a permanent exemption.
- 5) How to Place an Order for RAM:
  - (i) Only persons specifically designated by the Permit Holder to order RAM may do so.
  - (ii) When an order needs to be placed, first check the activity limits of the Permit to make sure the activity being requested is within the ordering and possession limits. If the item exceeds the current Permit limits, a written request to change the limits must be submitted to the RSO for RCC approval.
  - (iii) Call UNM Radiation Safety. Provide the following information:
    - (a) Contact name, lab #, phone #, and the name of the Permit Holder.
    - (b) Radionuclide, and chemical and physical form (note if a dry ice package).
    - (c) Activity in mCi or uCi, and number of units.
    - (d) Name of vendor and the expected delivery date.
  - (iv) Permit holders who have implemented use of the web-based recording keeping system may enter a requisition via this system. UNM Radiation Safety will confirm that the Permit Holder is authorized for the RAM, and provide an “authorization code”. Once this code is issued, no changes to the order are allowed without first notifying UNM Radiation Safety.

- (v) Order the material. The vendor must be instructed to reference the “authorization code” number on the package shipping papers and to use the “ship to” address for UNM Radiation Safety receiving provided above. The vendor must confirm the delivery date and be instructed to notify UNM Radiation Safety if the delivery date is different from what was previously provided.

6) Receiving the RAM Order:

- (i) UNM Radiation Safety will process the RAM package within 3 hrs of receipt in accordance with the New Mexico Administrative Code (NMAC) 20.3.4.432. If a package is received after working hours, the package shall be monitored no later than three hours from the beginning of the next working day. Receipt paperwork will be generated that shows the measured radiation and contamination levels. } font
- (ii) The package will be promptly delivered to the end-user laboratory and must be signed for by an authorized person. No RAM packages will be left unattended or without a signature.
- (iii) The end-user shall promptly place the RAM in its designated storage location.
- (iv) UNM Radiation Safety will retain and survey the packing material and shipping box. Once the radiation levels are indistinguishable from background, all radiation symbols and markings will be defaced and the packing materials and shipping box discarded as normal trash.
- (v) If a RAM package is accidentally delivered to the end-user, bypassing UNM Radiation Safety receiving, notify the RSO at once so that the proper receiving procedure can be implemented and the radioactivity accounted for in the UNM master database. DO NOT OPEN the package.

7) Exemptions to the normal order and receipt process:

- (i) The Nuclear Medicine department at UNMH and SRMC may order and receive unit dose radiopharmaceuticals directly from an approved vendor.
- (ii) The Radiopharmaceutical Sciences Laboratory at the School of Nursing and Pharmacy may directly order, receive and process RAM shipments, as delivered by a commercial radiopharmacy, after notification to UNM Radiation Safety and issuance of an authorization code. The RAM package receipt data shall be recorded and returned to UNM Radiation Safety. UNM Radiation Safety shall receive all other RAM shipments originating from vendors other than a commercial radiopharmacy, as transported by Fed Ex.
- (iii) The Radiopharmaceutical Sciences Laboratory at the School of Nursing and Pharmacy shall consider eluates obtained by milking generators to be a “shipment” of RAM, with the date, activity, and volume recorded and returned to UNM Radiation Safety as requested.
- (iv) Other exemptions may be granted by the RSO as deemed appropriate, when consistent with the regulations and radiation safety program.

B) Activation Products:

- 1) When stable materials are made radioactive by irradiation in the research reactor, the same rules as noted above for acquiring, receiving, processing, and transferring RAM apply. Adherence to specific limitations and authorizations will assure compliance with applicable



regulations and radiation safety practices and record keeping.

C) Shipping RAM from UNM:

- 1) Outgoing radioactive material shipments must go through UNM Radiation Safety. Records of each shipment to an outside entity must be maintained. It is the responsibility of UNM Radiation Safety to assure that shipments are packaged and labeled in accordance with regulations, and that the consignee is licensed to receive the shipment. A valid copy of the radioactive materials license for the consignee must be in hand and approved before shipping.
- 2) The translational radiopharmacy is exempt from UNM Radiation Safety involvement relative to transporting prepared radiopharmaceutical dosages to and from client facilities; however, copies of each client's current radioactive materials license shall be on-site for regulatory inspections.

**VIII. TRAINING AND EXPERIENCE FOR RADIATION WORKERS:**

A) Personnel who will work with radiation sources under an approved Permit Holder must complete a "Training and Experience (T&E) Form" and a "Rules Acknowledgement", to be filed with UNM Radiation Safety prior to working with radioactive materials.

B) The RCC has established three categories or levels in which individuals are approved for working with radioactive materials and/or radiation-producing machines:

- 1) "WDS Level" - may work with radiation sources only with direct supervision by an approved supervisor of use.
- 2) "WOS Level" - may work with radiation sources without supervision. Individuals in this category must complete the Introduction to Radiation Safety course or an approved alternate course (see Attachment D), or provide documentation or demonstration of having completed the equivalent training and education, and receive necessary function-specific training prior to commencing unsupervised work with radioactive materials.
- 3) "SOU Level" - Supervisors of use are Permit Holders or other qualified individuals whose level of training and experience in radiation safety is sufficient to allow them to supervise others. To become a SOU, the RCC must review and approve the applicant's qualifications as submitted in the T&E Forms.

C) Certain groups of clinical workers are exempt from this requirement, such as those individuals whose job duties require completion of a prior formal course of study that involves radiation protection and health effects, and/or special certification or registration as demonstration of competence. This includes Radiation Therapists, Radiology Technologists, Nuclear Medicine Technologists, and others as approved by the RSO.

D) Allied Health Schools:

- 1) Students must complete a radiation safety orientation during the first part of their school year, provided by the RSO or designee.
- 2) In the Nuclear Medicine Technology Program, no student is permitted to administer a patient dose unless a registered Nuclear Medicine Technologist has confirmed the radionuclide, dose, and patient identification, and, has confirmed that the radiopharmaceutical and route matches the information on the request form or written directive.

- 3) All students in the Nuclear Medicine Technology Program are to be under the direct supervision of a registered technologist for the purposes of dose ordering, receipt, preparation, and injection.
- 4) Students shall be supervised when performing required quality control tests and generating records required by regulation. It is the responsibility of the supervising registered technologist to ensure that all activities are conducted correctly and to ensure that no required operation was omitted.

## **IX. RADIOACTIVE MATERIAL INVENTORY:**

- A) UNM Radiation Safety is required to track the total activity of each radionuclide on the UNM campus at any point in time and across all Authorized User groups and UNM departments. This includes both sealed and unsealed radiation sources.
- B) Tracking the RAM inventory is essential to be able to demonstrate compliance with the possession limits of the UNM Radioactive Materials License. Exceeding a regulatory possession limit is a serious violation that must be avoided at all costs. To assist with complying with possession limits, each individual Permit Holder is issued individual limits on their Permit for each radionuclide. At no time may a Permit Holder possess more than their authorized quantities. Limits include:
  - 1) The total activity of each radionuclide allowed in the Permit Holder's lab at any point in time (this includes radioactive waste).
  - 2) The total activity of each radionuclide that may be ordered in a single shipment (applicable for research use).
- C) RAM inventories are the responsibility of the individual Permit Holder. Strict inventory control methods must be employed to track when radiation sources are removed and returned to and from their authorized secure storage location. In the case of stock vials of radio-chemicals, documentation must occur whenever aliquots are removed, which should include the date, user initials, activity removed (e.g. uCi), and activity in waste or in samples. The contents of all stock vials must be fully accountable and tracked on either hard copy inventory sheets (including decay) or in the EHSA online record keeping database.
- D) UNM Radiation Safety employs a software program to track the RAM inventory at UNM. RAM is tracked from receipt of shipment from the vendor to final disposition according to receipt date, activity, location of use (lab #), and authorized user. RAM inventory and radioactive waste inventories are decayed according to the original receipt date. The software allows UNM Radiation Safety to provide users with current information about package receipt, total inventory, and waste amounts at any point in time. Some license limits are in units of grams and material tracking would be performed as appropriate.
- E) Preferably on a quarterly basis, but no less frequent than semi-annually, the UNM Radiation Safety Office will request Radioactive Material Inventory verification from each Permit Holder.
- F) On a semi-annual basis, UNM Radiation Safety will perform an independent physical inventory of sealed sources in conjunction with leak testing. A copy of this report will be forwarded to the end-user for placement in the Lab Notebook or equivalent auditable record.



- G) Other material inventories will be performed by UNM Radiation Safety in accordance with regulatory authorities (e.g. NRC and NMMSS).

