

**BY ORDER OF THE  
SUPERINTENDENT**

**HQ UNITED STATES AIR FORCE ACADEMY  
INSTRUCTION 40-201**

**07 APRIL 2003**

**Medical Command**

**USAF ACADEMY IONIZING RADIATION  
PROTECTION PROGRAM**



**COMPLIANCE WITH THIS PUBLICATION IS MANDATORY**

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This instruction implements AFD40-2, *Radioactive Materials (Non-Nuclear Weapons)*. Because the United States Air Force Academy (USAFA) is committed to keeping individual and collective radiation doses as low as reasonably achievable (ALARA), this instruction mandates an administrative organization for radiation safety and establishes ways to foster the ALARA concept. The organization includes a radiation safety committee (RSC), a permit radiation safety officer (PRSO) for each permit, and the USAFA base radiation safety officer (BRSO). See **Attachment 1** for a listing of references, abbreviations, acronyms, and terms.

### **SUMMARY OF REVISIONS**

Names and Office symbols were updated. A bar ( | ) indicates revisions from the previous edition

## **1. Responsibilities:**

### **1.1. The Radiation Safety Committee:**

1.1.1. Shall be established in accordance with Federal regulations and radioactive material permit requirements. In order to establish a quorum and conduct business, one-half or more of the RSC membership must be present, including the Chairperson, Base Radiation Safety Officer, Nuclear Medicine Permit Radiation Safety Officer (RSO), and Physics Department Permit RSO or their alternates. Although a Nursing Representative is a member of the RSC, regular attendance is not required unless requested by one of the committee members. The USAFA RSC primary and alternate members shall be designated, in writing, by their commanders and include the following:

1.1.1.1. The 10th Medical Group Commander (Chairperson) or designated alternate.

1.1.1.2. The Base Radiation Safety Officer or designated alternate.

1.1.1.3. A recorder to be furnished by the 10th Medical Group.

1.1.1.4. The 10th Medical Group Permit RSO for Nuclear Medicine or designated alternate.

1.1.1.5. The Physics Department Permit RSO or alternate listed on the permit.

1.1.1.6. A 10th Medical Group Nursing and Dental Service Representative may also be required to attend to discuss ALARA issues if personnel frequent a Radiation Area.

1.1.2. Appoints permanent advisors and assigns specific responsibilities as indicated below. Their attendance at RSC meetings will be at the request of the RSC Chairperson or BRSO, and they will normally be present only when their specialty is to be discussed.

1.1.2.1. The Chief of Contracting (10 MSG/LGC) will appoint a permanent technical advisor and alternate. These individuals will be responsible for developing written procedures that ensure non-Air Force organizations do not begin activities involving the use of radioactive materials unless approval has been granted by the RSC or BRSO.

1.1.2.2. The Supply Contractor (10 MSG/LGR) will appoint a permanent technical advisor. This individual will be responsible for ensuring that neither radioactive materials nor items containing radioactive materials are backordered or issued without authorization of the RSC or BRSO.

1.1.3. Thoroughly reviews the qualifications of each radioactive material permit applicant to ensure that the applicant will be able to maintain exposure ALARA with the intended types and quantities of materials and methods of use.

1.1.4. Reviews the efforts of the applicant to maintain exposure ALARA when considering a new use of radioactive byproduct material.

1.1.5. Ensures that users of ionizing radiation sources justify their procedures and that individual and collective doses are ALARA.

1.1.6. Delegates authority to the individual permit RSOs to enforce the ALARA concept.

1.1.7. Supports the permit RSOs when they must assert their authority. If the RSC overrules a permit RSO, it records the basis for its action in the minutes of the quarterly meeting.

1.1.8. Encourages all users of ionizing radiation sources to review current procedures and to develop new procedures as appropriate to implement the ALARA concept.

1.1.9. Reviews occupational radiation exposure quarterly with particular attention to instances, which exceed action levels specified in this instruction. These reviews assess trends in occupational exposures, serve as an index of the USAFA ALARA Program quality, and indicate the need to investigate why action levels were exceeded.

1.1.10. Evaluates our institution's overall efforts annually for maintaining exposures ALARA. This includes reviews of operating procedures and past dose records, inspections, and consultations with the US Air Force Radioisotope Committee (RIC) or outside consultants.

1.1.11. Reviews proposed modifications to operating procedures, maintenance procedures, equipment, and facilities to determine if they will reduce exposure. If the proposed modifications are reasonable, improvements must be timely and demonstrable. If, in their judgment, the cost is unjustified, documents the reasons for this decision.

## 1.2. USAFA Base Radiation Safety Officer:

1.2.1. Shall be appointed, in writing, by the Superintendent (HQ USAFA/CC) and shall be the Bioenvironmental Engineer (710 MDOS/SGPB). Note that the level of command required for authorization must come from the commander with control over radioactive materials at 10th Medical Group and the Dean of Faculty organizations.

1.2.2. Establishes base ionizing radiation safety program. Serves as the focal point for radiation safety and radioactive material disposal issues as specified in Air Force Instructions and Technical Orders.

