

**BY ORDER OF THE COMMANDER
WRIGHT-PATTERSON AIR FORCE BASE**

**WRIGHT PATTERSON AIR FORCE BASE
INSTRUCTION 40-201**



25 JULY 2012

Medical Command

**RADIATION (IONIZING)
SAFETY PROGRAM**

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This instruction describes the responsibilities of all personnel involved with the control and use of radioactive material and radiation-producing devices. It also describes necessary procedures for the implementation of an effective radiation safety program at Wright-Patterson Air Force Base (WPAFB). This instruction applies only to ionizing radiation sources. Non-ionizing radiation sources such as lasers and microwave emitters are not covered by this instruction. This publication does not apply to the Air National Guard or the Air Force Reserve Center (ANG/AFRC) units. Refer recommended changes and questions about this publication to the Office of Primary Responsibility (OPR) using the AF Form 847, *Recommendation for Change of Publication*; route AF Form 847s from the field through the appropriate functional's chain of command. Ensure that all records created as a result of processes prescribed in this publication are maintained in accordance with AFMAN 33-363, *Management of Records*, and disposed in accordance with the Air Force Records Disposition Schedule (RDS) located at <https://www.my.af.mil/afrims/afrims/afrims/rims.cfm>. Governing directives for the radiation safety program are DoDI 6055.8, *Occupational Ionizing Radiation Protection Program*, AFD 40-2, *Radioactive Materials (Non-Nuclear Weapons)*, AFI 40-201, *Managing Radioactive Materials in the USAF*, AFMAN 48-125, *Personnel Ionizing Radiation Dosimetry*, and AFI 48-148, *Ionizing Radiation Protection*. This instruction requires collecting and maintaining information protected by the Privacy Act of 1974 authorized by Section 20.2106(a) and (c), 10 Chapter I, Code of Federal Regulations (10 CFR 20.2106(a)(c)) as directed by E.O. 12196, 29 CFR 1910.96(b)(2)(iii), (n) and (o), implemented by Air Force Manual AFMAN 48-125, *Personnel Ionizing Radiation Dosimetry* and the USAF Master Radiation Exposure Registry.

System of records notice F044 AF SG O, *United States Air Force Master Radiation Exposure Registry*, applies.

SUMMARY OF CHANGES

This revision implements and reflects changes made to AFI 40-201, 16 March 2011, and AFMAN 48-125, 4 October 2011. It must be reviewed in its entirety.

Section A—RESPONSIBILITIES	4
1. The Commander, 88th Air Base Wing, WPAFB, listed hereafter as the Installation Commander, is responsible for:	4
2. The WPAFB Radiation Safety Committee (WPAFB RSC) is responsible for:	5
3. The WPAFB RSO or designated alternate is responsible for:	6
4. The Commander, 88th Medical Group, WPAFB, listed hereafter as the Medical Center Commander, is responsible for:	7
5. Commanders of organizations which use radioactive material or radiation-producing devices are responsible for:	8
6. Permit RSOs or commander designated individual are responsible for:	8
7. Each individual using radioactive material or radiation-producing devices is responsible for:	9
8. Jurisdiction:	9
Section B—PERMITS FOR THE POSSESSION AND USE OF RADIOACTIVE MATERIAL AND RADIATION-PRODUCING DEVICES	10
9. AF License.	10
10. AF Permits.	10
11. WPAFB Permits.	10
12. Other Organizations.	10
13. Permit Requests.	10
14. Permit Authorization.	11
15. Contractors:	11
Section C—DESIGNATION OF AREAS	11
16. The following definitions are extracted from the 10 CFR Part 20:	11
17. Rem in One Hour.	12
Section D—Radiation Exposure Limits	12
18. Personnel Exposure.	12
19. Dose Limits.	12

Table 1. Radiation Workers 12

Table 2. Members of the Public 12

Table 3. Embryo/Fetus 13

20. Occupational Exposure of Fertile Females: 13

Section E—DOSIMETRY 14

21. Radiation Workers. 14

22. Investigative Levels. 17

Table 4. Investigative Levels 17

Section F—ALARA 17

23. ALARA. 17

24. ALARA Commitment. 18

Section G—Training 19

25. Personnel requiring training in radiation safety commensurate with their duties may include: 19

26. Training shall be provided to individuals, who in the course of their duties are likely to receive in a year an occupational dose in excess of 100 millirem: 19

27. Training shall be provided by: 19

28. Training sessions shall include but are not limited to the following: 20

29. Documentation. 20

Section H—ORDERING AND RECEIVING RADIATION SOURCES 20

30. Ordering Radioactive Material. 20

31. Authorization. 20

32. Special precautions shall be taken by the permittee when receiving and opening packages containing radioactive material: 21

Section I—RADIOACTIVE MATERIAL WORK PROCEDURES 21

33. Although each work environment shall necessitate individual work practices, the following procedures shall be incorporated in all radioactive material work procedures: 21

Section J—LEAK TESTING OF RADIOACTIVE MATERIAL (RAM) 22

34. Sealed sources of radioactive material are leak tested at intervals specified in the AF radioactive material permits. 22

35. Analysis. 22

36. Results. 22

37. Leaking Source. 22

Section K—RADIOACTIVE WASTE	22
38. Responsibility.	22
39. Management of Radioactive Waste.	23
Section L—POSTING REQUIREMENTS	26
40. Documents Posted.	26
41. Alternative Posting.	26
42. Radiation Exposure Posting.	27
Section M—EMERGENCY PROCEDURES	27
43. Emergency Situations.	27
44. Response Procedures:	27
45. Generic Emergency Response Procedures:	28
46. Emergency Response Teams:	30
Section N—Reporting Requirements	30
47. Mishaps, Incidents, and Accidents.	30
48. Notice of Violation or Hazard:	30
Table 5. Organizational Addresses and Telephone Numbers	31
Section O—Radon	31
49. Radon Limits.	31
Attachment 1—GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION	32

Section A—RESPONSIBILITIES

1. The Commander, 88th Air Base Wing, WPAFB, listed hereafter as the Installation Commander, is responsible for:

1.1. Ensuring that all installation personnel comply with this instruction. This includes military personnel, civilian employees, contractor personnel and visitors.

1.2. Ensuring that all installation activities comply with applicable federal and AF directives covering the usage of radiation-producing devices the permitting, procurement, storage, handling, accountability for and disposal of radioactive material and the reporting of incidents or accidents to the appropriate authorities.

1.3. Conducting an installation-wide radiation safety program through the Asset Management Division (CEA) under the direction of a WPAFB Radiation Safety Officer (WPAFB RSO).

1.4. Certifying, in writing, that WPAFB is committed to the successful implementation of an As Low As Reasonably Achievable (ALARA) program.

1.5. Designating the Installation RSO (WPAFB RSO) in writing and may designate an Alternate Installation RSO, which may act with full responsibilities of the designated Installation RSO in his/her absence.

1.6. Ensuring that the WPAFB RSO is notified of all planned uses of radioactive material and radiation-producing devices on the installation.

1.7. Enforcing the rule that non-Air Force organizations must have proper authorization to use radioactive materials and radiation-producing devices on the installation.

2. The WPAFB Radiation Safety Committee (WPAFB RSC) is responsible for:

2.1. Reviewing and approving proposals for the use of licensed radiation sources and makes recommendations to the commander concerning the protective measures to be taken. The WPAFB RSC also includes radiation-producing devices in its purview. The WPAFB RSC consists of a chairperson designated by the Installation Commander representing the executive management of WPAFB; a secretary who is the WPAFB RSO; the Medical Group (MDG) RSO; and members representing each major Installation and tenant organization that uses radiation-producing devices or radioactive material. Other individuals, because of special qualifications or management position, may be nominated and approved for membership by the existing members as appropriate. Adjunct members may also be selected to represent specific areas. Adjunct members are nonvoting. The WPAFB RSC shall meet at least once each calendar quarter and a quorum shall consist of majority of the voting membership including the WPAFB RSO and the representative of the executive management of WPAFB.

2.2. Reviewing and approving protocols for new/unique uses of radioactive material and radiation-producing devices by permitted activities.

2.3. Submitting reports to the Installation Commander concerning all actions taken. These reports shall be in the form of minutes of each regularly scheduled and special meeting. Minutes shall include a listing of members in attendance, members absent, discussions, actions, recommendations, decisions and results of all votes.

2.4. Reviewing training programs for radioactive material, equipment, facilities, supplies and procedures to ensure radiation safety.

2.5. Reviewing and approving the training and experience qualifications of the proposed Permit RSO and authorized users before submission to the AF Radioisotope Committee (RIC) for final approval.

2.6. Reviewing the annual ALARA report of the WPAFB RSO including results of any U.S. Nuclear Regulatory Commission (NRC) and AF inspections.

2.7. Recommending remedial action to correct any deficiencies in the radiation safety program.

2.8. Reviewing actions taken as a result of recommendations made in mishap reports submitted per AFI 91-204, Safety Investigations and Reports.