**X. RADIOACTIVE WASTE DISPOSAL:**

- A) Specific rules, regulations, and guidelines must be followed for the disposal of radioactive waste. Emphasis is placed on segregation of different types of waste according to radionuclide, half-life, chemical form, physical form, or combination thereof.
- B) Radioactive waste generated on campus shall not be disposed via sanitary sewer. Although this method is allowed by state administrative code, the City of Albuquerque has an ordinance that specifies zero tolerance for radioactive materials in the sanitary sewer system. Patient excreta is the only exception to this requirement.
- C) For the purposes of releasing “clean” or non-radioactive liquids, NMAC 20.3.4.461 is applicable. Contact UNM Radiation Safety for review of records prior to release of liquids from radiological controls.
- D) Radioactive waste (unsealed or sealed sources) with a half-life ( $T_{1/2}$ ) less than 120 days can be stored under the decay-in-storage (DIS) program, with subsequent disposal to the normal trash system as non-radioactive waste once the radioactivity levels have become indistinguishable from background levels. The minimum required DIS storage time is ten (10) half-lives.
- E) Radioactive waste with a  $T_{1/2}$  greater than 120 days must be collected and packaged for disposal to an outside licensed disposal facility. Radioactive waste burial sites charge by the pound; therefore, all radionuclide users are asked to make a conscious effort to minimize the volume of radioactive waste generated in their laboratories.
- F) Guidelines for the collection of radioactive waste in labs:
- 1) Waste Containers:
- (i) Use waste containers provided by UNM Radiation Safety.
  - (ii) Waste containers must be leak-proof and have a tight-fitting lid.
  - (iii) Do not place radioactive waste containers on high shelves.
  - (iv) All containers must have a clear plastic liner.
  - (v) Each waste container must be labeled as follows:
    - i. Visible Radiation-warning label.
    - ii. A label or tag must be affixed which identifies the radionuclides allowed in that container.
    - iii. Waste containers being tracked within the EHSA web-based record keeping system must contain a Waste Container number.
    - iv. Each container being tracked using a waste entry log shall have the log firmly affixed to the container.
    - v. For Waste Containers tracked in the EHSA web-based record keeping system - after a container is no longer in use and has been sealed, the waste container label

shall be printed out from the EHSA web-based record keeping system and affixed to the container.

- (vi) Containers shall not be stored in heavy traffic areas or immediately adjacent to workstations.
- (vii) The radiation level outside of the waste containers shall not exceed 2.0 mR/hr at 30 cm, without being placed behind appropriate shielding and UNM Radiation Safety notified prior to collection.
- (viii) Do not overfill waste containers. The size and weight of each container must be managed so handlers can safely lift and transport them.

2) Waste Minimization Program:

- (i) Survey all items with an appropriate instrument set on its most sensitive scale (does not apply to Tritium). Only contaminated waste should be placed into the radioactive waste stream.
- (ii) Do not use excessive supplies and materials in radiation work areas.
- (iii) Use spill containment trays.
- (iv) Conduct dry runs for new protocols to ensure proficiency with procedure before introducing RAM into operations.
- (v) Use the smallest amount of radioactive material in processes consistent with achieving the research or clinical objective.

3) Segregation:

The following are the expected forms of waste segregation. UNM Radiation Safety will provide specific guidance based on radionuclide use.

- (i) Physical Form: Use separate containers for dry solid, aqueous liquid, and liquid scintillation vials. See Section X.4, 5, and 6 for detailed instructions on each physical waste form.
- (ii) Half-life: Use different containers consistent with the half-lives of radionuclides:
  - (a) < 30 days
  - (b) 30-60 days
  - (c) 60-120 days
  - (d) > 120 days
- (iii) Biological: All biological waste must be collected separately:
  - (a) Consists of animal carcasses, bedding, and animal excreta. It may also include specimens in vials or containers.
  - (b) Waste containing biological (excluding animal carcasses), pathogenic, or infectious material or equipment (e.g., syringes, test tubes, capillary tubes) used to handle such material, shall be treated to reduce, to the maximum extent practical, the potential hazard of the non-radioactive materials.
  - (c) Waste with a half-life  $\leq$  120 days needs to be segregated from longer-lived waste. Small animals may be bagged and kept frozen in the PH's approved area until the



date of pick-up. The Animal Research Facility (ARF) will store radioactive bedding and cages (but not carcasses) until decayed to background.

- (d) Waste with a half-life >120 days shall be segregated into one of three different categories based on activity and radionuclides present:
    - 1.  $^3\text{H}$  and  $^{14}\text{C}$  waste with an average activity  $\leq 0.05 \mu\text{Ci}$  per gram of tissue, averaged over the weight of the entire animal.
    - 2.  $^3\text{H}$  and  $^{14}\text{C}$  waste with an average activity  $> 0.05 \mu\text{Ci}$  per gram of tissue.
    - 3. All other radionuclides other than  $^3\text{H}$  and  $^{14}\text{C}$ .
  - (e) Use strong, tightly closed, leak-proof plastic bags for animal remains and effects. Bags must be frozen and stored in the PH's approved freezer until pick-up.
  - (f) Do not place sharps or needles in the bags. Collect paper, plastic, foil, syringes, and absorbents separately and treat, if necessary, to reduce non-radiological hazards.
  - (g) Label the bags with the radionuclide, date, PH name, and the total activity per gram weight, averaged over the initial weight of the disposed animal.
- (iv) Uranium and Thorium: Waste containing U/Th in any form must be collected separately:
- (a) Dry Uranyl Acetate, Uranyl Nitrate, Thorium Nitrate, and solutions containing concentrations of these shall be collected and disposed as radioactive waste.
  - (b) Never combine waste containing uranium or thorium compounds with any other chemical waste, such as lead citrate.
  - (c) The total number of grams of uranium or thorium compounds in the container must be recorded on the label, as well as any hazardous chemical.
- (v) Mixed Waste:
- (a) Mixed waste is defined as waste that contains radioactive material and one or more hazardous chemical components. Most chemicals classified by the EPA as hazardous are regulated under the Resource Conservation and Recovery Act (RCRA). The hazardous waste can be either a listed hazardous waste (40 CFR 261, Sub-Part D), or a waste that exhibits any of the hazardous waste characteristics (40 CFR Part 261, Subpart C). Hazardous waste contractors will not accept a hazardous waste that also contains radioactive material.
  - (b) Disposal of mixed waste is very difficult and often cost-prohibitive. Therefore, generation of mixed radioactive is specifically PROHIBITED unless approved in advance in writing by the RSO. Any waste stream that involves the mixing of a hazardous waste with radioactive material must have prior approval from the RSO before generation. Failure to comply with this policy is grounds for suspension of the Principal Investigator's Radiation Permit. If mixed waste is generated, disposal costs will be passed on to the Permit Holder.
  - (c) Mixed waste containing radionuclides with a half-life of 120 days or less may be held for decay by UNM Radiation Safety in certain situations and disposed of in accordance with the hazardous material disposal requirements. Obtain the approval of the RSO before generating this waste.
  - (d) Mixed waste containing radionuclides with a half-life exceeding 120 days must be kept separate from all other mixed waste (if approved to be generated).

(vi) Lead:

- (a) Any waste material containing lead must be segregated from all other waste forms. This includes lead pigs. Do not place lead pigs in dry solid waste.

(vii) Chelating Agents:

- (a) High concentrations of chelating agents in radioactive waste may have an effect on waste-site stability. Waste containing chelating agents shall indicate the name and weight percentage of any chelating agents that are present in excess of 0.1% by weight.
- (b) Chelating agents include amine polycarboxylic acids (e.g., EDTA, DTPA) and hydroxy-carboxylic acids (e.g., citric acid and gluconic acid) used for the purpose of binding (i.e. to stabilize radioactive materials).

4) Dry Solid Waste:

- (i) Dry solid waste typically consists of absorbent pads, paper, plastic, gloves, disposable lab-ware, pipettes and other similar items contaminated with radioactive material. Dry solid waste must not contain any unabsorbed liquid, sharps, lead pigs, scintillation vials (including empty vials), chemicals, or biological waste.
- (ii) Dry solid waste must be segregated by radionuclide and half-life; < 30 days, 30 to 60 days, 60 to 120 days, > 120 days, and transuranics. If more than one waste category exists in a laboratory, the waste containers must be labeled as to which radionuclides are to be placed into each specific container. Careful consideration should be given to external dose rates created by gamma and high-energy beta emitters placed into waste storage containers. It may be necessary to shield the waste container or make arrangements with UNM Radiation Safety for routine pick-up.

(iii) Rules for Dry Solid Waste:

- (a) No liquids of any kind or any amount shall be placed in dry waste containers. All vials containing liquids must be emptied and lids removed before placing into dry solid waste.
- (b) No lead items shall be discarded in the dry solid waste stream. All lead shall be removed from dry waste and stored separately for pick-up.
- (c) No broken glass, loose needles, or unprotected sharps are permitted in the dry waste stream. Place these types of materials in a separate plastic container that protects handlers from injury, and store separately for pickup.
- (d) No flammable, pyrophoric or water reactive materials are permitted.
- (e) No biological material shall be placed into dry solid waste. Viable pathogenic or infectious agents are not permitted.
- (f) Organic solvent-contaminated items or items capable of generating toxic gases, vapors or fumes are specifically prohibited from the dry solid waste stream.
- (g) Chelating agents must be less than 0.1% by weight.
- (h) Waste containers must bear a label with the Permit Holder's name, radionuclide, activity, date, and room #.

5) Aqueous Liquid Waste:



- (i) Aqueous liquid waste is defined as any waste that contains water as the primary constituent, with any soluble organic or inorganic constituents present only in quantities and forms that do not result in phase separation or precipitation.
- (ii) Care must be taken to ensure that the quantities of organic or inorganic components added to the water do not render a mixed waste, because even small amounts of these substances, when combined with radioactive materials, may result in a mixed waste (a solution containing as little as 6% methanol in water is a mixed waste). Consult with UNM Radiation Safety before adding any hazardous material to aqueous waste. Aqueous liquid waste will normally consist of aqueous phase extractions from experiments and the first rinsing of radioactive material containers.

(iii) Rules for Aqueous Liquid Waste:

- (a) No solids allowed in aqueous liquid waste.
- (b) Do not overfill or use large containers (> 10 liter) that are too heavy to lift. Use containers provided by UNM Radiation Safety.
- (c) The pH of aqueous wastes shall be adjusted as close to neutral as possible, within the range of 5 to 9.
- (d) No mixing with liquid scintillation fluids.
- (e) Waste must contain less than 0.1% by weight chelating agents.
- (f) Containers must bear a label that indicates Permit Holder's name, radionuclide, activity, and percentage of non-aqueous material.
- (g) Disposal via the sanitary sewer system is prohibited at UNM. Unauthorized disposal of radioactive materials in the sewage system is **cause for immediate revocation of the Permit** to use radioactive materials.