1.2.3. Maintains and annually updates master inventory of all radioactive material, licensed or not, owned and operated on base. The inventory must include a detailed location and an area point of contact. A general description of each radioactive material and its use must also be provided. Provide copies of inventory to the Air Base Wing Commander (10 ABW/CC), Fire Chief (10 CES/CEF/CC), Chief of Civil Engineering Readiness Flight (10 CE/CEX), Command Post (10 ABW/CP), Security Police Squadron Commander (10 SFS/CC), and Ground Safety (USAFA/SE). Other radiation sources (x-ray machines, radio-frequency radiation emitters, lasers, etc.) are identified and evaluated through industrial hygiene surveys.

1.2.4. Briefs the Quality of Life Leadership Council on all Radioactive Material (RAM) locations, uses, and changes as required but at least annually.

1.2.5. Reviews occupational exposures and the external radiation exposures of authorized employees quarterly to determine that exposures are ALARA. Prepares a summary report for the RSC. Selects personnel to be monitored as part of the Air Force Thermoluminescent Dosimeter (TLD) program and manages this program in accordance with AFI48-125, *The US Air Force Personnel Dosimetry Program*. Documents briefing of personnel on proper wear and storage of TLDs at time of issue.

1.2.6. Reviews all locations where personnel may receive exposures to ionizing radiation at least annually. Identify radiation hazard areas, ensure they are properly posted, periodically survey these areas, and recommend procedures and policies to the commander and other responsible personnel.

1.2.7. Ensures that ionizing radiation workers receive briefings and educational sessions on ALARA Program concepts. This is the responsibility of the permit RSO or work place supervisor.

1.2.8. Ensures that authorized users, workers, and ancillary personnel who may be exposed to ionizing radiation receive instruction on ALARA policy.

1.2.9. Helps all users and workers develop ALARA procedures for working with radioactive materials.

1.2.10. Certifies the procedures to receive and evaluate suggestions of individual workers for improving health physics practices; encourages the use of those practices and procedures.

1.2.11. Coordinates with the USAF Radioisotope Committee on requests for new RAM permits and changes to existing RAM permits. Acts as the central point of contact (POC) for all requests to use RAM or devices on USAFA. Reviews and approves or disapproves all requests for licensing of RAM.

1.2.12. Reviews and coordinates all unit and work area instructions covering radiation protection.

1.2.13. Reviews, approves, and monitors contractor use of radioactive materials on USAFA.

1.2.14. Obtains disposal and recycling instructions for low-level radioactive waste as specified in Air Force Technical Orders. Assists equipment custodians and unit personnel with implementing disposition instructions and complying with all applicable regulations.

1.2.15. Monitors the receipt, transfer, and shipment of radioactive materials to and from USAFA.

1.2.16. Responds to incidents or accidents involving radioactive materials. Assists on-scene commander with controlling hazards of incident or accident. Reports incident or accident to USAF Radioisotope Committee Secretariat (HQ AFMOA/SGOR) in accordance with AFI40-201, *Managing Radioactive Materials in the US Air Force*.

### 1.3. Permit Radiation Safety Officers:

1.3.1. Review radiation levels in restricted and unrestricted areas quarterly and prepare a summary report for the RSC.

1.3.2. Investigate all known instances of deviation from good ALARA practices and, if possible, determines the cause or causes. When the cause or causes are known, the RSC will require changes in the program to maintain exposures ALARA.

1.3.3. Report incidents or accidents with RAM to the BRISO within 1 hour of occurring.

1.3.4. Are responsible for implementation of actions consistent with Air Force RAM permits. Conducts swipe sampling and or leak testing and radioactive materials inventory in accordance with permit, AFI40-201, and any applicable Technical Order directives. Forwards copy of leak test results and inventory to BRISO for review. Requests support from BRISO for annual area surveillance and annual ALARA training. Maintains all permit documentation for a minimum of 3 years and inventories a minimum of 5 years. Inventories shall include date of inventory, model number and serial number of each source as applicable, identity and quantity of radionuclide, location of each source, and the signature of the PRSO.

1.3.5. Annually report radionuclide emissions based upon possession limits in accordance with 40 CFR 61, *Compliance Procedures Methods for Determining Compliance with National Emission Standards for Radionuclides*, to the BRISO.

1.3.6. Are the point of contact for all Air Force Inspection Agency (AFIA) and Nuclear Regulatory Commission (NRC) inspections for respective permit.

1.3.7. Report any incidents or accidents involving permitted materials to the BRISO within 1 hour of discovery. Further notifications will be conducted in accordance with AFI40-201, paragraph 3.11.

### 1.4. Work Area Supervisors of Ionizing Radiation Equipment or RAM:

1.4.1. Ensure all personnel who work with radiation emitters are properly trained on the potential hazards. Training must be documented on the individual's AF Form 55, **Employee Safety and Health Record**.

1.4.2. Establish a work area operating instruction (OI) for radiation protection. Ensure the program covers all work area requirements. Coordinate work area instructions pertaining to radiation protection with the BRISO before printing. Obtain designation as user of RAM as required in individual permit prior to use of RAM. Comply with all permit requirements. Report incidents or accidents to PRSO immediately.

1.4.3. Ensure the names and telephone numbers of the BRSO, and emergency notification procedures in the event of an accident, are posted in the work area.

1.4.4. Ensure all ionizing radiation workers on the Air Force Dosimetry Program receive annual ALARA training. Train on specific operating procedures in the work area to keep exposures to a minimum.