2.9. Reviewing and recommending corrective actions for deficiencies identified by NRC and AF Inspector General (AF IG) inspection.

2.10. May function as the Permit Radiation Safety Committee for radioactive material permits on the installation with the duties and responsibilities as stated in AFI 40-201.

3. The WPAFB RSO or designated alternate is responsible for:

3.1. Functioning as the secretary of the WPAFB RSC and advising the Installation Commander on all significant radiation safety related activities.

3.2. Directing, for the Installation Commander, the overall conduct of the WPAFB radiation safety program whose primary goal is to maintain radiation exposures to personnel ALARA. The WPAFB RSO is the individual designated by the Installation Commander and the WPAFB RSC to investigate, evaluate, initiate corrective action and report on defects or noncompliance items relating to substantial safety hazards involving radioactive material or radiation-producing devices.

3.3. Enforcing all federal, Air Force, state and Installation rules and instructions relating to radiation safety.

3.4. Terminating any operation which, in the opinion of the WPAFB RSO, poses a substantial radiation safety hazard to personnel or the environment. A report of such actions shall be made immediately to the Installation Commander.

3.5. Ensuring that personnel and area monitoring are accomplished as required by applicable rules and instructions.

3.6. Advising in emergency radiation safety operations in the event of accidents/incidents involving radioactive material or radiation-producing devices.

3.7. Reviewing plans for facilities to be used for radioactive material or radiation-producing devices which could require shielding.

3.8. Providing assistance to the PRSO during preliminary hazard evaluations for proposed uses of radioactive material or radiation-producing devices.

3.9. Ensuring that the receipt, shipment and transfer of radioactive material are properly monitored and identified.

3.10. Maintaining all necessary records of the WPAFB radiation safety program, AF radioactive material permits, WPAFB radioactive material/radiation-producing device permits, including documentation in support of AF and federal instructions, licenses and permits.

3.11. Providing assistance to the PRSO in identifying to the individual users and their supervisors the protective equipment and facilities necessary for the safe conduct of projects involving the use of radiation.

3.12. Coordinating with the WPAFB RSC on all significant matters involving radiation safety.

3.13. Providing a personnel dosimetry program for employees involved in ionizing radiation projects, which includes tracking dosimetry results and establishing investigation levels to ensure exposures to personnel are maintained ALARA.

3.14. Manage the distribution and record-keeping requirements of the personnel dosimetry and bioassay program for occupational exposures.

3.15. Managing the environmental surveillance program relative to radiation safety and ensuring compliance with applicable federal, Air Force, state and WPAFB instructions and directives dealing with protection of the public and the environment from unwarranted radiation exposures.

3.16. Managing and controlling the radioactive waste disposal program which ensures proper packaging, storage, transport and disposal of radioactive waste by WPAFB organizations.

3.17. Overseeing radioactive material/radiation-producing device permits and generally licensed devices.

3.18. Monitoring the radiation safety training program for permit RSOs, supervisors, radiation monitors, users of radioactive material and radiation-producing devices and emergency response team members. Radiation safety training provided by others, such as military public health, permit RSOs or supervisors shall be approved by the WPAFB RSO.

3.19. Managing the WPAFB radioactive material and radiation-producing device inventory.

3.20. Providing emergency response capabilities in the event of accidents involving contamination of personnel or the environment or exposure of personnel to radioactive material or radiation-producing devices (according to the WPAFB disaster control plan, if applicable).

3.21. Providing expert consultation, advice, assistance and direction on the hazards associated with radiation and the methods to control these hazards as well as response to emergency incidents or accidents involving radioactive material or radiation-producing device.

3.22. Managing an inventory of calibrated radiation monitoring equipment and dedicated check sources for use in routine radiological surveillance and compliance surveys as well as immediate response to emergency situations.

3.23. Establishing the required frequency of area surveys.

3.24. Establishing instructions on how non-Air Force organizations obtain approval to use radioactive material and radiation-producing device on the installation.

3.25. Overseeing routine decontamination and site remediation activities.

4. The Commander, 88th Medical Group, WPAFB, listed hereafter as the Medical Center Commander, is responsible for:

4.1. Conducting a medical center radiation safety program under the direction of a medical group radiation safety officer (MDG RSO). This individual shall be responsible for the radiation safety program within the medical center.

4.2. Designating a qualified individual to be a member of the WPAFB Radiation Safety Committee (WPAFB RSC).

4.3. Ensure complete records are maintained of either measured or estimated radiation dose received by personnel during occupational practices and contingency operation in the member's medical record.

5. Commanders of organizations which use radioactive material or radiation-producing devices are responsible for:

- 5.1. Designating an individual to act as the single focal point for the organization on radiation safety matters.
- 5.2. Ensuring that qualified radiological monitors are designated for each functional area authorized to possess and use radioactive material or radiation-producing devices.
- 5.3. Assuring the timely reporting of accidents or incidents involving radioactive material or radiation-producing devices to the WPAFB RSO and according to AFI 91-204.
- 5.4. Ensuring that an ALARA training program is in place.
- 5.5. Ensuring that an annual internal audit is completed.
- 5.6. Ensuring the maintenance of records and reports required by NRC and AF regulations.

6. Permit RSOs or commander designated individual are responsible for:

- 6.1. Advising the WPAFB RSO of the proposed uses of radioactive material or radiation-producing devices by individuals within the organization and advising the WPAFB RSO of any matters affecting the radiation safety program of the organization. Maintains overall compliance with permit requirements.
- 6.2. Coordinating radiation survey or hazard evaluation activities with the WPAFB RSO.
- 6.3. Performing those radiation safety duties at the organizational level that are commensurate with training and experience (IAW AFI 40-20, Table A5.1)
- 6.4. Assuring the timely reporting of accidents or incidents involving radioactive material or radiation-producing devices to the WPAFB RSO, organizational commanders and according to AFI 91-204.
- 6.5. Assisting in the investigation of incidents or accidents relating to the use of radioactive material or radiation-producing devices.
- 6.6. Ensuring that radiation areas and locations where radioactive material are stored and used are properly posted.
- 6.7. Performing or arranging with the WPAFB RSO radiation safety training of newly assigned employees, students or workers who may be occupationally exposed to ionizing radiation and likely to receive greater than 100 mrem in a year.
- 6.8. Coordinating with the WPAFB RSO before initiating any project including procurement, use, storage and or disposal of radioactive material or devices or any changes in working conditions or activities which could affect the radiation safety program. All coordination shall be accomplished prior to initiation of the project.
- 6.9. Submitting to the WPAFB RSO for review any new or revised operating instructions, standard operating procedures or unit instructions impacting on the radiation safety program prior to implementation.
- 6.10. Ensuring that all users are familiar with radiation safety operating instructions and radiation safety procedures and the WPAFB ALARA program.

6.11. Ensuring that radiation personnel monitoring devices, when required, are issued and worn correctly by all users.

6.12. Advising the WPAFB RSO, in writing, of any proposed changes to the radioactive material inventory, any proposed acquisition of new radiation-producing devices or any proposed generation of radioactive waste. Such notice shall be submitted with sufficient lead time to permit adequate review and comment.

6.13. Issuing orders, as appropriate, to cease and desist any permit activity if unsafe practices are being used, gross negligence is observed or a failure to follow established procedures, policies or regulations is identified.

6.14. Identifying to the individual users and their supervisors the protective equipment and facilities necessary for the safe conduct of projects involving the use of radiation.

6.15. Maintaining all necessary records pertaining to their radioactive permit; to include the radioactive material inventories.

6.16. Managing an inventory of calibrated radiation monitoring equipment and dedicated check sources for use in routine radiological surveillance and compliance surveys.

7. Each individual using radioactive material or radiation-producing devices is responsible for:

7.1. Learning and implementing the rules of radiation safety as described in applicable federal, AF and WPAFB instructions as well as in organizational operating instructions.

7.2. Wearing personnel monitoring devices if directed by their supervisors and the WPAFB RSO.

7.3. Wearing appropriate protective clothing and equipment as prescribed by supervisors and the WPAFB RSO.

7.4. Becoming familiar with the ALARA program which is dedicated to maintaining exposure to ionizing radiation ALARA.

7.5. Reporting incidents/accidents and hazardous conditions immediately to their supervisor, Permit RSO, or the WPAFB RSO if appropriate.

7.6. Assisting the supervisor, Permit RSO, or the WPAFB RSO, as directed, to control the site of an accident/incident.

7.7. Informing their supervisor of any changes in equipment, procedures or other factors involving radioactive material or radiation-producing devices which may alter the radiation safety practices or radiation levels in unrestricted areas.

8. Jurisdiction:

8.1. The WPAFB RSC and WPAFB RSO have complete jurisdiction over all radiation safety matters on WPAFB.

8.2. The MDG RSC and MDG RSO, specifically named on an AF radioactive material permit are hereby delegated responsibility for all radiation safety matters within the Medical Group. The MDG RSO shall make available for review by the WPAFB RSO all reports concerning x-ray evaluations, radioactive material storage area evaluations, exposure

investigations and any other documentation such as the annual ALARA report that concerns radiation safety.