6) Liquid Scintillation Waste:

- (i) Liquid scintillation (LS) waste is liquid waste, which contains a xylene or toluene based scintillation fluid, or a scintillation fluid that is environmentally safe. LS waste is divided into two segregation categories based on the radionuclides present and the average activity per gram of media:
  - (a)  $^3\text{H}$  and  $^{14}\text{C}$  waste with an average activity  $\leq 0.05 \mu\text{Ci}$  (approximately 111,000 dpm/ml) per gram of media.
  - (b) All other radionuclides of any activity in LS fluid, and  $^3\text{H}$  and  $^{14}\text{C}$  waste with an average activity of  $> 0.05 \mu\text{Ci}$  per gram of media.
- (ii) It is important to have a realistic assessment of activity in LS waste. Estimates of activity should be based on calculations from counts obtained from a liquid scintillation counter (LSC). An average of  $0.05 \mu\text{Ci}$  per gram of media is equivalent to approximately 250  $\mu\text{Ci}$  per case of standard 20 mm vials (500 vials). It is very unlikely that activity concentrations this high are routinely used in normal laboratory procedures. Generators should be prepared to justify elevated LSV waste activities with supporting calculations or printouts.
- (iii) Special arrangements need to be made with UNM Radiation Safety if LS waste is collected in other than vial form, such as bulk liquid.

(iv) Rules for LS Waste:

- (a) No solids allowed (except swipes, filter or other counting media).
- (b) Vials containing  $^3\text{H}$  and  $^{14}\text{C}$  shall be segregated from other radionuclides.
- (c) Make sure vials are securely capped.
- (d) If a hazardous LS fluid is present (ie. toluene), it must be identified on the label.
- (e) Use the original vial trays to collect LS vials for waste pick-ups when possible, to keep vertical during collection and storage and reduce leakage.
- (f) If vials are collected in 5-gallon containers, they must be securely capped and carefully placed to prevent breakage.
- (g) All waste containers must indicate Permit Holder's name, radionuclide, activity, and chemical percentages of waste.

7) Sealed Sources:

- (i) Sealed sources that have reached the end of their useful life, or that are no longer needed by the Permit Holder, shall be transferred to UNM Radiation Safety for secure storage pending disposal or transfer to an authorized recipient.
- (ii) Disposal or transfer options are:
  - (a) Return to the manufacturer.
  - (b) Re-purpose for beneficial re-use, following completion of transfer documents.
  - (c) Dispose with a licensed waste broker.
  - (d) Hold for 10 half-lives or until radiation levels are indistinguishable from normal background radiation levels, and following removal or defacement of all radiation markings and labels, discard to the normal trash, with permission from the regulating body.

**XI. PERSONNEL MONITORING AND DOSIMETRY:**

- A) Occupational radiation monitoring of personnel at UNM and all associated UNM facilities is conducted according to the provisions of Subpart 4 of the New Mexico Administrative Code.
- B) The devices in use to monitor occupational exposure may be thermoluminescent dosimeters (TLDs), film badges, aluminum oxide ( $\text{AlO}_3$ )-based dosimeters, or other NVLAP-approved technology. The contract provider of personnel monitors shall be NVLAP-accredited (National Voluntary Laboratory Accreditation Program).
- C) Dosimeters are issued to personnel following a review of badge application forms. UNM Radiation Safety will determine if badges are required following an assessment of the applicant's work scenario relative to radiation source use, and the likelihood of that individual receiving an occupational dose in excess of the badging requirements (likely to receive an annual dose greater than 10% of the annual dose limit of 5.0 rem).
- D) All badge participants must complete dosimetry training that covers function-specific technical and operational practices to assist the individual(s) in safely performing their job, regulatory information such as dose limits, definitions, and radiation protection practices to minimize



exposure, ALARA and action levels, dosimetry program expectations, and other related material deemed appropriate by the RSO. Personnel dosimetry training is presently administered through Learning Central.

- E) Individuals likely to receive an annual occupational dose in excess of 100 mrem:
- 1) Shall be kept informed of the storage, transfer, or use of sources of radiation in the licensee's work place.
  - 2) Shall be instructed in the health protection problems associated with exposure to radiation sources, in precautions or procedures to minimize exposure, and in the purposes and functions of all protective devices employed.
  - 3) Shall be instructed in the applicable provisions of the Radiation Protection Regulations and methods to ensure compliance. The extent of these instructions shall be commensurate with the risk of health concerns and compliance issues for the specific work environment.
- F) Workers are Required to be Badged when Meeting one or More of the Following Conditions:
- 1) The RSO has determined that they are likely to receive a dose in excess of 10% of the applicable limits in one year, from sources external to the body.
  - 2) The worker is required to enter a "high radiation area" (HRA) in order to perform their job duties. A HRA is an area in which radiation levels could result in a dose equivalent in excess of 100 mrem in 1 hour at 30 centimeters away from the source or away from any surface the source penetrates.
  - 3) The worker is required to enter a "very high radiation area" (VHRA) in order to perform their job duties. A VHRA is an area in which radiation levels could result in a dose equivalent in excess of 500 rad in 1 hour at 100 centimeters away from the source or away from any surface the source penetrates.
  - 4) The worker operates a medical or industrial fluoroscopic device or is directly involved in the set-up or operational support of such a device. This excludes personnel who may have a clinical need to occasionally access a room in which fluoroscopy equipment is in use, when they are continuously supervised by authorized personnel, maintain at least 6 feet of distance from the fluoroscopy device, and have no direct involvement in its use.
  - 5) The worker is a "declared pregnant worker."
  - 6) When risk management conditions warrant, as deemed appropriate by the RSO.
- G) Rules for Badge Use:
- 1) Badges do not protect from ionizing radiation. The purpose of the badge is to document an individual's occupational radiation exposure, and to demonstrate compliance with annual dose limits and ALARA levels. The badges also provide valuable information to the RSO about the safety of the radiation work environment and the quality of the radiation safety program in the monitored area.
  - 2) Badges shall be worn every day while working, placed in a low background area after working hours, and not removed from the workplace.
  - 3) Place the badge in the neck or chest area, facing the radiation source.
  - 4) The badge must be worn OVER any lead apron, not underneath it. One exception to this rule is the "fetal monitor" as issued to a declared pregnant worker (DPW), which is worn in the abdominal area and underneath the lead apron.

- 5) Do not loan or borrow badges; wear only the assigned badge.
- 6) Do not wear the badge while not working and receiving medical x-rays during personal healthcare.
- 7) Do not lose or damage the badge. Report missing, lost, or damaged badges promptly.
- 8) Badges will have an exchange frequency of monthly or by calendar quarter based on risk. UNM Radiation Safety will bring new badges for the new month or quarter on or about the last working day of the month/quarter, and collect the old badges. Badges must be accessible for exchange in the event of any planned or unplanned absence from work. A “badge coordinator” is designated for each department to assist with the exchange process.
- 9) Return the badge ON TIME each month that it is due – by the 5<sup>th</sup> day of the start of each monitoring period. Late fees will be assessed for badges not returned on time.
- 10) Ring dosimeters shall be worn on the hand most likely to receive the highest dose, with the label section towards the source of radiation.
- 11) A worker may not wear a UNM-issued badge at another non-UNM location where he/she may be exposed to radiation, unless approved by the UNM RSO. The worker assumes responsibility for notifying the RSO at each location so that badge data may be shared.

Notify the RSO immediately upon termination of employment, badge loss, accidental badge exposures, or if job duties change relative to work with radiation.

#### H) ALARA Guidelines:

- 1) UNM shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and public doses that are as low as reasonably achievable (ALARA).
- 2) UNM shall establish “ALARA Notification Levels” with the badge vendor. The vendor shall promptly notify UNM in writing when the pre-set levels are exceeded.
- 3) The RSO shall maintain familiarity with the scientific benchmarking data and published peer-reviewed articles in the literature to ensure that occupational doses for specific user groups are consistent with national guidelines (as available).
- 4) The RSO / RCC shall establish quarterly ALARA action levels, set far below the annual dose limits, to serve as trigger levels for review and follow-up.
  - (i) If a participant exceeds the ALARA levels within a given quarter, an ALARA alert will be sent to the individual with an official ALARA level notification to be sent at the end of the quarter.
- 5) A list of those individuals who exceeded ALARA levels is presented to the RCC at each meeting. Where exposures cannot be justified, an investigation will be conducted.

#### I) Dose Limits:

- 1) **Adults:** The annual occupational dose limits (per year unless otherwise noted) are:
  - (i) The more limiting of the total effective dose equivalent (TEDE) being equal to 5.0 rem (0.05 Sv); or
  - (ii) The sum of the deep dose equivalent (DDE) and the committed dose equivalent (CDE) to any individual organ or tissue other than the lens of the eye being equal to 50.0 rem (0.5 Sv).
  - (iii) A lens dose equivalent (LDE) equal to 15.0 rem (0.15 Sv).