1.4.5. Immediately notify the BRSO following a radiation accident or incident. Do not change the set-up of anything involved. Collect all pertinent information concerning the accident or incident and draft a detailed sketch of what happened. Take photos, if possible. Assist BRSO in conducting investigation and implement recommendations BRSO presents to prevent future incidents or accidents.

1.4.6. Ensure a copy of this instruction is maintained in each work area where radioactive materials or x-ray producing equipment is maintained, stored, or used.

1.4.7. Review AF Form 1527, **History of Occupational Exposure to Ionizing Radiation** and report errors to the BRSO. Ensure a copy of each AF Form 1527 is returned to the BRSO with certification that it was received by the employee. Ensure all monitored personnel review these reports.

1.4.8. Ensure individual dosimeters are available for exchange at the end of each monitoring period.

1.4.9. Immediately refer pregnant workers to Public Health (710 MDOS/SGPM, 333-5186).

#### 1.5. **Prospective and Authorized RAM Users:**

1.5.1. Obtain designation as user as required by individual radioactive material permit prior to use of RAM. This designation is requested through the PRSO.

1.5.2. Consult with and receive the approval of the BRSO and the RSC during the planning stage before using radioactive materials in a new way.

1.5.3. Evaluate all methods of use before using radioactive materials to ensure that exposures will be kept ALARA. Users may employ trial runs for this evaluation.

1.5.4. Ensure that the USAFA RSO reviews all plans for modifying or designing facilities that involve using radioactive material or radiation-producing devices so that ALARA is considered.

1.5.5. Explain to all supervised individuals the ALARA concept and the need to maintain exposures ALARA. Comply with all permit requirements.

1.5.6. Ensure that workers who have access to radiation areas are trained and educated in good health physics practices and in maintaining exposures ALARA.

1.5.7. Immediately report any incident or accident involving RAM to the PRSO.

#### 1.6. **RAM Users Procuring Radioactive Materials Using the Government Purchase Card (GPC):**

1.6.1. Only the Physics Department (HQ USAFA/DFP) PRSO or alternate designated on the permit is allowed to purchase permitted radioactive materials with the GPC.

1.6.2. The requested radioactive material must already be authorized by the HQ USAFA/DFP permit and shall not exceed the authorized amount or scope of authorized use on the permit. The

PRSO or alternate shall provide to the BRSO vendor documentation that indicates at a minimum, catalog number, nuclide, and radioactivity of the requested material.

1.6.3. The BRSO shall provide Mission Support Group Logistics 10 MSG/LGRD with a memo (courtesy copies to Physics Department RSO and the Hazardous Material Pharmacy) authorizing the Physics Department RSO or alternate to order radioactive material. This memo shall include:

- 1.6.3.1. Number of sources of a particular nuclide to be purchased.
- 1.6.3.2. Radioactivity and nuclide of each source.
- 1.6.3.3. Catalog number of each source.
- 1.6.3.4. Authority to issue a control number for GPC card purchases only.

#### **1.7. Individuals Who Receive Occupational Radiation Exposure:**

1.7.1. Must receive minimum instruction in the ALARA concept and its relationship to work procedures and work conditions. This training will include:

- 1.7.1.1. Risks from radiation exposure.
- 1.7.1.2. Health risks to children of women who are occupationally exposed to radiation during pregnancy.
- 1.7.1.3. Maximum permissible dose limits.
- 1.7.1.4. Protective measures required in work areas.
- 1.7.1.5. ALARA philosophy and practice.
- 1.7.1.6. Resources available if they feel that ALARA is not being promoted on the job.
- 1.7.1.7. Opportunities to participate in drafting procedures they will be required to follow.

1.7.2. Comply with work area instructions and permit conditions.

1.7.3. Wear TLDs with name side away from the body at all times in radiation areas. Report missing or damaged TLDs immediately. Store TLD with control badge when not worn.

1.7.4. Report suspected overexposures immediately to the work area supervisor.

1.7.5. Report ionizing radiation exposures from outside employment and provide dosimetry results to the BRSO.

1.7.6. Keep ionizing radiation exposures to self and others ALARA.

1.7.7. Review SDRD Listing 1499-1, and AF Form 1527 as provided, and notify the work area supervisor of any errors noted. Certify that you received AF Form 1527 on one copy of the form and return this certification copy to the work area supervisor.

1.7.8. Report intentional abuse of the dosimetry program.

1.7.9. Immediately report suspected pregnancy to supervisor.

#### **1.8. Organizations Acquiring the Use or Purchase of Radioactive Materials on USAFA Through Any Contracting Mechanism (Corp of Engineers, Saber, Ft. Carson, etc.):**

1.8.1. Agency will contact the BRSO prior to developing the requirements document. The BRSO will assist the using activity, as necessary, in obtaining an accurate commercial description of the

requirements for use of radioactive materials required under contract. All requirement documents containing radioactive materials requirements must be approved by the BRSO prior to forwarding the purchase request package to contracting for purchasing action. Ensure that all contracts requiring the use of radioactive materials on USAFA include a requirement for the BRSO's approval prior to bringing the material on installation. As a minimum, the requirements document should contain the following:

1.8.2. Non-Air Force Organizations that bring radioactive materials on the installation or conduct operations using radioactive materials on base must get approval from the BRSO. To get this approval, the requesting organization must send a request, in writing, to the BRSO:

**710 MDOS/SGPB**

**2355 Faculty Drive, Suite 1A207**

**USAFA Academy, CO 80840**

The BRSO must be notified at least 30 calendar days in advance of the date any contractor or outside agency plans to bring radioactive material onto the base.