Section B—PERMITS FOR THE POSSESSION AND USE OF RADIOACTIVE MATERIAL AND RADIATION-PRODUCING DEVICES

9. AF License. The AF has been issued a master materials license by the U.S. Nuclear Regulatory Commission (NRC). This license authorizes the AF Radioisotope Committee (RIC) to grant AF radioactive material permits to Air Force organizations for possession and use of byproduct, source and special nuclear materials, normally controlled by the NRC.

10. AF Permits. WPAFB tenant organizations have been issued AF radioactive material permits by the RIC authorizing the possession and use of radioactive material of diverse types, forms and quantities.

11. WPAFB Permits. The WPAFB RSC has reserved the authority to control the possession and use of radiation-producing devices such as x-ray machines and accelerators that are not under the jurisdiction of either the NRC or the RIC.

12. Other Organizations. Organizations located at WPAFB and contractors performing work at WPAFB must possess a NRC or Agreement State License, an AF or Navy radioactive material permit, or WPAFB radioactive material/radiation-producing device authorization in order to possess and/or use radioactive material or radiation-producing devices.

12.1. Radioactive material includes any item that emits radiation without external power. Examples are byproduct, source and special nuclear material as defined in the Code of Federal Regulations (CFR), Title 10, Parts 30, 40 and 70. Products distributed as exempt by a manufacturer licensed to distribute to exempt persons do not require a permit, if used for their intended purpose. Any unusual activities involving these sources, such as attempting to remove the radioactive material from the item or accumulating large quantities of these items for storage may require a permit. Although there are no administrative controls over these items, they may require controlled disposal. If there is any doubt as to the requirement for a permit or the proper method of disposal, contact the WPAFB RSO for guidance.

12.2. A radiation-producing device is any piece of equipment that emits ionizing radiation, regardless of intent, when energized by an external power source. Examples include medical and industrial x-ray machines, x-ray diffraction and fluorescence units, scanning and transmission electron microscopes and particle accelerators. In general, any device that accelerates electrons or other atomic particles with a potential difference of 10,000 volts or greater and produces x-radiation, either intentionally or unintentionally, may require a WPAFB radiation-producing device permit. Some exceptions are television monitors, cathode ray tubes and video display terminals which are manufactured under the strict requirements of 21 CFR 1020.10. If there is any doubt as to the requirement for a permit, contact the WPAFB RSO for guidance.

13. Permit Requests. Requests for AF radioactive material permits or WPAFB radioactive material/radiation-producing device authorization shall be submitted in writing to the WPAFB RSO. Applications for either new permits, renewals of old permits, or amendments to existing permits or authorizations shall be reviewed by the WPAFB RSO who may either (a) reject the application, (b) return it for additional clarification, (c) refer it to the RIC or WPAFB RSC for

review, or (d) issue a permit or authorization. Once approved, organizations are required to comply with the statements made in their application as well as any additional conditions imposed by the WPAFB RSO and the WPAFB RSC and listed as a condition of the permit or authorization itself. Any changes in the activities or personnel specified in the permit shall be accompanied by the submission of an application for amendment of the permit. Applications for amendments shall be submitted in the same manner as the original or renewal application except that only those items being changed need be addressed.

14. Permit Authorization. A WPAFB radioactive material/radiation-producing device permit authorizes the possession and use of radioactive material or radiation-producing devices. All operations conducted under the conditions of the permit must be documented to ensure compliance with the WPAFB ALARA program.

15. Contractors:

15.1. Contractors performing services involving the use of radioactive material under the auspices of their own NRC or Agreement State License shall provide a copy of that license to the WPAFB RSO well in advance of operations being conducted at WPAFB. For contractors licensed by an Agreement State, in addition to a copy of the license, a completed copy of NRC Form 241, *Report of Proposed Activities in Non-Agreement States, Areas of Exclusive Federal Jurisdiction, or Offshore Waters*, shall be submitted to the WPAFB RSO. The WPAFB RSO will review the license to ensure that the material and activities are authorized. The contractor shall be required to comply with all applicable sections of this instruction as it applies to safe use of radioactive material and the reporting of incidents or accidents to the WPAFB RSO. The WPAFB RSO shall be notified when the operation is terminated.

15.2. Contractors performing services involving the use of radioactive material under the auspices of an AF radioactive material permit issued to WPAFB shall comply with all requirements specified in this instruction.

15.3. Contractors who will be using radiation-producing devices shall obtain a WPAFB radiation-producing device permit from the WPAFB RSO as would any WPAFB organization. Coordinate such activities with the WPAFB RSO prior to bringing radiation-producing devices' onto the installation.

15.4. For both radioactive material and radiation-producing device activities contractors shall provide a brief description of the work to be performed. Include the dates and locations where such activities shall be performed. While working on the installation, the WPAFB RSO can make on-site inspections to ensure the contractor follows proper radiation safety practices and can suspend any operations deemed to be unsafe or in violation of AF or NRC regulations.

Section C—DESIGNATION OF AREAS

16. The following definitions are extracted from the 10 CFR Part 20:

16.1. "Restricted area" means any area, access to which is limited for the purpose of protecting of individuals against undue risks from exposure to radiation and radioactive material.

16.2. "Radiation area" means an area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

16.3. "High radiation area" means an area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.1 rem in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

17. Rem in One Hour. The limits in the above definitions are specified in terms of "rem in one hour" not "rem per hour (rem/hr)." The difference between these two expressions is significant. If the limit was expressed as 0.005 rem/hr, then any measurement with a survey meter above 0.005 rem/hr would classify the location as a radiation area. However, when expressed as 0.005 rem in 1 hour, a measurement of 0.01 rem/hr could still be classified as a non-radiation area if the occupancy were limited to no more than 30 minutes each hour or if the radiation field were present for no more than 30 minutes each hour. Such might be the case for an x-ray operation. Therefore, the classification of a radiation area must also consider the occupancy of the area and the duration of the radiation exposure.

Section D—Radiation Exposure Limits

18. Personnel Exposure. Personnel who work with radioactive material or radiation-producing devices may be exposed to radiation during the course of their employment. The goal of the radiation safety program at WPAFB is to maintain all radiation exposures ALARA. However, it may be impossible to completely eliminate all radiation exposure. As a result, it is important to understand the procedures used to monitor for radiation exposure and also the significance of a radiation dose obtained during routine work activities.

19. Dose Limits. Federal regulations (10 CFR Part 20) specify the maximum permissible dose limits for radiation workers, workers under 18 years of age, non-radiation workers (i.e., members of the general public) and embryo/fetus.

Table 1. Radiation Workers

In Any Calendar Year	Radiation Workers	Workers Under 18
Whole body (TEDE)*	5 rem	0.5 rem
Lens of eye	15 rem	1.5 rem
Skin or extremities	50 rem	5 rem

NOTE: * The whole body means, for purposes of external exposure, head, trunk (including male gonads), arms above the elbow, or legs above the knee. TEDE means total effective dose equivalent.

Table 2. Members of the Public

One year	100 millirem
In Any One Hour	2 millirem

19.1. The dose in any unrestricted area resulting from AF controlled radiation sources shall not exceed the limits specified above. The installation RSO shall be responsible for the assessment, either by measurement or calculation, that these dose limits are not exceeded and shall maintain such records for a period of three years. If integrated radiation levels could exceed these limits, the area must be restricted.

Table 3. Embryo/Fetus

Entire pregnancy	500 millirem
Monthly	50 millirem

20. Occupational Exposure of Fertile Females:

20.1. Each female potentially occupationally exposed to ionizing radiation shall be informed by the WPAFB RSO or a member of the staff of the risks to the unborn.

20.2. A female military member shall, on becoming aware she is pregnant, notify her workplace supervisor or primary care manager. A non-military member should notify her workplace supervisor or primary care manager. A civilian woman’s decision to declare her pregnancy is entirely voluntary. Declaration of pregnancy shall be in writing and include the estimated date of conception, for the radiation exposure limits of the embryo/fetus to be applied.

20.3. The WPAFB RSO may limit specific duties of a declared pregnant female who is occupationally exposed to radiation and who in the opinion of the WPAFB RSO may receive a whole body exposure greater than 500 millirem per year, either in the course of routine duties or as a result of a credible accident involving the radioactive material or radiation-producing devices. The WPAFB RSO’s evaluation shall include consideration of the workplace and the source of radiation, the individual's past history of exposure to radiation as documented by personnel dosimetry records, current radiation measurements applicable to her specific tasks, current exposure histories of coworkers, and likely exposures which would be incurred in the event of a credible accident.