- (iv) A shallow dose equivalent (SDE) of 50.0 rem (0.5 Sv) to the skin or to an extremity.
- 2) **Minors** ( $\leq 18$  years): 10% of any of the adult dose limits.
- 3) **Embryo/Fetus**: The dose limit for the entire gestational period is 0.5 rem (5 mSv), and 50.0 mrem per month.
  - (i) This applies only to a “declared pregnant worker” (DPW), defined as a badged employee who has voluntarily informed her employer in writing that she is pregnant and has estimated the date of conception.
  - (ii) Please refer to the “UNM Pregnant Worker Policies and Procedures,” which govern the dose monitoring policies and other requirements that must be followed at UNM.
- 4) **Members of the Public (MOP)**: A MOP is defined as any individual who is not an employee or contractor being monitored for occupational radiation exposure, and not a patient who is receiving prescribed medical radiation. Dose constraints include:
  - (i) A TEDE not to exceed 0.1 rem (1 mSv) in a year; and
  - (ii) A dose in any unrestricted area from external sources not to exceed 2.0 mrem (0.02 mSv) in any one hour; and
  - (iii) A TEDE from infrequent exposure to radiation  $\leq 0.5$  rem (5 mSv).
- 5) **Patients**: There are NO limits on radiation exposure to patients undergoing a diagnostic or therapeutic medical procedure prescribed by a Physician Authorized User or other licensed practitioner. The licensee shall make all reasonable attempts however to ensure that patient doses are as low as diagnostically achievable and in line with published data and industry standards of care, when available.

J) Records and Reports:

1) **Dosimetry Reports:**

- (i) Monthly and quarterly dosimetry reports are promptly reviewed upon receipt by the RSO or designee, and signed and dated.
- (ii) The review criteria shall be justification of any abnormal dose, assessment of error codes, trend analysis, confirmation that doses are ALARA for the specific worker group, and evaluation of absent and lost badges. Fetal badges are specifically reviewed to ensure a uniform monthly exposure ( $\leq 50$  mrem/month).
- (iii) An immediate investigation will be conducted if any regulatory dose limit is exceeded, the individual and their Manager notified, the RCC notified, and a report sent to NMED. The RCC will review the results of the investigation and a decision made as to the need for limitation of any further dose for the calendar year.
- (iv) If badges are lost, UNM Radiation Safety will be responsible for calculating an estimated dose to be added to the participants’ dose of record. The estimate will be reported at the following quarterly RCC meeting.
- (v) The dosimetry reports will be made available to participants either directly or through the badge coordinator and/or Manager.
- (vi) The RSO maintains a copy of the reports for the life of the license.

2) **Annual Reporting of Occupational Dose - Form 5’s** (20.3.10.1003.B)

- (i) UNM Radiation Safety monitors all personnel according to the NMED monitoring criteria. A summary report of total annual exposure for the preceding calendar year shall be issued to:
    - (a) All participants who received in excess of 100 mrem (1.0 mSv) TEDE or TODE for the year in question.
    - (b) Any badge program participant at their request. Managers will be made aware that the reports are available and communicate this to their staff.
  - (ii) This report is sent following receipt of all badge data from the dosimetry vendor.
  - (iii) The Form 5's reflect individual radiation exposure, and should be held and distributed confidentially. Persons in receipt of Form 5's are instructed to preserve the report for future reference.
- 3) **Termination and History Reports:**
- (i) If an employee is terminating employment and requests their occupational exposure history, UNM Radiation Safety will provide the data in writing for the current calendar year. If the most recent exposure data is not available, it may be estimated using a standard formula, or the forwarding address of the requestor can be provided and the data sent when it becomes available.
  - (ii) At the request of a former employee who was badged at UNM, or at the request of their new employer, UNM Radiation Safety will provide the badge data in writing to the requestor within 30 days of the request or within 30 days of receipt of the most recent monitoring period data for the former employee. This information will only be released to a third party if the request is signed and dated by the former employee, authorizing the release of their UNM badge data.
  - (iii) New employees of UNM who were badged at another location for the current calendar year are required to provide their previous badge data to UNM Radiation Safety, or authorizing (by signature) UNM Radiation Safety to obtain their current year history from their previous employer.

## **XII. RADIATION SAFETY RECORDS, REPORTS, AND RETENTION:**

- A) UNM Radiation Safety will maintain records required by regulation in a central location. Since radiation safety records are subject to inspection by NMED and/or the NRC, they shall be maintained in auditable format relative to accessibility, retention time, and organization.
- B) **Records:**
  - 1) **Unsealed Source Inventory:**
    - (i) Refer to section IX, (C-F), above for details on record keeping requirements for inventory.
  - 2) **Permit Holder Surveys:**
    - (i) Permit Holders are responsible for periodically assessing and measuring the radiation environment in their authorized use locations.
    - (ii) Research Permit Holder Surveys
      - (a) The frequency of this formal assessment is monthly for active use labs. For inactive labs with radioactive material on hand, the monthly survey only need



include the radiation source storage area and a note indicating that no RAM was used that month. When the amount of RAM in use exceeds the amounts listed in Table 1 below, the survey must be performed the same day of use.

- (b) Part I of the lab survey consists of making external area radiation measurements throughout the lab at key locations, using an appropriate portable instrument that is sensitive to the radiation types in use. Areas that must be surveyed include all occupied workstations, RAM use, storage and disposal areas, and adjacent unrestricted areas. Results of the area survey should be recorded in mR/hr or cpm.
- (c) Part II of the lab survey consists of performing wipe tests to check for removable contamination of surfaces. Wipe samples should be counted in a liquid scintillation counter, gamma counter, well counter, or other suitable instrument that will display the results in dpm/100 cm<sup>2</sup>. If contamination is found that exceeds the established tolerance, the area shall be decontaminated and resurveyed with all results documented.

(iii) Clinical (Nuclear Medicine and Radiation Oncology) Permit Holder Surveys

- (a) Ambient radiation level surveys with a radiation detection survey instrument shall be performed at the end of each day of use in all areas where radiopharmaceuticals were prepared or administered.
- (b) Contamination surveys for removable contamination shall be performed at the end of each day of use all areas where radiopharmaceuticals requiring written directive were prepared for use or administered.
- (c) Surveys for manual brachytherapy source implant and removal shall be performed as follows:
  1. Immediately after implant procedures are completed, survey to locate and account for all sources that have not been implanted.
  2. Immediately after removing the last temporary implant from a patient, survey of the patient to confirm that all sources have been removed.
- (d) Surveys for use of high dose rate (HDR) remote afterloader shall be performed as follows:
  1. Before releasing a patient that has been treated using a HDR, survey the patient and HDR unit to confirm that the radiation source has been removed from the patient and has been returned to a safely shielded position.
  2. Upon installation of a new HDR source or after repairs to the source shielding, driving unit or electrical or mechanical components, survey to verify that maximum and average radiation levels from the surface of the main source safe to not exceed levels stated in Sealed Source & Device Registry.

(iv) Action Levels for Permit Holder Surveys

**Table 1**

<b>Ambient Dose Rate Action Levels</b>	
<b>Area Surveyed</b>	<b>Action Level</b>
Unrestricted Area	0.1 mR/hr

Restricted Area	2.0 mR/hr
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**Table 2**

<b>Loose Surface Contamination Levels<sup>12</sup></b>	
<b>Area Surveyed</b>	<b>Action Level</b>
Unrestricted Area	200 dpm/100 cm <sup>2</sup>
Restricted Area	2000 dpm/100 cm <sup>2</sup>

- <sup>1</sup> More restrictive loose surface contamination limits may be enforced on specific permits based on radiotoxicity and radiation emitted by radionuclides in use.
- <sup>2</sup> Although the Restricted Area limit is established at 2000 dpm/100 cm<sup>2</sup>, the ALARA goal for all areas should be to maintain loose surface contamination levels below 200 dpm/100 cm<sup>2</sup>.

- (v) Permit holders are responsible for taking appropriate actions to reduce ambient dose rate and/or contamination levels below the established action levels listed in Tables 1 and 2 above.
- (vi) Records of lab surveys shall be maintained on a form or database designed for that purpose and stored in the Lab Notebook or equivalent auditable record. UNM Radiation Safety staff will audit records periodically. The lab survey reports are also auditable by inspectors.
- (vii) A Permit Holder may submit a request, in writing, to UNM Radiation Safety to enter dormant status, at which time all material in his/her possession will be collected, postings removed, and the lab released for unrestricted use following a thorough survey for removable contamination. A dormant Permit Holder shall not be responsible for monthly self-surveys and will not be subject to routine inspections by UNM Radiation Safety. The Permit Holder must submit a request, in writing to UNM Radiation Safety, to exit dormancy and resume his/her approved activities.

**Table 3**

<b>Activity Levels Requiring Surveys Same Day As Use 10 X Schedule B Quantities</b>			
<b>Radioisotope</b>	<b>Activity (uCi)</b>	<b>Radioisotope</b>	<b>Activity (uCi)</b>
Hydrogen-3 (Tritium)	10,000	Chromium-51	10,000
Carbon-14	1,000	Technetium-99m	1,000
Phosphorus-32	100	Iodine-125	10
Sulphur-35	1,000	Iodine-131	10
Fluorine-18	10,000	Gallium-68	1,000

4) Bioassay Records:

- (i) Individuals involved in operations that utilize unsealed radionuclides above the activity levels indicated in Table 3, shall have their use scenario evaluated by the RSO, and a bioassays performed as directed by the RSO. Bioassay may be required



at regular intervals when usage is continuous.

- (a) In the case of an unsealed liquid therapeutic administration of  $^{131}\text{I NaI}$ , or for researchers performing protein iodinations, thyroid bioassay shall be performed within 24-48 hrs following handling and administration. Bioassay shall consist of a direct thyroid count using a thyroid uptake probe calibrated for the iodine radioisotope in question, with results recorded in a bioassay log maintained in the department.
- (b) Baseline bioassays should be performed whenever possible prior to commencement of new  $^{131}\text{I}$  procedures.
  - (ii) Exempt from the bioassay requirements are radionuclides present as metallic foils, plated sources, clinical therapeutic radiopharmaceuticals administered in capsular form or intravenously, and other material forms not likely to disperse.
  - (iii) The bioassay samples (or results of direct bioassay) may be analyzed at the University of New Mexico. The type of bioassay testing and analysis method (direct or indirect) shall be appropriate for the radionuclide, chemical form, and route of excretion. The RSO shall provide guidance on a case-by-case basis.
  - (iv) Depending on the type of operation and hazard involved, the Radiation Control Committee (RCC) will consider the need for bioassay at other levels. Certain spills and skin contamination events may warrant bioassay as dictated by the RSO.