1.8.3. To obtain an approval, all contractors must make available for review the following information:

1.8.3.1. A brief description of the proposed activities:

1.8.3.2. A copy of a valid Nuclear Regulatory Commission (NRC) Radioactive Material License or Agreement State Radioactive Materials License (which must be current). All amendments must be included.

1.8.3.3. Non-Air Force organizations that don't have an NRC permit and who are not Department Of Energy (DoE) or DoE prime contractors exempted from licensing must contact (through BRSO) Radioisotope Committee (AFMOA/SGPR) for guidance and approval to use radioactive materials on an Air Force installation.

1.8.3.4. The name, local address, and phone number of the PRSO named on their license.

1.8.3.5. A copy of the portion of the Air Force contract describing the work to be done and inclusive date.

1.8.3.6. Copies of training certificates for authorized users.

1.8.3.7. A copy of most recent leak test results (not over 180 days old).

1.8.3.8. An acknowledgment that the BRSO has authority to suspend contractor operations believed to be unsafe and the right to make periodic checks.

1.8.4. Contractors will not bring radioactive materials onto USAFA without written consent of the BRSO. Permission, if granted, will be only for the activities and isotopes specified in the documents submitted.

1.8.5. Use of radioactive material will be minimized consistent with Air Force requirements.

1.8.6. Every accident or incident involving licensed radioactive material will be reported to the BRSO immediately.

1.8.7. The BRSO may terminate permission to use radioactive materials at any time for violation or noncompliance with NRC, US Air Force, State, or other regulatory requirements.

1.8.8. Transportation and Control of Radioactive Materials while on USAFA will be conducted in accordance with 49 CFR 172.500 through 49 CFR 172.556, *Transportation Requirements*.

1.8.9. Vehicles transporting radioactive material will be marked when required by regulation with the appropriate radioactive material warning placards affixed to a conspicuous place on each side of the transport vehicle.

1.8.10. The source will be transported in the original manufacturer's shipping container or equivalent type "A" shipping container.

1.8.11. The isotope will be secured via lock and key when not in actual use.

1.8.12. Radioisotopes will not be kept on base overnight without specific permission from the BRSO.

**1.9. Traffic Management Office, 10 MGS/LGRDS:**

1.9.1. Packages and ships all radioactive materials in accordance with Department of Transportation (DOT) requirements. Obtains technical guidance from BRSO as needed to accomplish this task.

1.9.2. Maintains written procedures and log for processing and monitoring of inbound and outbound radioactive shipments.

1.9.3. Notifies Base Radiation Safety Officer within 3 hours of a package received with DOT White or Yellow Radioactive Materials labels. Places hold on package pickup until Base RSO or designated representative accomplishes safety survey. Assists Base RSO in performing the safety survey as necessary.

1.9.4. Notify the BRSO, **prior to shipment**, of any outgoing packages that contain radioactive material. Provide the BRSO with identity of shipper, appropriate point of contact, and telephone number. Radioactive material packages must not be shipped without BRSO approval.

**1.10. Base Supply, 10 MSG/LGRDS:**

1.10.1. Maintains an unrestricted radioactive material storage area, if needed, for serviceable excess or unserviceable stock-listed commodities (containing radioactive materials) which have been turned in by using organizations for return to stock or for disposition decision. The storage area will remain an unrestricted area as long as no more than 100 radioactive electron tubes and or spark gaps are stored there and the radiation dose rate outside the bins remains below 2 millirems per hour according to the *Requisition, Handling, Storage and Identification of Radioactive Material Technical Order (TO)*, T.O. 00-110N-3.

1.10.2. Posts a completed Radioactive Material Warning Placard in the area.

1.10.3. Posts a completed Radioactive Material Warning Label in or on each bin containing a radioactive commodity.

1.10.4. Contacts the BRSO if the number or type of items in storage increase beyond a total of 100 items, including lensatic compasses.

1.10.5. Establish written procedures for handling radioactive items turned in by organizations or individuals. Procedures must specifically address radioactive items turned in to the Individual Equipment Issue Element and provide appropriate instructions for all personnel on handling, storage, requesting disposition instructions, and shipping of radioactive items. This instruction provides guidance on writing OIs.

#### 1.11. Security Police:

1.11.1. Attempt to identify and stop all contractors or contractor vehicle operators from bringing radioactive materials onto installation without authorization from the BRSO.

1.11.2. Verification of transport authorization may be obtained by calling Bioenvironmental Engineering.

1.11.2.1. Our contact numbers are:

Office: 333-4825

Pager: 593-6171 (24 hr)

Cell: 440-6123

## 2. Radioactive Material Disposal:

2.1. Owners must report excess serviceable or repairable items containing radioactive material to the BRSO when they are no longer required locally.

2.2. Radioactive Electron Tubes and Spark Gaps will be disposed of in accordance with T.O. 00-110N-7S-2, *Handling and Disposition of Radioactive Electron Tubes and Spark Gaps*.