20.4. If the RSO determines it is unlikely that the declared pregnant female would receive a total exposure during the term of the pregnancy (including the period preceding the confirmation of the pregnancy) in excess of 500 millirem, she may continue in her radiation-related duties. However, if the individual is not already on the AF personnel dosimetry program, she shall be enrolled for the duration of her pregnancy. Arrangements shall be made with USAFSAM/Radiation Dosimetry (OEHH) to receive, in addition to the laboratory's routine written report, telephone notification of the individual's dosimetry results as soon as each dosimeter is processed by the laboratory. Should exposure results indicate a trend which, if continued, could result in exceeding the 500 millirem limit, a re-evaluation shall be made as to whether she should continue her radiation duties, be restricted from certain high risk duties, or be removed entirely from occupational exposure.

20.5. Special consideration must be made when a declared pregnant worker's radiation duties involve the operation of high output sources or the use of unsealed radioactive material. Pregnant workers shall not continue in duties involving these sources without the concurrence of AFMSA/SG3PB. When a pregnancy is suspected and reported to the

immediate supervisor, women working with such sources or materials shall receive a prompt evaluation by the WPAFB RSO (within five workdays after receipt of the consult request) and, if warranted, actions such as restrictions or removal may be taken even prior to confirmation of the pregnancy.

Section E—DOSIMETRY

21. Radiation Workers. Individuals who routinely work with or in the vicinity of sources of ionizing radiation may be designated as radiation workers by the WPAFB RSO after an evaluation of the potential hazards. Radiation workers are issued radiation dosimeters which are exchanged either monthly or quarterly as determined by the WPAFB RSO: In certain circumstances, radiation workers may also be issued self reading pocket or digital dosimeters in addition to standard radiation dosimeters to permit immediate evaluation of a potentially hazardous radiation environment.

21.1. AF radiation dosimeters shall only be issued to military or civilian government employees or contractors working with government owned and operated radiation sources. Contractors using contractor owned and operated radiation sources shall be required to provide dosimeters to their own personnel.

21.2. The WPAFB RSO and his/her staff are responsible for:

21.2.1. Determining whether radiation monitoring is required.

21.2.2. Determining the frequency of radiation monitoring.

21.2.3. Issuing and exchanging radiation dosimeters.

21.3. The supervisor, or designated radiation dosimeter monitor, of a newly assigned worker has the responsibility to request radiation monitoring for that individual. Monitoring shall be required if the worker shall be located in an area designated by the WPAFB RSO as a potential radiation hazard area or if, because of the assigned duties, the individual is classified as a radiation worker requiring dosimetry.

21.4. Each individual to be monitored shall be provided with a radiation safety briefing to include an explanation concerning proper wearing and storage of the dosimeter and the right to review the dosimetry results each month or quarter. The installation RSO shall ensure that each individual monitored is provided with the summary results of dosimetry (internal and external) annually on AF Form 1527-1.

21.5. The supervisor shall reinforce this information by introducing the dosimeter monitor who shall indicate the dosimeter storage location and describe the procedures for requesting a review of the dosimetry results maintained by the supervisor.

21.6. The supervisor shall not permit anyone to enter a radiation use area or work with radioactive material or radiation-producing devices unless that individual has been designated a radiation worker, been properly briefed, and been issued a dosimeter, if appropriate. Visitors to any restricted areas shall be accompanied by persons knowledgeable about the protection and safety measures in the area and must be provided adequate information and instruction before entering the area. Visitors entering a radiation area or a high radiation area or that could incur a deep dose equivalent of greater than 10 millirem shall be provided personnel monitoring devices. In those rare instances where it is essential

for visitors to enter such restricted areas for brief periods and where they may receive greater than 10 millirem, the supervisor shall ensure that each visitor is provided with a self reading pocket dosimeter or other radiation monitoring device and that the following information is recorded and a copy provided to the WPAFB RSO:

21.6.1. Name.

21.6.2. Organization/Address.

21.6.3. Telephone No.

21.6.4. SSAN.

21.6.5. Dosimeter Serial No.

21.6.6. Initial and final dose readings (if direct reading).

21.6.7. Date, time and duration of visit.

21.6.8. If at all possible, prior coordination with the WPAFB RSO concerning visitor access to restricted radiation areas should be accomplished.

21.7. Monthly or quarterly, as applicable, report of the exposures recorded on the dosimeters is published (AF Listing 1499). This report is provided to the WPAFB RSO who reviews the results to determine if the exposures recorded are in compliance with the ALARA program. After review of the report, the WPAFB RSO forwards a copy to the supervisors of the personnel monitored. These results shall be available to radiation workers for review.

21.8. There are several types of dosimeters which may be issued and specific rules governing proper wear of dosimeters:

21.8.1. Thermoluminescent dosimeter (TLD) badges are issued to monitor personnel for radiation exposure. There are three types of badges and depending on the type of radiation work performed, one, two or possibly all three will be issued to a single individual.

21.8.1.1. The first type is called a whole body badge. As indicated by its name, it is designed to measure the radiation exposure to the entire body. Obviously, no badge which is approximately 1 by 2 inches can measure the radiation exposure to the whole body. However, the badge should be worn at the location of highest expected whole body radiation dose. The whole body badge is typically worn somewhere between the waist and the shoulders (i.e., waistband, collar or shirt pocket). In this location, the badge will provide a measure of the radiation exposure to the internal organs and the gonads. If as is generally the case, the individual normally faces the radiation source, the badge should be worn on the front. However, if in some unusual instance, the radiation source is routinely behind the individual, the badge may be worn on the back. Since this badge is designed to provide a measure of the radiation exposure to the whole body, it should always be worn so as to be exposed to the same radiation environment as the body.

21.8.1.2. The second type of badge is called the collar badge and is normally worn on the shirt collar. It is designed to provide a representative sample of the radiation exposure to the critical organs above the shoulders, i.e., the thyroid in the neck and the lens of the eye. When a protective shield such as a lead apron is worn, the collar

badge is placed outside the protective shield not under it. Results recorded on a collar badge are often reported as a "head" dose.

21.8.1.3. The third type of badge is called an extremity badge or finger badge. It is worn like a ring on a finger of the hand which is most likely to be exposed to the radiation. If the source of radiation is typically held in the hand, the ring should be worn with the top portion turned around facing the palm and the radiation. However, if the radiation originates from a remote source such as an x-ray diffraction unit and the hand is likely to be exposed from the back, the ring should be worn in the usual manner.

21.9. If dosimeters are issued and irrespective of how many other dosimeters are assigned, a whole body dosimeter is always worn by a radiation worker. Any other badges issued are worn in addition to the whole body badge--never in place of it. The reason is, simply stated, that the collar and finger badges measure radiation exposure only to specific organs of the body whereas the whole body badge measures the radiation exposure to the most critical organs.

21.10. All radiation badges should be worn while working in a designated radiation use area. The badges should be put on before beginning work and removed after leaving the radiation use area. When not being worn, the badges must be stored on a rack or board of some kind in a radiation-free environment along with a control badge. This location is normally called a "control board." The control badge always remains on the control board. Its purpose is to measure the background radiation level in the storage area and while the badges are in transit so that this radiation exposure can be subtracted from the measured values on the personnel badges since this exposure represents radiation not received by the badge while worn in the work environment. Badges must never be taken home or stored in any other location such as desk drawers or attached to lab coats. Badges should also never be worn when undergoing medical radiation procedures such as diagnostic x-ray or dental examinations, nuclear medicine evaluations or radiation therapy treatments. Badges will provide an accurate measure of the radiation to which an individual is exposed only if they are worn and stored properly. If a badge is lost or damaged an investigation will be performed by the WPAFB RSO to estimate the exposure actually received during that monitoring period. The individual to whom the badge was issued shall be required to sign a statement explaining the circumstances of the loss or damage.

21.11. In addition to routinely issued radiation monitoring badges, some activities of a higher risk of a large exposure may also require the use of self reading pocket dosimeters or similar device. Unlike TLDs which record the exposure but must be sent to OEHH for processing resulting in a delay of several weeks before the results are obtained, pocket dosimeters are designed to be evaluated immediately. Although traditionally not as accurate as TLDs, self reading pocket dosimeters do provide an instant indication as to whether an exposure has occurred. For this reason, self reading pocket dosimeters are issued to visitors likely to receive greater than 10 millirem so that it can be determined if an exposure has occurred before the visitor is lost to follow-up.

21.12. If anyone suspects that a dosimeter has been exposed either deliberately or unintentionally to radiation irrespective of whether it was being worn at the time or not, the supervisor and the WPAFB RSO shall be notified immediately. The dosimeter shall be

collected and delivered to OEHH for processing. If there is some evidence (such as survey meter readings or self reading pocket dosimeter results) that an individual was, in fact, overexposed, the WPAFB RSO shall be notified immediately. In the event that the installation RSO is notified by OEHH that an overexposure may have occurred, the RSO shall immediately contact the Unit Commander and request the individual be removed from all duties involving potential radiation exposure until an investigation is completed. The RSO shall investigate suspected overexposures and provide a written report within seven days through the MAJCOM Bioenvironmental Engineer to OEHH and AFMSA/SG3PB. Similar procedures shall be followed if the RSO is notified by an individual, or suspects, that an overexposure may have occurred.