**Table 4**

<b>Radionuclide Hazard Groups</b>			
<b>Group 1</b> Very High Hazard 0.1 mCi	<b>Group 2</b> High Hazard 1 mCi	<b>Group 3</b> Medium Hazard 10 mCi	<b>Group 4</b> Low Hazard 100 mCi

Pb-210*		C-14	Y-90	Sm-151	
Po-210	Na-22*	Na-24*	Y-91	Ho-166*	
Ra-223	Ca-34	Si-31	Zr-93*	Tm-170*	
Ra-226*	Sc-46*	P-32	Nb-95*	Lu-177*	H-3
Ra-228*	Co-60*	S-35	Mo-99*	Re-183*	Be-7*
Ac-227	Sr-90	Cl-36	Ru-103*	Ir-190*	O-15
Th-228	Ru-106*	K-42*	Rh-105*	Ir-192	F-18
Th-230	I-125	Sc-47	Pd-103	Pt-191*	Ga-68
Th-230	I-129	V-48*	Ag-105	Pt-193*	Ni-59
Np-237	I-131*	Cr-51*	Ag-111	Au-196*	Zn-69
Pu-238	Cs-137*	Mn-54*	Cd-109*	Au-198*	Ge-71
Pu-239	Ce-144*	Mn-56*	Sn-113*	Au-199*	Tc-99 <sup>m</sup>
Pu-240	Eu-154*	Fe-55	I-123	Tl-200*	U-238
Pu-241	Ta-182*	Fe-59*	Te-127*	Tl-201*	Natural Thorium
Pu-242	Bi-210	Cu-64*	Te-129 <sup>m</sup> *	Tl-202	Natural Uranium
Am-241*	At-211	Zn-65*	Ba-140*	Tl-204	Noble Gases
Cm-242	Ra-224	Ga-72*	La-140*	Pb-203*	
Cf-252	U-233	As-76*	Pr-143	Rn-220	
		Rb-86*	Pm-147	Rn-222*	
		Sr-89		U-235	

\*Emits gamma radiation in significant amounts

#### 5) Lab Surveys and Audits by UNM Radiation Safety:

- (i) UNM Radiation Safety shall perform surveys in all laboratories where unsealed radionuclides are used. The minimum frequency of these surveys will comply with state regulations. Higher risk labs (as determined by the RSO and RCC) may be surveyed at a greater frequency. The RSO may increase the audit frequency based on historical data including but not limited to severity or persistence of violations and disregard to policy and procedure.
- (ii) The RSO / RCC set action level tolerances for alpha, beta, and gamma contamination as measured in wipe tests. Contamination found in unrestricted areas should be immediately decontaminated to background levels when possible. In restricted areas and if background levels cannot be achieved, contamination must be reduced to levels shown in Table 2 above, except for human diagnostic and therapeutic applications.
- (iii) Lab survey reports and any follow-up actions will be maintained by UNM Radiation Safety. The quarterly RCC minutes shall document that survey outcomes were reviewed with the RCC.

#### 6) Release of equipment and rooms from radiological controls

- (i) Release of Equipment from Radiation Control - any equipment and materials that have been used or contaminated with radioactive material must be surveyed for contamination prior to releasing the items for unrestricted use. UNM Radiation Safety personnel will survey and release equipment and materials for unrestricted use if there is no fixed or removable radioactivity distinguishable from background radiation. Permit holders are required to contact UNM Radiation Safety to release items under their use prior to repair, transfer, or disposal.
- (ii) Release of Radioactive Material Laboratories and Facilities from Radiation Control – the Permit Holder shall ensure that all areas/rooms identified on his/her permit are



closed out upon expiration or termination of the permit or are no longer used for radioactive work. A close out survey must be performed by UNM Radiation Safety to ensure that no radioactive materials or radioactive waste remains in the lab space prior to release for unrestricted use.

7) Medical Therapy In-Patient Room Surveys:

- (i) Areas utilized by patients undergoing radiopharmaceutical therapy with unsealed radionuclides will be released from licensee control when area radiation and contamination levels are in compliance with regulatory limits, UNM policies, and are as low as reasonably achievable.
- (ii) Loose surface contamination levels will be in compliance with UNM Radiation Safety survey and release standard operating procedures. Room release will not occur until it is documented that no individual, when continuously present in any section of the room that may be occupied, could receive a dose in excess of 2.0 mR in any one hour. The goal for the room release shall be that radiation levels are indistinguishable from normal background radiation, consistent with the ALARA philosophy.
- (iii) Records to be maintained (for 3 years) for all medical radiopharmaceutical therapies include:
  - (a) Room release survey and decay-in-storage records (RSO)
  - (b) Written Directives
  - (c) Documentation of patient meeting the release criteria of 20.3.7.703.I
  - (d) Administration records
  - (e) Evidence that the patient was provided written instructions when applicable

8) Sealed Source Inventory and Leak Testing:

- (i) A physical inventory of all sealed sources (meeting the leak test requirements) and special nuclear materials shall be performed at intervals not to exceed six months. An inventory of exempt and generally licensed sources will be maintained.
- (ii) For ALARA purposes, monitoring by instrument shall be considered acceptable for physically verifying the presence of reactor fuel and other reactor-related sources.
- (iii) Records will be maintained for 3 years by UNM Radiation Safety and at all end-user locations. The record will identify each sealed source, the original activity, reference date, current activity, model and serial number, storage location, name of the person performing the test, instrument(s) used, and the results of the leak test in dpm or uCi.
- (iv) Any sealed source leak test exhibiting  $> 0.005$  uCi of radioactivity will cause the source to be immediately removed from service and placed into safe storage. A report will be filed with NMED according to the requirements of NMAC 20.3.4.415.
- (v) Sealed sources listed in the NRC NSTS database will be accounted for during the Annual Inventory Reconciliation (AIR) process.

9) Portable Instrument Calibration:

- (i) Portable survey meters shall be calibrated before first use, annually, and following any repair that could affect the calibration. UNM Radiation Safety staff may

calibrate UNM survey meters, or the service provided by a third party specifically licensed for instrument calibration.

- (ii) Instruments used only for low-level contamination monitoring may be electronically calibrated using a pulser. Instruments used for making exposure rate measurements will be calibrated using a certified NIST-traceable gamma radiation source. For each type of calibration the requirements of 20.3.7.703(C) will be met.
- (iii) All instruments used to comply with the requirements of 20.3.7 shall have a dedicated check source, preferably attached to the instrument, and proper operability confirmed each day of use by comparing the measured daily value to that indicated on the calibration sticker. Records of this daily operability check are not required.
- (iv) A label will be affixed to the instrument that identifies the instrument and serial number, calibration date and next due date, calibration source, check source reading (if applicable), correction factors (if any) and the name or initials of the person performing the calibration.
- (v) UNM Radiation Safety will maintain instrument calibration records in accordance with 20.3.7.715(F) for 3 years.

C) Radiation Safety Training (see Attachment D for course listings):

- 1) Annual radiation safety training is required for departments whose employees are likely to exceed 100 mrem per year from normal or abnormal situations. This shall include the following areas, and others as deemed appropriate by the RSO. The training may be in the format of live presentations, computer-based self-learning programs, web-based training on Learning Central, or other approved method. Training records shall be maintained and will include the names of the participants, completion date, results of a competency exam if applicable, and a copy of the training content outline or program.
  - (i) Nuclear Medicine
  - (ii) Radiation Oncology
  - (iii) Nurses and staff who care for radiation patients
  - (iv) Nuclear engineering
  - (v) Research labs
  - (vi) Radiopharmacy
  - (vii) Radiology
  - (viii) Custodians, Housekeepers, and other Ancillary Staff
- 2) DOT Hazardous material training is required every 3 years for any UNM worker who is required to ship or receive radioactive materials. Records are maintained within the end-user department.

D) Reporting:

- 1) The RSO, in conjunction with the RCC and Licensee Management, shall determine when incidents involving radiation sources are to be reported to the State or to a Federal Agency. Under no circumstances (but not withstanding the directives of the "Notice to Employees" Form), shall an end-user, Authorized User, Permit Holder, or any individual authorized to use



licensed radiation sources, take part in external reporting, without first providing an internal report to the RSO for investigation.

- 2) External reporting shall comply with the requirements of all applicable sections of the NMAC regulations.

### **XIII. POSTING AND LABELING:**

#### **A) Radiation Signs:**

- 1) Signs shall be posted to make individuals aware of a radiation hazard before that individual enters the area, so that the proper precautions can be taken to minimize radiation exposure.
- 2) Each sign shall bear the universal warning symbol, colors, and background for radiation hazard as defined in NMAC 20.3.4.427. Areas that exhibit the following radiological conditions shall be posted. Posting an area with any of the following signs, when no radiation hazard is present, is prohibited. The wording on the sign shall be consistent with regulations as follows:
  - (i) Caution - Radioactive Material: In areas where licensed radioactive materials are used or stored, in quantities that exceed 10X the  $\mu\text{Ci}$  quantities listed in Table 462.1 of NMAC 20.3.4.462 Appendix C "Labeling Requirements".
  - (ii) Caution - Radiation Area: In accessible areas where radiation levels exist that could expose an individual to 5.0 mrem (0.05 mSv) in one hour at 30 cm from the source or surface that the source penetrates.
  - (iii) Caution - High Radiation Area: In accessible areas where radiation levels exist that could expose an individual to 100.0 mrem (1.0 mSv) in one hour at 30 cm from the source or from any surface that the source penetrates.
  - (iv) Caution - Very High Radiation Area: In accessible areas where radiation levels exist that could expose an individual to 500.0 rad (5.0 Gy) in one hour at 100 cm from the source or surface that the source penetrates. The words "Grave Danger" should be used, unless it has been determined that the use of these words would cause undue stress to patients.
  - (v) Caution - X-Ray: In areas where stationary x-ray producing equipment is used.