2.3. Generators of other radioactive materials requiring disposal shall submit to the BRSO a written request for disposal guidance. The request must contain as much of the following information as possible: name of item, quantity, radionuclide, physical form of the radionuclide (solid, liquid, gas), chemical form of the radionuclide, National Stock Number (NSN), activity of the item in millicuries, and the name and phone number of the POC.

2.4. The owner of the radioactive material is responsible for scheduling radioactive disposal and or recycling shipment with the Traffic Management Office and the Base RSO, and implementing all disposal or recycling guidance obtained. The Traffic Management Office is responsible for shipping radioactive materials/items in accordance with U.S. DOT requirements.

## 3. Static Displays, 10 MSG/LGR:

3.1. The Logistics Plans and Programs Office (10 MSG/LGR/333-4250) maintains the radiation safety record for each historical aerospace vehicle they manage in accordance with AFI84-103, *U.S. Air Force Heritage Program*. These records will detail all radioactive commodities present in each vehicle as documented by initial and periodic radiation surveys.

3.2. The BRSO and the static display manager will coordinate and perform necessary radiation surveys. The static display monitor will contact the BRSO within 6 months of the arrival of any new static display. The BRSO will conduct a radiation survey in coordination with the item manager and document findings on AF Form 3583, **USAF Museum Aerospace Vehicle Static Display/Component Radiation Survey Log**, and/or AF Form 3584, **USAF Museum Aerospace Vehicle Static Dis-**

**play/Component Radiation Swipe Log.** If radioactive materials are determined to be present in a static display vehicle, the BRSO will ensure radiation exposures to AF personnel and the public are kept within acceptable limits.

3.3. Historical radiation logs for each radioactive item must be updated at least once every 3 years. The BRSO will conduct a radiation survey of the display to determine if there were any changes since the previous survey.

3.4. If radioactive material is found to be present in a static display, all maintenance activity for the radioactive components must be coordinated through the BRSO. Radioactive components must never be sanded, ground, machined, drilled, etched, or subjected to any process, which produces respirable particles or changes the form of the component.

3.5. Report any damage to radioactive components of static displays to the BRSO immediately.

#### 4. Emergencies Involving Radioactive Materials:

4.1. Any incident involving radioactive materials must be reported immediately to the Fire Department (ext. 911). The Fire Department maintains a listing of all RAM storage locations.

4.2. Also, immediately notify Bioenvironmental Engineering. Our contact numbers are listed in paragraph 1.11.2.1.

4.3. Emergencies involving radioactive materials will be reported to the USAF Radioisotope Committee as outlined in AFI40-201. The BRSO and Bioenvironmental Engineering personnel are authorized to conduct this reporting as specified in AFI40-201.

#### 5. Monitoring Individual Radiation Exposures:

5.1. **Occupational External Radiation.** When any occupational external radiation dose exceeds established limits specified in Table One, the USAFA and permit RSO investigates the cause of the abnormal exposure according to AFI48-125. The RSC reviews investigation results. The BRSO must follow the procedures outlined in AFI48-125 when conducting this investigation.

**Table 1. Abnormal Exposure Levels.**

| Exposure Type    | Monthly (REM) | Quarterly (REM) |
|------------------|---------------|-----------------|
| Lens of the Eye  | 1.250         | 3.750           |
| Head             | 0.417         | 1.250           |
| Extremity        | 4.160         | 12.500          |
| Shallow – Skin   | 4.170         | 12.500          |
| Sum of Deep Dose | 4.170         | 12.500          |
| Neutron          | 0.000         | 0.000           |
| TEDE             | 0.417         | 1.250           |

5.2. **Investigations and Action Levels.** The RSC reviews the justification for and approves all revisions of Action Levels. The following actions occur at the levels listed in Table Two.

5.2.1. An individual dose that is less than the action level requires no action unless deemed necessary by the BRSO or PRSO.

5.2.2. An individual dose equal to or greater than the action level (Dose  $\geq$  Action Level).

5.2.2.1. The individual is contacted by the BRSO to determine why action level was exceeded. The BRSO or PRSO reports the results at the next RSC meeting following the quarter the dose was recorded.

5.2.2.2. The RSC reviews each dose and compares it to doses of other workers performing similar tasks.

5.2.2.3. A written report of the investigation must be completed and submitted to the RSC. This report may be part of the standard report on TLD monitoring results.

**Table 2. Radiation Exposure Action Levels.**

| LOCATION         | TYPE DOSE        | ACTION LEVEL (REM) | MONITORING PERIOD |
|------------------|------------------|--------------------|-------------------|
| Radiology        | Eye              | 0.375              | Quarterly         |
| Area B           | Head             | 0.125              |                   |
| 10 % of ABNORMAL | Extremity        | 1.250              |                   |
|                  | Shallow – Skin   | 1.250              |                   |
|                  | Deep - B/G/X-Ray | 1.250              |                   |
|                  | Deep – Neutron   | 0.000              |                   |
|                  | Total Effective  | 0.125              |                   |
|                  |                  |                    |                   |
| Mammography      | Eye              | 0.188              | Quarterly         |
| Area C           | Head             | 0.063              |                   |
| 5 % of ABNORMAL  | Extremity        | 0.630              |                   |
|                  | Shallow – Skin   | 0.630              |                   |
|                  | Deep - B/G/X-Ray | 0.630              |                   |
|                  | Deep – Neutron   | 0.000              |                   |
|                  | Total Effective  | 0.063              |                   |
|                  |                  |                    |                   |
| Nuclear Medicine | Eye              | 0.375              | Quarterly         |
| Area D           | Head             | 0.125              |                   |
| 10 % of ABNORMAL | Extremity        | 1.250              |                   |
|                  | Shallow – Skin   | 1.250              |                   |
|                  | Deep - B/G/X-Ray | 1.250              |                   |
|                  | Deep – Neutron   | 0.000              |                   |
|                  | Total Effective  | 0.125              |                   |
|                  |                  |                    |                   |
| Cat Scan         | Eye              | 0.188              | Quarterly         |