22. Investigative Levels. In addition to federally imposed dose limits, the NRC has also recommended the adoption of investigation levels for radiation workers. These levels are not legal limits. They are values arbitrarily set at 10 percent (or some similar value) of the federally mandated limits to assist radiation safety program monitors to comply with the ALARA concept by anticipating potential difficulties and initiating corrective actions. Therefore, investigations shall be accomplished in a timely manner by the WPAFB RSO for doses received by individuals in excess of the established ALARA levels. The investigation shall consider each such exposure in comparison with those of others performing similar tasks.

Table 4. Investigative Levels

Per Monitoring Period	Radiation Workers (millirem)
Whole body (TEDE)*	125
Lens of eye	375
Skin or extremities	1250
Investigative levels for Areas 3 and 3A	
Whole Body (TEDE)*	300
Lens of eye	375
Skin or extremities	1250

NOTE: * The whole body means, for purposes of external exposure, head, trunk (including male gonads), arms above the elbow, and legs above the knee.

Section F—ALARA

23. ALARA. The ALARA concept was developed in response to scientific evidence which suggests that no level of radiation exposure is entirely risk-free. It is a policy which states that although there are acceptable, conservative levels of radiation exposure specified by federal regulations which offer a low risk of adverse health effects compared to the other hazards of life and occupation, it is prudent to make every effort to reduce exposures to the lowest levels reasonably achievable, thereby lowering the health risk associated with that exposure. In fact, individual and cumulative radiation exposures must be maintained as close to zero as possible given the type of activities involved, the state of technology, the risk to the individuals exposed

and the benefit to society from the activity being accomplished. The guidance contained in this instruction provides the basis for conducting an effective ALARA program.

24. ALARA Commitment. The radiation safety program at this installation is managed by the WPAFB RSO and reviewed by the WPAFB RSC for the Installation Commander. WPAFB is committed to the concept of ALARA. The ALARA commitment is summarized below:

24.1. Management (88 ABW/CC):

24.1.1. The management of WPAFB is committed to the ALARA program for maintaining individual and collective radiation doses ALARA. According to this commitment, WPAFB has developed an administrative organization and written policies, procedures and instructions to promote the ALARA concept. The organization consists of the WPAFB RSC and the WPAFB RSO.

24.1.2. The management of WPAFB shall review and sign the annual ALARA report prepared by the WPAFB RSO and approved by the WPAFB RSC.

24.1.3. The management of WPAFB shall authorize modifications to operating and maintenance procedures and to equipment and facilities if they shall reduce exposures unless the cost is considered unjustified. If requested, verification shall be provided that improvements have been sought, that modifications have been considered and that they have been implemented when reasonable. If modifications have been recommended but not implemented, management shall be prepared to describe the reasons for not implementing them.

24.2. WPAFB RSC:

24.2.1. The WPAFB RSC shall delegate authority to the WPAFB RSO for enforcement of the ALARA program and shall support the WPAFB RSO when it is necessary to assert authority. If the WPAFB RSC overrules the WPAFB RSO, the facts and basis for such action shall be documented in the minutes of the WPAFB RSC meeting.

24.2.2. The WPAFB RSC may require users to develop new procedures to implement the ALARA concept and shall review occupational radiation exposure records to ensure compliance with ALARA.

24.3. WPAFB RSO:

24.3.1. The WPAFB RSO shall thoroughly review the qualifications of each applicant for a WPAFB radioactive material/radiation-producing device permit to ensure that the applicant shall be able to take appropriate measures to maintain exposures ALARA.

24.3.2. The WPAFB RSO shall perform annual reviews of the radiation safety program and present the findings to the WPAFB RSC.

24.3.3. The WPAFB RSO shall perform a quarterly review of radiation exposure records and records of radiation surveys and present the results to the WPAFB RSC each quarter.

24.3.4. The WPAFB RSO shall ensure users, workers, and ancillary personnel are provided briefings describing the ALARA program at least annually.

24.3.5. The WPAFB RSO shall encourage users to submit suggestions for improving health physics practices and increasing the effectiveness of the ALARA program and

shall evaluate them with the goal of implementing as many of them as are considered acceptable and reasonable.

24.3.6. The WPAFB RSO shall investigate all deviations from ALARA and direct changes when appropriate.

24.4. Users:

24.4.1. Users shall provide the WPAFB RSO with information concerning newly proposed uses of radioactive material or radiation-producing devices with sufficient lead time to permit the RSO to adequately evaluate the proposal. Alternate approaches shall be considered in the interest of ALARA.

24.4.2. Users shall explain the ALARA concept to individuals supervised by them, ensure that they understand the concept and are adequately trained for the task required and document the training.

24.5. Radiation Workers:

24.5.1. Workers shall be instructed annually in the ALARA concept and its applicability to work practices and conditions

24.5.2. Workers shall be advised of available recourses if they feel that the ALARA concept is not being implemented.

Section G—Training

25. Personnel requiring training in radiation safety commensurate with their duties may include:

25.1. Users.

25.2. Supervisors.

25.3. Radiation monitors.

25.4. Permit RSOs.

25.5. Emergency response teams.

25.6. Special inspection groups (SIG).

25.7. Ancillary personnel (such as housekeeping) who may perform duties in areas where radioactive material or radiation-producing devices are used.

26. Training shall be provided to individuals, who in the course of their duties are likely to receive in a year an occupational dose in excess of 100 millirem:

26.1. Before the individual is permitted to assume duties with or in the vicinity of radiation sources.

26.2. Annually during a refresher training course.

26.3. When there is a significant change in duties or radiation safety requirements.

27. Training shall be provided by:

27.1. The permit RSO, with the assistance of the WPAFB RSO, according to the above schedule.

27.2. The Public Health Flight, Occupational Health (88 AMDS/SGPM) during annual occupational safety briefings to workers. The contents of these briefings as they relate to radiation safety shall be approved by the WPAFB RSO.

28. Training sessions shall include but are not limited to the following:

28.1. Applicable regulations and permit conditions.

28.2. Areas where radiation sources are used or stored.

28.3. Potential hazards from the radiation sources.

28.4. Appropriate radiation safety procedures.

28.5. Work rules pertaining to radiation sources.

28.6. Employee obligation to report unsafe conditions or practices.

28.7. Initial response procedures to radiation emergencies.

28.8. Employee right to be informed of occupational radiation exposure results.

28.9. Location where pertinent regulations and documents are available for review.

28.10. Practices and procedures to ensure personnel exposures are maintained ALARA.

29. Documentation. All radiation safety training shall be documented and copies maintained by WPAFB RSO or permit RSO, as appropriate. When such training is required under this section, workplace supervisors shall ensure it is documented on each individual's AF Form 55, *Employee Safety and Health Record*.

Section H—ORDERING AND RECEIVING RADIATION SOURCES

30. Ordering Radioactive Material. No one may order or receive radioactive material or radiation-producing devices without first obtaining an AF radioactive material or WPAFB radioactive material/radiation producing device permit for possession and use of the material or device.

31. Authorization. Individuals or organizations who are issued a valid AF, Navy or a WPAFB radioactive material/radiation-producing device permit may order radioactive material or radiation-producing devices authorized by their permit. When placing orders, the following actions shall be accomplished:

31.1. The order must be forwarded to the WPAFB RSO through the permit RSO prior to submission to procurement.

31.2. If an order is to be verbal (i.e., placed by phone or directly to a visiting supplier) the WPAFB RSO shall be notified immediately by phone of the intent to order and this shall be followed within five workdays by a written notification to the WPAFB RSO.

31.3. The WPAFB RSO shall review the order to ensure it does not exceed the appropriate AF radioactive material or WPAFB radioactive material/radiation-producing device permit

authorization, shall file a copy of the request with the permit, and forward the original to procurement or provide verbal authorization for immediate action.

31.4. The purchase order request shall specify that the WPAFB RSO shall be contacted at extension 72010 during normal duty hours on receipt of the item at any location on WPAFB. If the package contains radioactive material and appears to be damaged or leaking, the WPAFB RSO shall be notified immediately through the WPAFB Consolidated Command Post at extension 76314, irrespective of the day or time.

31.5. On notification that the item has arrived at WPAFB, the WPAFB RSO shall either send a member of the staff to inspect and monitor the package or merely request notification when the package is delivered to the user. Only the WPAFB RSO or the user shall open the package. The action taken shall depend on the hazard associated with the particular item and the condition of the package.

31.6. After the package is opened by the user and the contents examined, the WPAFB RSO shall be notified immediately if there is either a discrepancy between the items ordered and received or if the items appear damaged. If all items are as ordered and in acceptable condition, notification shall be in writing to permit updating of the master WPAFB inventory (copies of shipping documents should be included).