#### **3) Exemptions to Posting Requirements:**

- (i) For periods of less than 8 hours, if the radiation sources are constantly attended by an individual who takes the necessary precautions to prevent exposure to others, and, the licensee can control the area.
- (ii) Hospital rooms housing patients who meet the release criteria.
- (iii) Rooms having a sealed source with radiation levels  $\leq 5.0$  mrem/hour at 30 cm.
- (iv) Rooms having a radiation-producing machine where radiation levels are  $\leq 5.0$  mrem/hour at 30 cm.

#### **B) Notice to Employees Form (NRC-3 and Form NMED 045):**

- 1) "Notice to Employees" forms shall be visibly posted in a sufficient number of places in every department where licensed activities are conducted, to permit employees working in or frequenting any portion of a restricted area to observe a copy on the way to or from their place of employment.<sup>1</sup>
- 2) In lieu of posting the regulations, operating procedures, licenses, license conditions, and other documents associated with the license, as required by NMAC 20.3.10.1001, a notice is included at the bottom of the form "Notice to Employees" which states where these documents are stored and may be accessed.

C) Radiation Safety Contact Information:

All labs using licensed or registered radiation sources are required to post the current contact information for UNM Radiation Safety staff. The most current version is available by contacting UNM Radiation Safety at HSC-radiationsafety@salud.unm.edu.

D) X-Ray Machine Registration and Operator Certificates:

- 1) Valid registration certificates shall be maintained for all x-ray producing equipment. Within 30 days of an expiration date, a renewal shall be initiated. UNM Radiation Safety manages the registration and renewal process.
- 2) Registration certificates shall be clearly and visibly posted in a central location in all areas where x-ray equipment is used.
- 3) Only qualified individuals who have been certified by NMED as described in NMAC 20.3.20.300, or who fall under the exemptions noted in NMAC 20.3.20.300.I (licensed practitioners or supervised students and residents in a formal program of study etc.), may operate x-ray producing equipment in medicine. It is the responsibility of the qualified individual to renew the certificates in a timely manner to avoid lapse in certification.
- 4) The original certificates of qualified individuals defined by XIII.D.3 shall be publicly displayed at the place of employment.

E) Labeling:

- 1) All containers holding licensed RAM shall be clearly labeled with the radiation symbol and the words "Caution - Radioactive Material". Other required information on the label includes the radionuclide, activity, date, lab number, and any other information necessary to allow individuals allowed access to the area to take the necessary precautions to minimize exposure.
- 2) Exemptions to container labeling are described listed below:
  - (i) Containers holding licensed material in quantities less than those listed in NMAC 20.3.4.462. An abbreviated list of quantities requiring labeling are listed in Attachment C.
  - (ii) Containers holding licensed material in concentrations less than those specified in Table III of NMAC 20.3.4.461.
  - (iii) Containers that are under constant surveillance by a radiation worker while they are in use.

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<sup>1</sup> "Restricted area" means an area, access to which is limited by the licensee or registrant for purposes of protection of individuals against undue risks from exposure to sources of radiation. (NMED Subpart 1, Section 106)



- 3) Containers that are exempt from the full labeling criteria in E1, shall still be labeled at a minimum with a "Caution – Radioactive Material" label. Exceptions to this rule are allowed for small containers such as microcentrifuge tubes or liquid scintillation vials where the label will interfere with the intended use. In those cases, the tray or box in which the containers are stored should be labeled as "Radioactive".
  - 4) Before moving empty containers that formerly held radioactive material to the normal trash, UNM Radiation Safety shall do the following:
    - (i) Survey the container inside and out with an appropriate survey meter set on its most sensitive scale and with no interposed shielding, to demonstrate that radiation levels are indistinguishable from background. For low energy beta emitters such as  $^3\text{H}$ ,  $^{14}\text{C}$ , and  $^{35}\text{S}$ , the container should be wipe tested and counted in a liquid scintillation counter to demonstrate compliance.
    - (ii) Remove or obliterate all symbols, wording, and markings indicating radiation hazard.
    - (iii) If the end-user wishes to keep an empty container for future use, an "Empty" label may be placed over the radiation markings.
  - 5) Medical x-ray producing equipment shall have a label at the console that contains the radiation symbol, and the words "WARNING: This X-ray Unit May Be Dangerous To Patient and Operator Unless Safe Exposure Factors and Operating Instructions Are Observed".
  - 6) X-ray producing equipment for analytical use, shall have a label at the console with the words CAUTION--HIGH INTENSITY X-RAY BEAM, or words of similar intent on the x-ray machine housing. They shall also have the words "CAUTION: X-RAYS PRODUCED WHEN ENERGIZED, or words of similar intent near any switch that energizes an x-ray tube.
- G) Lab Safety Rules: (to be included in the laboratory Radiation Safety notebook)
- 1) Read and be familiar with the procedures in the RSM.
  - 2) Before performing an experiment, determine if proper approvals have been granted and that the experiment will not constitute a violation of rules and regulations.
  - 3) Keep radioactive materials, contaminated equipment, and sealed sources in designated and properly labeled containers. Set up your lab to facilitate contamination control.
  - 4) Keep RAM work areas clean, uncluttered, and organized.
  - 5) Lock up all RAM after business hours or when the lab is unoccupied, even for short periods of time and for any quantity of radioactivity. Security of RAM shall be continuous and a top priority.
  - 6) Wear whole body and ring dosimeters (as applicable) when working with RAM.
  - 7) Operations in which radionuclides may become airborne should receive special consideration in regard to monitoring and sampling. Contact the RSO for instructions.
  - 8) Do not smoke, eat, drink, or store food or beverages in any posted RAM lab. Keep personal belongings out of the area.
  - 9) Use only mechanical devices to pipette radioactive solutions.
  - 10) Survey the work area and your entire person after every use of unsealed RAM.
  - 11) Store and transport RAM in a manner to prevent breakage or spillage.

- 12) Wear lab coats and protective apparel to prevent internal and external contamination, commensurate with the amount of radioactive material in use. Always wear disposable gloves when handling anything that is potentially contaminated.
- 13) Use absorbent paper to line work areas and exchange it when necessary. Secondary containment (spill trays) is required when working with radioactive liquids.
- 14) Immediately contain and attend to any spill of RAM. Clear the area of persons not involved in the spill, and contact the RSO for assistance as necessary.
- 15) No potentially contaminated equipment may leave a RAM Lab for service, calibration, repair, disposal etc. without first being cleared by the RSO or designee.
- 16) Be aware that a build-up of pressure may occur in vials of radioactive solutions, and could be released by inserting a hypodermic syringe needle through the rubber seal. A cotton or wool plug is recommended to trap this spray. In the case of a screw cap vial, surround the rim of the cap with cotton and, unscrew the cap slowly until pressure is equalized. Always work over a tray in a fume hood.

#### **XIV. SPILL AND EMERGENCY RESPONSE:**

##### A) Major and Minor Spills:

- 1) Spills of radioactive material can be minor or major. Minor spills are generally very low level, contained easily, within the comfort and skill level of the responsible worker, and simple to clean up because the affected surface is protected with absorbent or by a spill tray, for example. A major spill has more significance and must be reported to UNM Radiation Safety. A major spill has one or more of the following characteristics:
  - (i) Involves a large (mCi) quantity of radioactivity.
  - (ii) Causes a radiation level that exceeds 2.0 mR/hr at 30 cm.
  - (iii) Involves radionuclides with high radiotoxicity (see Table 4).
  - (iv) Is spread over a large area or irregularly shaped area.
  - (v) Difficult to contain.
  - (vi) Involves skin contamination, an injury, and/or radiation exposure to any individual.
  - (vii) Occurs in an unrestricted area.
  - (viii) Threatens to be released into air, water, or sanitary sewer.
  - (ix) Is beyond the worker's comfort level or abilities
- 2) Spill Response:
  - (i) STOP work activities and attend to the spill. Wear full personal protective clothing, including gloves and shoe covers.
  - (ii) Medical care of the injured shall take top priority over the radiation issues. In addition, the PRIMARY hazard such as a fire, flood etc. shall also take precedence. Assist the injured, extinguish the fire or pull the fire alarm, control the source of flooding etc., and then attend to the spill. Placing absorbent material on the spill to prevent spread is a recommended concurrent initial action.