| LOCATION           | TYPE DOSE        | ACTION LEVEL (REM) | MONITORING PERIOD |
|--------------------|------------------|--------------------|-------------------|
| Area G             | Head             | 0.063              |                   |
| 5 % of ABNORMAL    | Extremity        | 0.630              |                   |
|                    | Shallow – Skin   | 0.630              |                   |
|                    | Deep - B/G/X-Ray | 0.630              |                   |
|                    | Deep - Neutron   | 0.000              |                   |
|                    | Total Effective  | 0.063              |                   |
|                    |                  |                    |                   |
| DFP, Physics Dept. | Eye              | 0.375              | Quarterly         |
| Area P             | Head             | 0.125              |                   |
| 10 % of ABNORMAL   | Extremity        | 1.250              |                   |
|                    | Shallow - Skin   | 1.250              |                   |
|                    | Deep - B/G/X-Ray | 1.250              |                   |
|                    | Deep - Neutron   | 0.000              |                   |
|                    | Total Effective  | 0.125              |                   |

**5.3. Pregnancy Procedures.** A pregnant employee's monthly dosimetry results must not exceed 0.05 REM per month or exceed the 0.500 REM exposure limit for the fetus during the term of the pregnancy. If the dose to the embryo/fetus is found to have exceeded 0.500 REM prior to declaring the pregnancy, the dose thereafter shall not exceed 0.05 REM. Personnel dosimetry results, which meet or exceed these levels, must be investigated and the results of the investigation reported to the RSC. (**NOTE:** Female employees should confirm any suspected pregnancy as soon as possible and notify their immediate supervisor. Bioenvironmental Engineering will place those women on the monthly monitoring program for the duration of the pregnancy.)

**6. Using Radioactive Materials Safely.** Proven protective measures in handling radionuclides prevent exposure to radioactive materials above the maximum permissible levels. Such measures maintain exposures ALARA and minimize entry of radionuclides into the body by ingestion, inhalation, absorption, or through open wounds when workers handle unconfined radioactive materials. Safety requires positive planning and diligent execution of procedures beyond the usual care taken in work with other materials. Workers must analyze in advance the hazards of each job, guard against foreseeable accidents, and use protective devices and planned emergency procedures if accidents do happen.

**6.1. Creating ALARA Operating Instructions.** Each permit RSO or supervisor of areas where ionizing radiation sources are used must prepare an OI governing the safe use of radioisotopes and other sources of ionizing radiation including a signature block for the USAFA RSO on the signature page. Each OI must incorporate these general guidelines for the safe handling of radiation sources including both external and internal radiation hazards.

6.1.1. An external radiation hazard derives from any source located outside the body that can emit radiation which penetrates tissue (i.e., gamma, x-rays, and neutrons). Three important factors in working with this hazard are time, distance, and shielding. Consider the following:

6.1.1.1. Plan to limit exposure during the course of work and stay out of controlled areas unless entry is required.

6.1.1.2. Handle radioactive materials with tongs or long-handled tools when feasible, remembering that doubling the distance from a radioactive source decreases the exposure to one quarter of the original level.

6.1.1.3. Shielding is a complex issue and must be discussed on a case-by-case basis at the time the USAFA RSO reviews area radioactive work procedures.

6.1.2. An internal radiation hazard occurs when use of a source presents a potential for ingestion, inhalation, absorption, or entry through an open wound. In addition to time, distance, and shielding, the following guidelines help limit internal radiation hazards and maintain exposures to ALARA levels:

6.1.2.1. Hands should be washed frequently through the workday, particularly before eating or smoking, and at the end of each day.

6.1.2.2. No edibles of any kind are to be brought into radioisotope work areas.

6.1.2.3. Workers should refrain from using personal items (i.e., pocket knives, handkerchiefs, lipsticks, etc.) in radioisotope work areas.

6.1.2.4. Workers with open wounds should not handle radioactive materials without adequate waterproof covering of the wound.

6.1.2.5. Mouth pipetting of solutions containing radioactive materials is strictly forbidden. Pipetting of these solutions should be done with a suction device.

6.1.2.6. Workers should frequently survey the hands, uncovered skin, and clothing during procedures and take immediate steps to remove contamination if detected. Workers must report any incidents of skin or clothing contamination to the appropriate permit RSO as soon as possible after discovery. The permit RSO will then notify the USAFA RSO.

6.1.2.7. A baseline urinalysis should be established for workers who are potentially exposed to tritium.

6.1.2.8. Local exhaust ventilation may be required to control personal exposures. If work includes liquid, gaseous, or powdery materials, consult the USAFA RSO.

6.1.2.9. Protective garments for low-level work should include laboratory coats, shoe protection in the form of simple cloth or plastic covers, rubber or plastic gloves, and eye protection.