32. Special precautions shall be taken by the permittee when receiving and opening packages containing radioactive material:

32.1. Visually inspect the package and, if damaged, notify the WPAFB RSO immediately.

32.2. Measure the exposure rate at the package surface and, if greater than expected, contact the WPAFB RSO.

32.3. Wear gloves when opening a package containing liquids.

32.4. Verify the contents with the packing slip.

32.5. Examine the integrity of the final source container.

32.6. If anything unusual is encountered contact the WPAFB RSO.

32.7. As specified in 10 CFR 20.1906, packages containing in excess of certain specified quantities of radioactive material must be monitored for external radiation and contamination within 3 hours after receipt during working hours and within 3 hours from the beginning of the next working day if it is received after working hours.

Section I—RADIOACTIVE MATERIAL WORK PROCEDURES

33. Although each work environment shall necessitate individual work practices, the following procedures shall be incorporated in all radioactive material work procedures:

33.1. Wear laboratory coats or other protective clothing at all times where unsealed radioactive material is used.

33.2. Wear disposable gloves at all times while handling unsealed radioactive material.

33.3. Before leaving restricted areas and where unsealed radioactive material is used, monitor hands and clothing for contamination with an appropriately sensitive survey meter.

33.4. Areas where unsealed radioactive material are stored or used shall be coordinated with the installation and Permit RSOs. No eating, drinking or smoking shall be permitted in these areas. In addition, cosmetics shall not be applied in those areas and exposed portions of the body such as the face should not be touched

33.5. Do not store food, drink, or personal effects in areas where radioactive material are stored or used.

33.6. If issued, wear personnel monitoring devices at all times while in areas where radioactive material are used or stored.

33.7. Dispose of radioactive waste only in designated, labeled and properly shielded containers.

33.8. Do not pipette radioactive liquids by mouth.

33.9. Wash hands before eating, drinking, smoking or leaving work area.

33.10. Discard contaminated protective equipment such as rubber gloves and boots into segregated radioactive waste disposal containers.

33.11. Individuals with open wounds shall not work with radioactive material without proper protection.

33.12. Items shall not be placed in ordinary trash or flushed down non-approved drains unless they are first checked for radioactivity with an appropriately sensitive survey meter.

33.13. In areas where unsealed radioactive material is used, monitor surfaces after each use.

Section J—LEAK TESTING OF RADIOACTIVE MATERIAL (RAM)

34. Sealed sources of radioactive material are leak tested at intervals specified in the AF radioactive material permits. Current requirements are:

34.1. Beta and gamma sources in excess of 100 microcuries - As specified in the applicable permit or SS&DR.

34.2. Alpha sources, designed for the purposes of alpha emissions, in excess of 10 microcuries – As specified in the applicable permit or SS&DR.

35. Analysis. Leak testing shall be accomplished by the permit RSO, WPAFB RSO or staff for analysis by WPAFB RSO or other that is licensed/permitted to perform the analysis.

36. Results. Results shall be maintained by the WPAFB RSO and a copy forwarded to the user along with an interpretation of the results and any actions required.

37. Leaking Source. If contamination is detected in excess of acceptable limits (usually 0.005 microcurie), the source shall be secured in an isolated area until arrangements can be made for the WPAFB RSO and staff to supervise decontamination of the item or packaging for shipment either to the supplier or an approved radioactive waste disposal site.

Section K—RADIOACTIVE WASTE

38. Responsibility. Organizations possessing a valid radioactive material permit may generate radioactive waste during the course of their operations. Each organization shall assume full

responsibility for collection, packaging, storage and disposal of radioactive waste generated. If accomplished properly, the potential for contamination of the environment or subjecting personnel to unnecessary radiation risk shall be eliminated. Each organization shall provide a secure, isolated area for temporary storage of its own waste, on-site, near the location where generated. Each site shall be approved by the WPAFB RSO. When a container is filled and ready for disposal, the WPAFB RSO shall be notified. The WPAFB RSO shall make arrangements for pickup of the waste by a disposal contractor authorized by AF Radioactive Waste Program Office or transferred to an authorized AF radioactive material permit. Contracts for pickup and disposal of radioactive waste shall NOT be made by the generator.

39. Management of Radioactive Waste. To ensure safe handling of radioactive waste, the following guidance is provided. Any proposed deviations from this guidance must be submitted in writing to the WPAFB RSO and approval must be obtained prior to implementation of the alternative procedures.

39.1. Generation of Waste. The primary goal of all users is to minimize the accumulation of radioactive waste to those items which cannot be disposed of in any other manner. One suggestion is to avoid combining radioactive and non-radioactive waste such as paper products and ordinary laboratory waste. This will reduce volume and cost and facilitate final disposal. However, in the interest of reducing nonessential waste, care should be exercised not to inadvertently dispose of radioactive waste without regard to proper disposal procedures. Guidance may be obtained from the WPAFB RSO. In general, most radioactive waste is generated in one of two ways:

39.1.1. Routinely, such as in a research laboratory.

39.1.2. Infrequently, such as when a device used for many years is no longer required. In this case, the WPAFB RSO should be contacted as soon as the item is identified as excess and the WPAFB RSO shall provide specific directives for the proper management of the item. If the item is small, radiologically stable and presents no unusual hazard, the WPAFB RSO may elect to assume responsibility for the item, consolidating it with other similar items for more efficient disposal. If this is the case, the WPAFB RSO may store the items in a secure location until enough have accumulated to fill a shipping container.

39.2. Segregation. An important aspect of proper waste disposal is segregation of waste (i.e., separation of different types). Segregation may involve separating:

39.2.1. Solids from liquids. Examples are separation of solid check sources from liquid scintillation vials or separation of vials containing liquid scintillation fluid from surgical gloves, paper products and glassware which may be coated with the same fluid.

39.2.2. High activity from low activity radionuclides. An example is separation of sources which are less than one millicurie from sources which are greater than or equal to one millicurie (one millicurie arbitrarily selected).

39.2.3. Long half-life from short half-life radionuclides. An example is separation of sources which have half-lives less than 120 days from those which have half-lives greater than or equal to 120 days. Short half-life material may be decayed in storage and disposed of as non-radioactive waste if approved by the WPAFB RSO in writing. Decay in storage procedures are described in this instruction.

39.2.4. Different categories of material. An example is separation of alpha emitting transuranics such as plutonium and americium from gamma emitting byproduct material such as cobalt and cesium.

39.2.5. Chemical/biological waste from radioactive waste. An example is separation of radionuclides contained in animal carcasses from those contained in liquid scintillation vials.

39.2.6. Commercial radioactive waste disposal facilities typically have extremely conservative segregation and disposal criteria. Proper segregation will eliminate the possibility of having to reopen the container and separate the contents at some later date possibly subjecting personnel to unnecessary radiation or chemical exposure. If there are any doubts as to the segregation procedures required, contact the WPAFB RSO.

39.3. Containers. Radioactive waste shall only be collected in new or recently refurbished containers such as 30 or 55 gallon drums; size of the container will be dependent on the rate at which waste material is accumulated. A container should be chosen which can be filled in one year or less. The selected container, whether new or refurbished, must show no extensive signs of weathering or mishandling (i.e., no rust or dents) and must have no openings other than the top lid (i.e., no bung holes, even if sealed). If the container has a gasket on the lid, the gasket must be neoprene and no moisture is permitted inside the container. The NSN for an acceptable 30 gallon drum is 8110-00-866-1728 while the NSN for an acceptable 55 gallon drum is 8110-00-082-2626. If there are any doubts as to the acceptability of a container, contact the WPAFB RSO.

39.4. Liners. The container used for radioactive waste shall have two transparent plastic liners or one 8 mm liner installed. The liners shall be at least 4 mils thick and be appropriate in size for the container used. They shall be of sufficient length so that the top of each liner can be twisted into a tail long enough to be folded over onto itself and the inverted "U"-shaped end secured with duct tape. If there are any doubts as to the acceptability of the plastic liners, contact the WPAFB RSO.

39.4.1. Solids. If only solid waste is generated, the two plastic liners described above shall be placed one inside the other directly inside the container. Each liner shall be sealed individually resulting in a double encapsulation.

39.4.2. Liquids. Liquids are not normally acceptable for radioactive waste disposal. Some liquids may be disposed of through the sanitary sewer; however, the decanting requirements must be satisfied. Other liquids such as contained in liquid scintillation vials are acceptable but must be collected separately from all other waste. The following is a summary of the procedures for packaging of liquid scintillation vials for disposal:

39.4.2.1. For collection of liquid scintillation vials, the first liner shall be installed in the container, followed by at least 5 inches of absorbent material such as NSN 7930-00-269-1272. The amount of absorbent material must be sufficient to absorb twice the amount of liquid, however, DO NOT pour the liquid into the absorbent material, leave it in the vials. The second liner shall then be placed over this dry absorbent layer.

39.4.2.2. Thus the container shall consist of the drum, a plastic liner, a layer of absorbent material and finally a second liner. The waste is placed inside this second

liner. If the waste consists of liquid scintillation vials, the intact vials shall be placed inside this inner liner. Once the inner liner is secured, another 5 inches of absorbent material shall be placed on top of this sealed inner liner before the outer liner is sealed. This top layer of absorbent material is intended to absorb the liquid should the drum be turned upside down.