- (iii) If the spill could involve airborne RAM, causes high radiation levels (10's-100's of mR/hr), or otherwise involves circumstances too complex to manage, evacuate the area, close and lock the door, and contact the RSO. Remain in the area until the RSO arrives on the scene. If additional security is required, contact the UNM Police Department (UNMPD).
- (iv) Take steps to minimize the spread of contamination.
- (v) Contact the RSO if the spill is major or if assistance is needed.
- (vi) Warn others to stay away from the affected area. If individuals may be contaminated, detain them until they can be surveyed from head to toe.
  - (a) Persons with skin contamination shall immediately wash the affected areas with warm water flushes and gentle scrubbing with a mild soap, taking care not to abrade the skin. The RSO must be contacted.
  - (b) Documentation must include the area of skin affected, initial cpm or mR/hr measured at 1 cm away, the date and time, and radiation readings and times following all subsequent decontamination efforts.
- (vii) Delineate the spill boundary and use barriers or other means to secure it.
- (viii) Obtain the spill kit. Set up a container to collect radioactive waste. Decontaminate the area working from areas of low to high contamination (perimeter to center). Continue until radiation readings are indistinguishable from background or no further reductions are achievable. Gloves shall be changed frequently.
- (ix) Write an incident report, identifying all radiation levels, locations affected, personnel affected, the probable cause of the spill, and steps to prevent future occurrences.

3) Other Radiation Emergencies and Incidents:

- (i) The following situations require immediate reporting to the RSO:
  - (a) Fire or smoke in any radioactive materials use area.
  - (b) Flooding in any radioactive materials use area.
  - (c) Damage to a radiation area from a natural disaster.
  - (d) Unauthorized entry into a radiation area or other security breach.
  - (e) Loss, theft, or missing radioactive materials or radiation-producing machine.
  - (f) Malfunction of any device designed to maintain radiation source safety.
  - (g) An in-house therapeutic radiation patient who codes, requires transfer from their assigned room due to a medical emergency, or dies.
  - (h) A therapeutic radiation patient who is released to home with radiation precautions, but who presents in the ER due to a medical condition, or who otherwise cannot follow the radiation precautions issued at the time of discharge.
  - (i) A radiation accident victim in the ER who is contaminated and also injured.

## **XV. RADIATION SAFETY PROGRAM CHANGES:**

- A) The University of New Mexico holds a Type A Broad Scope RAML issued by NMED. For this type of license, UNM has established a radiation safety program oversight structure consisting of UNM Licensee Management, a Radiation Control Committee, and the Radiation Safety Officer. The duties and responsibilities of this management triangle are specified in the UNM Radiation Safety Manual and include, in part:
- 1) RCC review and approval of program and procedural changes.
  - 2) Implementation of program and procedural changes.
  - 3) Audits of licensed operations to determine compliance.
  - 4) Taking appropriate actions when noncompliance is identified, including analysis of the cause, corrective actions, and actions to prevent recurrence.
- B) UNM is authorized to make radiation safety program changes or revisions to procedures previously approved by the NMED Radiation Control Bureau or the NRC, under the following conditions:
- 1) The change shall be reviewed and approved by the RCC prior to implementation.
  - 2) All regulatory requirements must be satisfied.
  - 3) The revision or change shall not impact existing license conditions.
  - 4) The effectiveness of the UNM radiation safety program must not be decreased.
- C) The RCC will review and approve changes or revisions based on information provided by the RSO. The RSO will evaluate the regulatory compliance issues, license conditions, and radiation safety impact of the change or revision. The RCC may also consider other sources of information in the review and approval process. Documentation of the radiation safety matters considered in the RCC review and the reason for the change will be made in the RCC meeting minutes.
- D) Program changes will be documented in the relevant program document or in the Radiation Safety Manual. Procedure revisions will be documented in the relevant procedure or in the Radiation Safety Manual, as appropriate. Minor program or procedural changes may be documented in the relevant procedure or program, or in the Radiation Safety Manual at the time of the next periodic review of that document.
- E) Program or procedural changes of a minor nature such as administrative matters or ministerial technical changes that enhance the program, may be implemented by the RSO with subsequent notification to the RCC, as appropriate. Changes to UNM Radiation Safety contact information may be updated in the Radiation Safety Manual by the RSO with subsequent notification to the RCC.



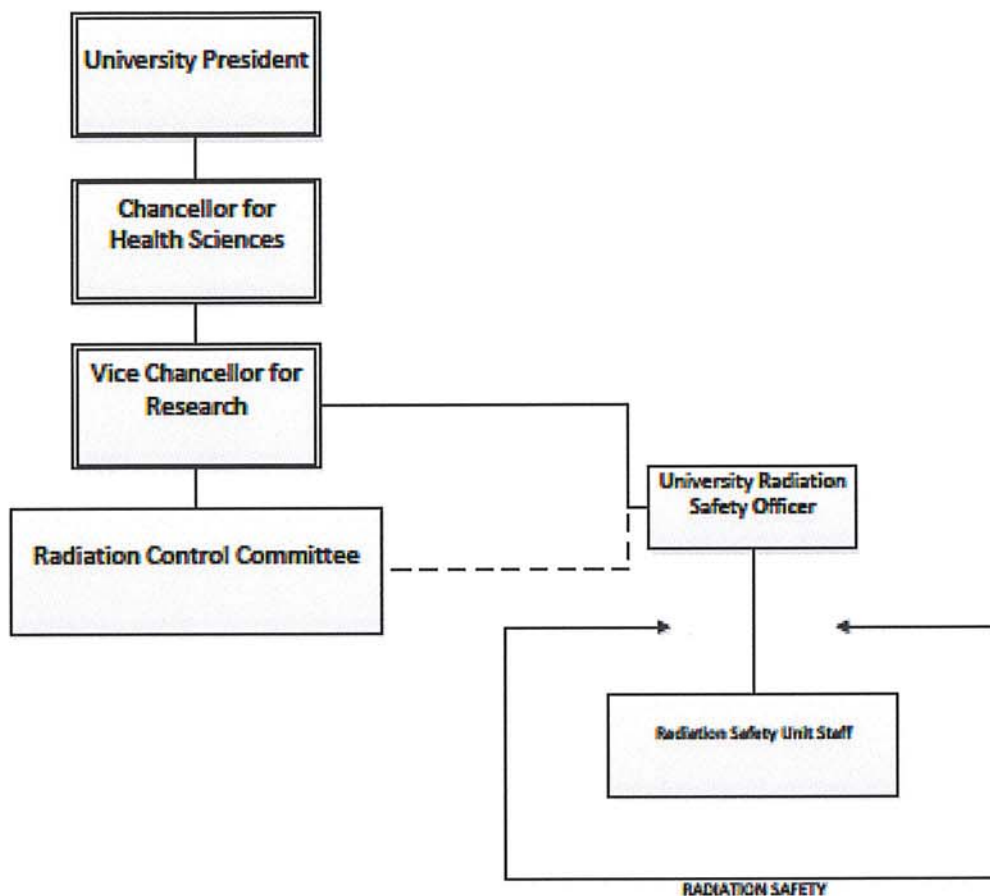
## ATTACHMENTS

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- A. UNM Health Science Center - Office of Research  
Radiation Safety Office Organizational Chart
- B. Radiation Control Committee (RCC) Membership Guidelines
- C. Quantities of Radioactive Material Requiring Labeling
- D. UNM Radiation Safety Training Courses and Orientations
- E. UNM Radiation Safety Forms
- F. Description of Acronyms
- G. Signature Page (maintained in the UNM Radiation Safety Office)

## Attachment A

### UNM Health Sciences Office of Research UNM Radiation Safety - Organizational Chart



#### Radiation Safety Institutional Compliance Committee Affiliations

**IRB** - Requires ancillary review and approval by the Human Use Subcommittee of the RCC for protocols involving radiation.

**IACUC** - Member of Radiation Safety staff serves in non-voting advisory role

**IBC** - Member of Radiation Safety staff serves in non-voting advisory role

**Hospital Safety Committee** - RSO serves as member

**Reactor Safety Advisory Committee** - Member of Radiation Safety staff serves as member



## Attachment B

### Radiation Control Committee Membership Guidelines

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- I. The Radiation Control Committee (RCC) membership guidelines follow the NMED regulations in Title 20 Chapter 3, Part 7.702(D).
- II. The membership must include an Authorized User of each type of use permitted by the radioactive materials license, the RSO, a representative from Nursing, and a representative from Management who is neither an Authorized User nor the RSO. The RCC may contain other members who the licensee considers appropriate.
- III. The following is the suggested membership (department or division representation):
  - A. Radiation Safety Officer
  - B. Licensee Management Representative
  - C. Nursing Representative
  - D. Representative(s) from the Basic Sciences (Biology, Chemistry, Physics)
  - C. Nuclear Engineering
  - D. Radiology (Nuclear Medicine, Interventional Radiology and Medical Physics are suggested)
  - E. Blood Bank
  - F. Cardiology (Cardiac Catheterization Lab)
  - G. Radiopharmacy
  - H. Cancer Center
  - I. Outlying facilities (Sandoval Regional Medical Center)

Of these members, a Chair and Vice Chair shall be appointed who is not the RSO or the Licensee Management representative.

## Attachment C

### Quantities of Radioactive Material Requiring Labeling (partial listing NMAC 20.3.4.462)

Radionuclide	Quantity (microcuries)
H-3	1,000
C-14	100
F-18	1,000
Na-22	100
P-32	10
P-33	100
S-35	100
Cl-36	10
Ca-45	100
Cr-51	1,000
Mn-54	100
Fe-55	100
Fe-59	10
Co-57	100
Co-60	1
Ni-63	100
Zn-65	10
Ga-68	1,000
Ge-68	10
Sr-89	10
Sr-90	0.1
Y-90	10
Tc-99m	1,000
Cd-109	1
In-111	100
I-123	100
I-125	1
I-131	1
Cs-137	10
Ba-133	100
Sm-153	100
Gd-153	10
Th-201	1,000
Ra-223	0.1
Ra-226	0.1
Th-230	0.001
Th-232	100
Thorium-natural	100
U-232	0.001
U-235	0.001
U-238	100
Uranium-natural	100
Pu-239	0.001
Am-241	0.001
Lu-177	100



## Attachment D

### Radiation Safety Training Courses and Orientations

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A. Course Name: **Introduction to Radiation Safety**

This course is designed to meet the needs of a technician who has minimal experience working with radioactive materials (RAM), and who is not familiar with regulations, policies, and procedures that relate to radiation source use. However, all new staff or those starting out in a radiation-use laboratory will benefit regardless of prior experience, and are encouraged to attend. Successful completion of this course is a prerequisite to working independently under an approved UNM Permit.