6.1.2.10. Advance preparations should be made to minimize leaks, spills, or other losses. Consideration should be given to the physical state of the material being handled. Drip pans, splash guards, absorbent paper, strippable floor and counter coverings, and similar inexpensive provisions greatly reduce the need for decontamination, surveys, and replacement of permanent facilities if a spill occurs.

**7. Personnel Decontamination.** There are special techniques for the removal of radioactive contamination from the skin, hair, etc. These techniques reduce radiation exposure promptly, minimize absorption of radionuclides into the body, and keep localized contamination from spreading.

7.1. **Immediate Steps.** Decontamination should begin as soon as contamination is detected. It should continue until no activity is detected with appropriate survey instruments. The only exception is if the skin becomes thin or reddened. The health of the skin must be maintained to minimize absorption and internal deposition.

7.2. **Procedures.** Each permit RSO should incorporate the following procedures into an OI for each area where radioactive materials are used.

7.2.1. Don suitable protective clothing such as laboratory smocks and surgeons' rubber gloves.

7.2.2. Make a quick survey of exposed skin, hair, and clothing to determine location of contamination.

7.2.3. Localize the area to be decontaminated so that the radioactive materials are not spread to other areas of the body.

7.2.4. Carefully remove contaminated garments, if necessary.

7.2.5. Wash the affected area with soap and water. Keep radioactive materials out of eyes, nose, and mouth, and minimize spread to any clean area of the body.

7.2.6. Dry thoroughly and repeat survey.

7.2.7. If contamination is present, repeat the shower with scrubbing, taking care not to damage the skin.

7.2.8. Decontaminate hair by repeated application of liquid soap and rinse water, using towels to keep water from running onto the face and shoulders. If contamination remains and is not being reduced after three such washings, a physician should be notified.

7.2.9. If contamination is found in the eyes, mouth, or an open wound, flush copiously with water and contact a physician immediately for further instructions.

7.3. **Decontamination Kit.** Each work area where radioactive materials are handled must maintain a personnel decontamination kit containing the following:

7.3.1. Two pairs of surgical gloves.

7.3.2. Two packages of cotton-tipped applicators.

7.3.3. One soft scrub brush.

7.3.4. A container to hold soap solution.

7.3.5. Liquid soap.

7.3.6. Towel.

7.4. **Wash Disposal.** All washing actions must take place in a stoppered sink, or other suitable provisions must be made to ensure contaminated water isn't released into the sewage system until the USAFA RSC determines that a release will not violate 10 CFR 20.303m, *Standards for Protection Against Radiation*, and that the provisions of TO 00-110N-2, *Radioactive Waste Disposal*, have been followed.

**8. Records.** Bioenvironmental Engineering maintains RSC meeting minutes, RAM continuity binders, and work place case files that are available for official review from those using organizations. All records

for permitted items must be maintained by the PRSO in accordance with the permit. If not specified, records must be maintained for a minimum of 3 years after permit termination.

**9. Conducting Surveys and Inspections.** Surveys and inspections are generally conducted to identify and evaluate radiation sources or the amount of radiation being emitted from sources. Picking the right survey meter is critical in performing an accurate survey. Ability to respond to the radiation being measured, sensitivity, response time, and energy dependence are key characteristics favorable to the radiation being detected. The ADM 300A series radiac meter is a good general-purpose meter utilizing standard, alpha, beta, x-ray, and gamma ray probes for detection.

9.1. Radiation level surveys are conducted to determine dose rate levels in areas where RAM is stored, used, or otherwise handled. All perimeter areas are checked to ensure radiation levels to the general public are not above applicable standards (Ref: 10 CFR 20.1301-1302).

9.2. Contamination surveys are designed to determine if radioactive material is present in an area where it might pose some hazard to personnel or the environment. Surface contamination may be fixed or removable. Removable or loose contamination surveys are based on measurements over an area of 100 centimeters squared. A wipe of the surface is collected to determine if any removable contamination is present. The surface is also checked to ensure the radioactive source is not leaking. Geiger Mueller detectors with thin walls or windows are a good choice for general contamination surveys.

9.3. When conducting surveys, the licensee shall maintain records showing the results of surveys, inspections and calibrations for at least 3 years (Ref: 10 CFR 20.2103(a)). Additionally,

AFI40-201 requires that anytime compliance based surveys are conducted, a dedicated check source must be used to check meter calibration. The check source must be read at the beginning of each day of use of the meter and at any time that damage to the meter is suspected.

**10. Forms Adopted.** AF Form 55, **Employee Safety and Health Record**; AF Form 1527, **History of Occupational Exposure to Ionizing Radiation**; AF Form 3583, **USAF Museum Aerospace Vehicle Static Display/Component Radiation Survey Log**; AF Form 3584, **USAF Museum Aerospace Vehicle Static Display/Component Radiation Swipe Log**.