39.4.2.3. The reason for this procedure is that at the disposal site, the container and outer liner shall be opened and the inner liner shall be removed from the container. Its contents shall then be placed in a machine which shall separate the liquid scintillation fluid from the vials. Therefore, no absorbent material or any other objects may be placed inside the inner liner. If there are any doubts as to the acceptability of the absorbent material or the packaging procedures, contact the WPAFB RSO.

39.5. Inner Containers. As items are deposited in the radioactive waste drum, it is recommended that smaller transparent plastic containers be used to hold routine quantities of waste generated. For example, the waste generated each day during an experiment may be placed in a separate plastic container and sealed or the waste from each experiment (perhaps spanning several days) may be collected in a single plastic container and sealed. This procedure would permit a more detailed inventory of the final container contents prior to final sealing if there were any questions regarding the contents. Each smaller container could be removed and inspected without requiring the individual to sort through the actual waste which may pose a chemical/biological hazard, as well as radiological hazard.

39.6. Final Closure. When a container is full and ready for disposal, the WPAFB RSO shall be notified. The WPAFB RSO or representative shall visually inspect the container and shall initial the inventory sheets to indicate that proper procedures were followed. Since items packaged in the drum shall not normally be removed for a detailed inventory, the WPAFB RSO shall not assume responsibility for problems arising as a result of incorrect inventories. If any problems do arise regarding the contents of the drums, it shall be the responsibility of the organization generating the waste to resolve those problems with guidance from qualified radiation safety or radioactive waste disposal personnel.

39.7. Disposal to Sanitary Sewer. Liquid radioactive waste to be disposed through the sanitary sewer shall only be authorized by the WPAFB RSO. The WPAFB RSO shall review the types and amounts of material proposed for disposal and the procedures and shall verify that such disposal is authorized and does not exceed the maximum permissible quantities established in 10CFR20.2003. If such disposal is deemed acceptable, the WPAFB RSO shall designate and label a drain approved for liquid radioactive waste and only this drain shall be used. Material shall be flushed with a continuous stream of water (not a trickle) for the time indicated by WPAFB RSO.

39.8. Decay-In-Storage (DIS). DIS may be authorized for all radioactive waste with half-lives less than 120 days. DIS is a procedure in which radioactive waste is placed in a storage container such as a drum and allowed to remain undisturbed for at least 10 half-lives. The material must be stable and must be maintained in a secure location where it shall not be disturbed during the storage interval which could extend up to 1200 days under specifically authorized circumstances. After the 10 half-lives have elapsed, the remaining activity shall be approximately one thousandth of the original activity but it must still be monitored by the

WPAFB RSO using an appropriately sensitive survey meter to ensure that no radiation above background is detectable. For DIS to be most effective, radioactive waste must be segregated according to half-life. Ideally, each container would contain only radionuclides with the same half-life. However, more realistically, the radioactive waste should be segregated into several categories according to half-life, such as, 1-15 days, 16-30 days, 31-45 days, 46-65 days, and 66-120 days.

39.9. Incineration. Authorization to incinerate can only be granted by the RIC through the WPAFB RSO and must be specified as a condition to a WPAFB radioactive material permit before it can be accomplished. Incineration shall normally only be approved for cases where disposal to a commercial radioactive waste burial site is difficult or impossible such as for animal carcasses or mixed chemical/biological/radioactive waste where the incineration of the chemical and biological components is not restricted. Applicable federal and state air emission requirements must be complied with.

39.10. Specific Waste. The NRC has authorized the disposal of some small quantities of radioactive waste as normal waste. This authorization applies only to carbon-14 (C-14) and hydrogen-3 (H-3), also known as tritium. Specifically, 10 CFR 20.2005, states that C-14 and H-3 may be disposed of without regard to radioactivity, if the amount is less than or equal to 0.05 microcurie per gram of medium used for liquid scintillation counting or per gram of animal tissue averaged over the weight of the entire animal. This exemption does not eliminate the requirement to dispose of the scintillation fluid and carcasses according to applicable chemical and biological waste disposal instructions. In addition, the instruction requires records of the amount disposed be maintained to ensure compliance.

39.11. Records. Every item that is placed into a waste disposal container, flushed down an approved drain, incinerated or allowed to DIS, shall be recorded. A separate form shall be maintained by the generator for each container, each drain, and each incinerator and all of the columns listed on the form shall be completed. If inner containers are used they should be numbered consecutively and the inventory should indicate into which inner container each item of waste was placed. When a container is ready to be sealed for disposal or DIS, the WPAFB RSO shall be informed.

Section L—POSTING REQUIREMENTS

40. Documents Posted. Except as otherwise specified, copies of this instruction, 10 CFR Part 19 and Part 20, applicable AF permit, permit conditions, documents referenced in the permit and NRC Form 3, *Notice to Employees*, shall be posted in at least one conspicuous location within each work area where activities involving the use of radioactive material are conducted.

41. Alternative Posting. If posting of a document specified above is not practical, with the exception of NRC Form 3, *Notice to Employees* a notice may be posted which describes the document and states where it may be reviewed. Copies of the references listed in this instruction and other pertinent documents concerning the use of radioactive material are maintained by the WPAFB RSO in building 89, area C, at extension 72010. The notice shall state that the documents are available for review during normal duty hours.

42. Radiation Exposure Posting. The AF Listing 1499 lists each individual's radiation exposure record. This form is provided to supervisors at the end of each monitoring period and should also be made available for review.

Section M—EMERGENCY PROCEDURES

43. Emergency Situations. Potential radiation hazards may include:

43.1. Spills of RAM. A spill is not limited to liquids. Release of radioactive material from its container irrespective of the form of the material is considered a spill. The material may be in powdered form, liquid, gas, or a solid mass. Spills pose a hazard because of the potential for: (1) contamination of the environment, (2) contamination of the skin of personnel, (3) ingestion or inhalation of RAM, and (4) production of a high radiation field which may result in a radiation dose exceeding permissible limits even if the individual does not become externally contaminated. A spill may result from a simple incident such as the dropping of a container or it may result from a more serious event such as a fire or explosion.

43.2. Production of a radiation field by an x-ray machine, irradiator, accelerator or radioactive material (even if the material is completely contained). An x-ray machine, radioisotope irradiator, or accelerator may be emitting radiation when it is supposed to be off, such as; when a switch or circuit malfunctions and the unit does not shut down when switched off or it may be emitting radiation into an area where it is not expected, such as; when an accelerator beam is deflected into the wrong experimental area. In these instances, individuals may be exposed to high radiation fields possibly without their knowledge.

44. Response Procedures:

44.1. Differences in response to the two situations described above include:

44.1.1. For spills, the material must be confined to prevent further contamination and individuals/environment may require decontamination.

44.1.2. For radiation fields, individuals must be removed from the radiation field or the radiation source must be interrupted (e.g., turning off the x-ray machine or shielding the irradiator source).

44.1.3. For both cases, the primary concern is first, the protection of individuals in the vicinity including emergency response personnel and second, the protection of the environment. Life saving activities always takes priority over other considerations. In fact relatively large personnel exposures may be permitted for life saving procedures. This, however, is a one time permissible exposure which can never be repeated. Essential first aid always takes precedence over decontamination.

44.2. Emergency procedures are divided into two categories:

44.2.1. The first category involves generic response procedures, that is, procedures applicable to most situations.

44.2.2. The second category involves site-specific response procedures, that is, procedures unique to a specific location or situation.

44.2.3. This instruction describes typical generic response procedures. Site-specific procedures are developed by the user during application for a WPAFB radioactive

material permit. Copies of both generic and site-specific emergency response procedures are maintained by the WPAFB RSO and are made available to emergency response teams such as the fire department, security police and disaster preparedness. The WPAFB RSO shall either direct or delegate responsibility for all radioactive material cleanup operations.

45. Generic Emergency Response Procedures:

45.1. Spills. An acronym used by some groups to assist in recalling spill control procedures is SWIMS which stands for:

- 45.1.1. Stop the spill.
- 45.1.2. Warn others.
- 45.1.3. Isolate the area.
- 45.1.4. Minimize the exposure.
- 45.1.5. Secure the area and prevent any non-filtered exhaust.

NOTE: A somewhat more detailed explanation of the procedures is presented below:

45.1.6. Prepare for a spill by having a "spill kit" readily available complete with all of the items required to respond.

45.1.7. Advise all personnel not directly involved with the initial spill incident or the subsequent cleanup to evacuate the area. Anyone suspected of being contaminated during the incident or cleanup should not leave the area until monitored and decontaminated if necessary.

45.1.8. One individual should assume responsibility for immediate actions. This is not the time to argue protocol or seniority. Just as for CPR where the individual who starts CPR is in charge until he/she relinquishes control, so, in a spill, the individual who starts giving commands should continue to do so until a more qualified and knowledgeable individual arrives on scene.