UNM Radiation Safety, in consultation with Permit Holders, the RSO, and the UNM Radiation Control Committee, determines who is required to take the course.

The course is offered quarterly and consists of a series of lectures, a practical lab and project (at the discretion of the instructor), and a final exam. The course schedule is announced via email to all Permit Holders. Certificates are issued upon successful course completion. The course may be challenged by successfully passing the exam and demonstrating sufficient technical proficiency.

Successful completion of certain UNM registered courses may exempt an individual from having to take this course. These include “Radiation Safety Engineering, No. 230”, “Nuclear Detection and Measurement, No. 323L”, “Introduction to Radiation Protection, No. 401”, and “Radiobiology, No. 491L”.

The course outline includes basic fundamentals, training in safe handling techniques, regulations, routine practices, and response to abnormal procedures as follows:

1. Basic Radiation Physics Fundamentals:
  - Atomic Structure
  - Radioactive Decay and half-life
  - Radiation types and their properties
- b. Methods of Dose Reduction using Time, Distance, and Shielding
- c. Radiation Detection and Measurement:
  - Theory of detection and measurement
  - Portable survey meters (ionization chambers, GM counters)
  - Personnel monitoring with film badges, TLD, OSL
  - Other counting and detection systems
- d. Radiation Biology and Health Effects:
  - Mechanisms of injury from radiation
  - Stochastic and Non-Stochastic Effects

- Early and Late effects
- e. Regulations and Policies:
- Limits and tolerances for radiation dose and contamination
  - Reportable events (what situations require reporting to the RSO)
  - Radioactive waste disposal
  - Review of key UNM radiation safety procedures
  - Radiation Worker Rights and Responsibilities

B. Course Name: **“General Radiation Awareness Training”**

This course is intended for general workers who may have a business need to work in or frequent areas where radiation sources are used and stored, but have no responsibility for them. It is a right-to know, very basic instructional program, to increase awareness of radiation safety and recognition of areas where radiation sources are used. Emphasis is placed on visual recognition and response to warning signs. This course is available on-line through Learning Central or as an in-person training. UNM Physical Plant employees and non-radiation workers in research laboratories are required to complete this course.

C. Course Name: **“Radiation Safety Refresher Training”**

This course is intended for any radiation worker who has completed initial radiation safety training and is designed to reintroduce and reinforce concepts regarding safe and acceptable use of licensed sources of ionizing radiation at UNM. The refresher training must be completed within 12 calendar months of initial training and every 12 calendar months thereafter.

D. Course Name: **“Radiation Safety Training for Research Lab Workers”**

The intended audience for this course is workers who use radioactive materials such as radiotracers in the research lab environment, and will be working under the direct supervision of a Permit Holder or other individual with supervisor of use status. The course is a self-learning program with a quiz that provides a cursory overview of regulations, policies, and procedures related to radiation source use at UNM. This course does not fulfill training requirements for individuals who intend to carry out unsupervised work with radioactive materials, and is merely an enhanced awareness training. “Radiation Safety Training for Research Lab Workers” is available exclusively through Learning Central.

E. Course Name: **“Radiation Safety for Animal Resource Facility (ARF) Personnel”**

This course covers best practices for protection against ionizing radiation in the Animal Resource Facility (ARF). Specific instruction is provided in the areas of basic radiation physics, background radiation, dosimetry, radiation caution signage, ALARA principles, procedures for handling animals and cages, security, and emergency response. Satisfies annual training requirements for ARF technicians and supervisors. “Radiation Safety for Animal Resource Facility (ARF) Personnel” should be completed at least annually by affected staff.



F. **Course Name: “Personnel Radiation Monitoring with Radiation Badges”**

This course is required for all new participants in UNM’s dosimetry program. Course content provides general instruction in principles of radiation protection as well as specific guidance for care and use of individual monitoring devices. “Personnel Radiation Monitoring with Radiation Badges” is available exclusively through Learning Central.

G. **Course Name: “X-Ray Diffraction Safety Training”**

This course presents information regarding hazards, best practices, and regulations associated with the use of x-ray diffractometers in research. The training must be completed prior to working with any XRD equipment and supplemented by function-specific training administered by the XRD owner or key operator. This course is available exclusively through Learning Central.

H. **Course Name: “Radiation Safety Training for Nurses who Care for Radiation Patients”**

Regulations dictate that nurses may not render care to radiation patients without first completing an appropriate course of instruction, with refresher training required annually thereafter. The course content is prescriptive in the regulations, and must include discussion of all types of radiation sources that may be encountered including pictures and graphics of the sources and related safety equipment. Nurses will not be issued radiation badges or be permitted to care for a radiation patient, without official documentation of having completed this course within the past 12 month period.

The course for UNM nurses is available as a self-learning computer-based instructional program and includes a competency quiz. This course was developed by the RSO and is managed through the nurse educators at UNMH.

I. **Course Name: “Fluoroscopy Training Program”**

This course is available on Learning Central as a self-learning program for workers whose job description requires them to operate or assist in the operation of fluoroscopy machines. The class teaches radiation safety techniques and strategies in helping to reduce radiation dose to patient and operator while optimizing image quality.

The course for UNM fluoroscopy users is available as a self-learning computer-based instructional program and includes a competency quiz. This course was developed by the Medical Physics group and is managed through the radiology educators at UNMH.

J. **Course Name: “Nuclear Medicine Radiation Safety Training Programs”**

The following training courses are available:

1. **“Radiation Safety in Nuclear Medicine”**. The intended audience is Nuclear Medicine Technologists and Authorized Users. The course is required initially and annually thereafter. The course is available as a self-learning computer-based training program with a competency quiz.

2. **“Radiation Safety Orientation for Nuclear Medicine Technology Students”**. This class is presented live by the RSO, or designee, to new arriving students in the Allied Health School as a live program, at the beginning of the school year.
3. **“US Department of Transportation Hazardous Materials Training”**. This course is required for workers whose job description requires the receipt, processing, or shipping out of radioactive material packages. The course must be completed initially and at 3-year intervals, with documentation readily available in the applicable department.
4. **“Radioactive Material Spill Response Training”**. This course is presented live by the RSO or designee for Nuclear Medicine staff. The desired repetition time is annual.



## Attachment E

### Forms\*

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<b><u>FORM ID #:</u></b>	<b><u>NAME OF FORM:</u></b>
RSF-01	“Permit Application For Use Radioactive Materials or Radiation-Producing Machines”
RSF-02	“Radioactive Waste Pick-up”
RSF-03	“Animal Radionuclide Research Approval”
RSF-10	“Transfer of Radioactive Material”
RSF-50	“Radiation Badge Request Application” - on-line application - contact RSO
RSF-54	“Declaration of Pregnancy”
RSF-53-1	“Lost Dosimeter Report”
RSF-60-1	“Radiation Worker’s Training & Experience”
RSF-80-1	“Radiation-Producing Machine Information”
RSF-82	“Authorization for Analytical X-Ray Device”

**Copies of Radiation Safety Forms may be obtained from the UNM HSC Office of Research Radiation Safety website at**

**[http://hsc.unm.edu/som/research/radiation\\_safety/index.html](http://hsc.unm.edu/som/research/radiation_safety/index.html)**

**or by contacting the UNM Radiation Safety Officer.**

**\*Form numbers may change as SOP’s are updated and revised. Contact UNM Radiation Safety for most current version.**

## Attachment F

### Description of acronyms

Acronym	Description
AIR	Annual inventory reconciliation
ALARA	As low as reasonably achievable
AMP	Authorized Medical Physicist
ANP	Authorized Nuclear Pharmacist
AU	Authorized User
CFR	Code of Federal Regulations
DIS	Decay in storage
DOT	Department of Transportation
DPM	Disintegrations per minute
DPW	Declared pregnant worker
HRA	High radiation area
HSC	Health Sciences Center
HUS	Human Use Subcommittee
IACUC	Institutional Animal Care and Use Committee
IRB	Institutional Review Board
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NRC	Nuclear Regulatory Commission
NSTS	National Source Tracking System
PH	Permit Holder
RAM	Radioactive materials
RAML	Radioactive materials license
RAMQC	Radioactive materials in quantities of concern
RCB	Radiation Control Bureau
RCC	Radiation Control Committee
RSM	Radiation Safety Manual
RSO	Radiation Safety Officer
SOU	Supervisor of Use
SRMC	Sandoval Regional Medical Center
UNM	University of New Mexico
UNMH	University of New Mexico Hospital
UNMPD	University of New Mexico Police Department
VHRA	Very high radiation area
WDS	With direct supervision
WOS	Without supervision

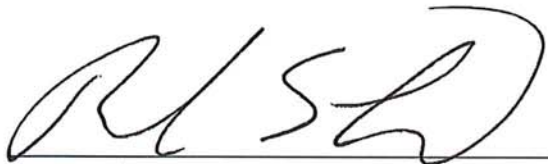
**Attachment G**

**UNM Radiation Safety Manual  
Revision: December 1, 2018  
Signature Page**

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Approved By:  12/19/18  
UNM Radiation Safety Officer Date

Approved By:  12/19/18  
UNM Radiation Control Committee Chair Date

Approved By:  12/19/18  
Licensee Management Representative Date