DONALD R. YOHO, JR, Col, USAF, MC, CFS  
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**Attachment 1****GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION*****References***

**10 CFR Part 20** *Standards for Protection Against Radiation*

**29 CFR 1910.1096** *Ionizing Radiation*

**40 CFR 61** Appendix E, *Compliance Procedures Methods for Determining Compliance with National Emission Standards for Radionuclides*

**49 CFR Parts 171, 172, 173, 175, 177 and 178,** *Transportation Requirements*

**AFI 40-201** *Managing Radioactive Materials in the US Air Force*

**AFI 48-125** *The US Air Force Personnel Dosimetry Program*

**AFI 84-103** *U.S. Air Force Heritage Program*

**AFI 91-204** *Safety Investigations and Reports*

**AFMAN 32-4004** *Emergency Response Operations*

**Technical Manual T.O. 00-110N-10** *Requisitioning, Use, and Disposition of Lensatic Compass FSN 6605-079-0007YS*

**Technical Manual T.O. 00-110N-12** *Requisitioning, Use, Storage, and Disposition of Submersible Wrist Compass NSN 6540-00-382-1000*

**Technical Manual T.O. 00-110N-15** *Requisition, Use and Disposition of Lensatic Compass NSN 6605-00-151-5337YS*

**Technical Manual T.O. 33B-1-1** *Non Destructive Inspection Methods*

**AFOEHL Report 90-211RD00253MRF** *USAF Personnel Dosimetry Program Instruction Manual*

***Abbreviations and Acronyms***

**AFIA**—Air Force Inspection Agency

**ALARA**—As Low As Reasonably Achievable

**BRSO**—Base Radiation Safety Officer

**DOT**—Department of Transportation

**NRC**—Nuclear Regulatory Commission

**NSN**—National Stock Number

**OI**—Operating Instruction

**PRSO**—Permit Radiations Safety Officer

**RAM**—Radioactive Material

**RIC**—US Air Force Radioisotope Committee

**RSC**—Radiation Safety Committee

**RSO**—Radiation Safety Officer

**TLD**—Thermoluminescent Dosimeter

**TO**—Technical Orders

### *Terms*

**Alternate Radiation Safety Officer (RSO)**—An individual fully qualified as an RSO who has been approved by the US Air Force Radioisotope Committee to act in the absence of the named RSO on the permit. An alternate RSO is required during any absence of the named RSO for over 30 days.

**As Low As Reasonably Achievable (ALARA)**—Set of actions taken to reduce personnel exposures to the lowest levels possible, consistent with existing technology, cost, and operational requirements.

**Assistant RSO**—An individual who is not fully qualified as an RSO for a given permit but who has been approved by the US Air Force Radioisotope Committee to perform RSO duties under the supervision of the named RSO to gain experience toward qualifying as an RSO in his or her own right. Naming of an individual as an assistant on a permit provides a way to document a chronology of experience and on-the-job training acceptable to the Nuclear Regulatory Commission (NRC) to meet specific experience requirements under NRC regulations.

**Authorized Users**—An organization authorized by a USAF Radioactive Material Permit to have and use radioactive materials, or a person specifically named on a USAF Radioactive Material Permit to handle or supervise handling radioactive materials listed on the permit.

**Base Radiation Safety Officer (BRSO)**—An individual with the necessary education, military training, and professional experience in radiation protection practice appointed by the installation commander, HQ USAFA/CC or the USAF Radioisotope Committee to manage radiation safety programs. The term “Radiation Safety Officer” is a functional title and does not denote a commissioned status of specialty code. An RSO should be the most technically qualified base and permit Radiation Safety Officers. Specific technical experience and training relating to the permit is necessary to serve as a permit RSO.

**Byproduct Material**—Radioactive material (except source and special nuclear material) yielded in, or made radioactive by, exposure to the radiation incident to producing or using source or special nuclear materials (e.g., Cesium-137, Iodine-131, Cobalt-60).

**Nuclear Regulatory Commission (NRC)**—An agency established by Title II of the Energy Reorganization Act of 1974 (Public Law 93-438) to regulate source, byproduct, and special nuclear materials as provided for by the Atomic Energy Act of 1954 and Public Law 93-438.

**Permit**—For the purpose of this instruction, a US Air Force Radioactive Material Permit.

**Radiation Area**—Means any area, accessible to personnel, in which there exists radiation at such levels that a major portion of the body could receive in any 1 hour a dose in excess of 5 millirem, or in any 5 consecutive days a dose in excess of 100 millirem.

**Survey**—Is defined in 10 CFR 20 as an evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal, or presence of radioactive material or other sources of radiation. When appropriate, such an evaluation includes a physical survey of the location of radioactive material and measurements or calculations of levels of radiation, or concentrations or

quantities of radioactive material present.

**US Air Force Radioactive Material Permit**—Written authorization from the US Air Force Radioisotope Committee for Air Force organizations to receive, possess, distribute, use, transfer, or dispose of radioactive materials. Permits generally parallel NRC licenses in application and scope. Application may be for medical, industrial, research, or a combination. Unlike the NRC, a single permit may combine authorization for byproduct, source, and special nuclear materials. The scope of permits may be broad or limited.

**US Air Force Radioisotope Committee (RIC)**—Coordinates the administrative and regulatory aspects of licensing, possession, distribution, use, transfer, and disposal of all radioactive material in the Air Force except that radioactive material transferred from the Department of Energy to the Department of Defense in nuclear weapons systems, and certain radioactive components of weapons systems. The RIC acts as the single point of Air Force contact with the NRC or Agreement States on licensing. The RIC recommends to the Surgeon General ways to control ionizing radiation hazards and exposures to ionizing radiation from using radioactive material.