45.1.9. Stop the spill if possible. This may involve turning a container right side up, capping it or throwing some material over the source to absorb or reduce the emissions. In either case, the benefit of performing this activity (e.g., preventing contamination from spreading to uncontrolled areas) must be balanced by the risk to the individual performing it (e.g., contamination, inhalation or exposure of the individual). If all of the contents have escaped from the container, don't waste time capping it.

45.1.10. Warn individuals not involved in the spill to evacuate the area. Designate someone to call for assistance. Call the WPAFB RSO and others, such as the supervisor, radiation monitor, or emergency response teams (e.g., fire department or ambulances) as required. The WPAFB RSO shall ensure that all notifications required by AFI 40-201 and 10 CFR 20.2201 and 20.2202, are accomplished

45.1.11. Determine extent of the spill. If liquid or solid, try to mark boundaries. If gas, which areas are affected.

45.1.12. Secure non-filtered exhaust and any other pathways outside the area (e.g., air vents, windows, drains, etc.).

45.1.13. Don protective equipment such as gloves, boots, anti-contamination clothing, and respirators. Minimize the number of personnel involved. Protective gear such as self contained breathing apparatus and bunker suits used by firefighters shall normally provide sufficient protection from contamination although monitoring should be accomplished prior to removing such equipment to prevent inadvertent contamination.

45.1.14. Measure radiation levels. Use meters, air samplers, etc.

45.1.15. Monitor all personnel. Obtain all information necessary to perform follow-up evaluations on personnel (e.g., name, address, phone numbers, SSAN, location at scene, duration of exposure, etc.). Check individuals for external contamination. If clothing is contaminated, remove it. If skin is contaminated, shower or wash, depending on available facilities. Although contamination should not be permitted to enter the sanitary system, personnel decontamination takes priority. Consider the need for internal evaluation (i.e., bioassay sampling such as urine, feces, nasal swabs, etc.). Bioassay samples are best collected immediately (provided external contamination of the sample is not a problem) and again after 24 hours. The WPAFB RSO shall provide guidance on follow-up sampling intervals.

45.1.16. Monitor environment and surfaces. Clean up if contaminated and collect all waste in plastic bags and place in sturdy containers.

45.1.17. For fires, water should be used sparingly since it may tend to spread contamination.

45.1.18. Radioactive material not involved in the incident should not be moved. Transporting sources to an alternate storage location during an incident to safeguard them is not recommended. Such actions tend to increase the possibility of personnel exposure or contamination due to accidental spills in transit. It is also possible that such actions could cause a loss of control over the sources. Under normal circumstances, the location of most sources shall be known in advance and measures can be taken to deal with them. However, if an attempt is made to move sources, the attempt may not be successful and response personnel might not then be aware of their new location. This could pose a greater hazard than initially existed.

45.1.19. After the cleanup has been completed, a report of the incident shall be prepared as directed by the WPAFB RSO and a copy submitted to the WPAFB RSC.

45.2. Radiation Fields. Accidents involving potential exposure to radiation fields are in general easier to deal with than spills although no less hazardous. The following procedures are recommended:

45.2.1. Shut down the source. For an x-ray unit this may involve interrupting the electrical supply either at the unit or at a main panel while for a radioisotope irradiator containing radioactive material it may be necessary to shield the source. In some cases it may not be possible to stop the radiation.

45.2.2. One individual should assume responsibility for immediate actions.

45.2.3. Warn others of the problem and send for assistance from the WPAFB RSO and others.

45.2.4. Isolate the area by closing doors or setting up improvised barriers to prevent entry. Be certain that no one is in the area before securing it.

45.2.5. After the situation has been corrected, a report of the incident shall be prepared as directed by the WPAFB RSO.

46. Emergency Response Teams:

46.1. The WPAFB RSO or a member of the staff shall provide initial training and annual refresher training to all personnel who may be called on to respond to accidents/incidents involving radioactive material or radiation-producing devices.

46.2. Supervisors shall be responsible for informing the WPAFB RSO of newly assigned personnel to permit scheduling of initial training.

46.3. A listing of locations where radioactive material or radiation-producing devices are stored or used, a summary of the sources located in each area and a copy of the site-specific emergency procedures provided by the organization possessing the sources shall be made available to each emergency response team.

Section N—Reporting Requirements

47. Mishaps, Incidents, and Accidents. Any abnormal occurrence involving radioactive material or radiation-producing device shall be reported by the using organization to the WPAFB RSO immediately after the abnormal occurrence becomes known. Based on the severity of the occurrence, as specified in AFI 91-204 and AFI 40-201, the WPAFB RSO shall notify the following:

47.1. 88 ABW/CC/DV/JA/PA/SE.

47.2. AFMSA/SGP3B.

47.3. HQ USAF/SGOE.

47.4. HQ AFMC/SGPC/A7C/.

47.5. Other interested organizations with jurisdiction such as US Environmental Protection Agency, Food and Drug Administration or State of Ohio.

48. Notice of Violation or Hazard:

48.1. Any worker or representative of workers who believes that a violation of NRC or AF instructions or permit conditions has occurred, or that any defect in facilities or equipment exists which may pose a hazard to personnel or the environment shall report such conditions to:

48.1.1. The immediate supervisor, permit RSO, branch or division chief, or department chairperson.

48.1.2. The WPAFB RSO at extension 72010. In absence of the WPAFB RSO, reports may be made to the Chairperson of the WPAFB RSC.

48.2. Initial reports may be submitted verbally; however, a written report shall be submitted within five workdays for proper documentation (AF Form 457, USAF Hazard Report, may be used). The willful failure to report such violations or hazards to personnel in accordance

with procedures provided in this section may be considered a dereliction of duty and could result in disciplinary action.

48.3. Requests for inspection of violations or defects involving radioactive material possessed under authority of a NRC license or AF radioactive material permit may be made to the Installation IG or directly, in writing, to the RIC, AF IG, or the NRC Office of Inspection and Enforcement, Region III, according to 10 CFR 19.16(a). Addresses and telephone numbers for these organizations are presented in following table:

Table 5. Organizational Addresses and Telephone Numbers

ORGANIZATION	ADDRESS	TELEPHONE	
		DSN	COMMERCIAL
AF Radioisotope Committee	HQ AFMSA/SG3PB 7700 Arlington Blvd, Ste 5151 Falls Church VA 22042-5151	761-6946 858-5058*	703-681-6946 301-981-5058
AF Inspector General	HQ AFIA/SGO 9700 G Avenue, Suite 318D Kirtland AFB NM 87117	246-2610	(505) 846-2610
NRC Region III (Inspection & Enforcement)	801 Warrenville Road Lisle IL 60532-4351	-----	(800) 522-3025

NOTE: *After duty hours (Bolling AFB Command Post)

Section O—Radon

49. Radon Limits. USEPA standards for exposure to radon are applicable to residential and non-residential structures on WPAFB. Newly constructed or acquired structures shall be assessed by the RSO for exposure to radon progeny, with the exception of hangars, maintenance bays, dedicated storage facilities, structures occupied less than four hours per day, temporary facilities and elevated structures with unobstructed air flow underneath. Tests shall be performed not earlier than one year after construction using long-term monitors. Structures identified with radon concentrations greater than 4.0 picocuries/liter shall be remediated by CE. Structures that have been mitigated shall be reassessed by the WPAFB RSO within six months.

AMANDA W. GLADNEY, Colonel, USAF
Commander

Attachment 1**GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION*****References***

AFI 40-201, *Managing Radioactive Materials in the US Air Force*, 16 March 2011
AFI 48-148, *Ionizing Radiation Protection*, 21 September 2011
AFI 91-204, *Safety Investigations and Reports*, 24 September 2008
AFMAN 33-363, *Management of Records*, 1 March 2008
AFMAN 48-125, *Personnel Ionizing Radiation Dosimetry*, 4 October 2011
AFPD 40-2, *Radioactive Materials (Non-Nuclear Weapons)*, 15 March 2007
DoDI 6055.8, *Occupational Ionizing Radiation Protection Program*, 15 December 2009

Adopted Forms

AF Form 1527-1, *Annual Occupational Exposure History to Ionizing Radiation*, February 2007
AF Form 457, *USAF Hazard Report*, 1 September 1973
AF Form 55, *Employee Safety and Health Record*, 5 August 2011
AF Form 847, *Recommendation for Change of Publication*, 22 September 2009
NRC Form 3, *Notice to Employees*, August 2011
NRC Form 241, *Report of Proposed Activities in Non-Agreement States, Areas of Exclusive Federal Jurisdiction, or Offshore Waters*, May 2012

Abbreviations and Acronyms

ALARA—As Low As Reasonably Achievable
NRC—Nuclear Regulatory Commission
RIC—Radioisotope Committee
RSC—Radiation Safety Committee
RSO—Radiation Safety Officer
TLD—Thermoluminescent dosimeter