

**BY ORDER OF THE COMMANDER  
19TH AIRLIFT WING**

**LITTLE ROCK AIR FORCE BASE  
INSTRUCTION 48-101**



**25 JUNE 2012**

***Aerospace Medicine***

**INSTALLATION RADIATION SAFETY  
PROGRAM**

**COMPLIANCE WITH THIS PUBLICATION IS MANDATORY**

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This written program implements AFPD 48-1, *Aerospace Medicine Program*; the Department of Defense (DOD) Instruction 6055.8, *Occupational Radiation Program*; AFI 40-201, *Managing Radioactive Materials in the Air Force*; AFI 48-148, *Ionizing Radiation Protection*; October 2005 Bioenvironmental Engineer's Guide to Ionizing Radiation; AFMAN 48-125, *Personnel Ionizing Radiation Dosimetry*; T.O. 33B-1-1, *Nondestructive Inspection Method*; AFOSH Std 48-139, *Laser Radiation Protection Program*; ANSI Z136.1, *American National Standard for Safe Use of Lasers*; AFOSH Std 48-9, *Radio Frequency Radiation Safety Program*; IEEE Std C95.7-2005, *IEEE Recommended Practice for Radio Frequency Safety Programs*; and ALARA (As Low As Reasonably Achievable) concept for exposures to ionizing radiation (e.g. radioactive material (RAM) or radiation producing devices (RPDs)) at Little Rock AFB. It gives guidance for all commanders, radiation safety officers (RSO), unit safety representatives (USR), contracting office personnel, and all other personnel whose duties involve potential exposure to ionizing and non-ionizing radiation. This instruction applies to all functional areas at Little Rock AFB where military and civilian personnel have duties that involve performing or supervising work in areas where exposures to ionizing and non-ionizing radiation may occur. It also applies to persons not occupationally exposed (that is, general public) to the extent that it addresses controls to protect the public from the potential hazards from sources of ionizing and non-ionizing radiation owned and/or operated by the Air Force. This instruction does not apply to the exposure of medical patients during diagnostic or therapeutic procedures, nor does it apply to

exposures of personnel to ionizing radiation resulting from the employment of nuclear or thermonuclear weapons in combat. Ensure that all records created as a result of processes prescribed in this publication are maintained In Accordance With (IAW) Air Force Manual (AFMAN) 33-363, *Management of Records*, and disposed of IAW with the Air Force Records Information Management System (AFRIMS) located at <https://www.my.af.mil/gcss-af61a/afrims/afrims/>. 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

**SUMMARY OF CHANGES**

This document has been substantially revised and must be completely reviewed. Major changes include: addition of non-ionizing radiation protection requirements, addition of the requirement that permit RSOs must come from the unit owning the radioactive item, requirements regarding permit RSO have been added, addition of Historical Office section and Nondestructive Imaging requirements, 314 AW organizations have been changed to 19 AW organizations. A star (\*) indicates a revision from the previous edition.

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## Chapter 1

### INTRODUCTION

#### *Section IA—Overview*

**1.1. Purpose.** The purpose of the base radiation safety program is to establish protection requirements necessary for the safe use of radiation producing devices and material. A properly managed radiation protection program will minimize the incidence of exposures to radiation to workers and the public, ensure a knowledgeable workforce exists, and maintain compliance with all federal and Air Force regulations.

**1.2. Scope.** This instruction provides the responsibilities and requirements for an effective radiation safety program for those who work with or around ionizing or nonionizing radiation. In addition, it provides procedures to ensure the public's safety when near radiation. Ionizing radiation requirements apply to: x-ray emitting devices, all items on Little Rock AFB requiring a radioactive permit or classified as a generally licensed device, and all areas that procure/transport/store such items. Nonionizing radiation requirements apply to: 3R, 3B, and 4 lasers and radiofrequencies of 3 kHz -300 GHz.

1.2.1. The standards and requirements in this instruction apply to occupational exposures and do not necessarily need to be applied to an emergency response environment.

#### *Section IB—Responsibilities*

##### **1.3. Installation Commander:**

1.3.1. The 19 AW/CC is ultimately responsible for all aspects of the Little Rock AFB Radiation Safety Program including:

1.3.1.1. Ensures all base personnel comply with this instruction. This includes military personnel, civilian employees, National Guard personnel, contractor personnel, and visitors.

1.3.1.2. Ensures all base activities comply with applicable Federal and Air Force directives covering the usage of radiation-producing equipment, the permitting, procurement, storage, handling, accountability for and disposal of radioactive material (RAM), and the reporting of incidents or accidents to the appropriate authorities.

1.3.1.3. Appoints, in writing, qualified individuals to be the installation radiation safety officer (IRSO) and unit safety representative (USR). This is typically the installation bioenvironmental engineer (BE) or a health physicist.

1.3.1.4. Conducts a base-wide radiation safety program through the 19th Aerospace Medicine Squadron (AMDS) Bioenvironmental Engineering Flight (BEF), under the direction of the IRSO.

##### **1.4. IRSO:**

1.4.1. Serves as the installation commander's single point of contact for all radiation safety matters. IRSO investigates, evaluates, initiates corrective action, and reports on defects or

noncompliance items relating to substantial safety hazards involving RAMs or radiation producing devices (RPD).

1.4.2. Terminates any operation which, in the opinion of the IRSO, poses a substantial radiation hazard to personnel or the environment. A report of such actions will be made to the installation commander.

1.4.3. Conducts investigation of incidents of alleged or actual overexposures to radiation.

1.4.4. Provides expert consultation, advice, assistance, and direction to base agencies (i.e. anti-terrorism working group (ATWG), threat working group (TWG), fire department, incident commander, emergency management working group (EMWG), and environmental safety and occupational health council (ESOHC)) on the hazards associated with radiation and the methods to control these hazards, as needed. Briefs at least annually the ESOHC, or equivalent, regarding use of RAM on the installation.

1.4.5. Reviews design plans for facilities to be used for RAMs or RPDs that could require shielding and provide preliminary hazard evaluations.

1.4.6. Provides expert oversight of all permit radiation safety officers (RSO), USRs, and radiation programs to ensure all Federal, Air Force, state, and base rules and instructions relating to radiation safety requirements are met.

1.4.7. Conducts annual review of written RAM template permits policy and conducts annual permit audits. Provides results to permittees.

1.4.8. Provides radioisotope committee (RIC) secretariat approved template permit RSO training and tests to permit RSO candidates. Provides names of those individuals who pass the test to the RIC secretariat.

1.4.9. Ensures USRs are assigned and annually trained for all units that may use, possess, or come in contact with ionizing/non-ionizing radiation.

1.4.10. Manages and controls the receipt, shipment, transfer, and disposal/recycling of radioactive items and wastes, to include proper packaging and storage by installation organizations.

#### **1.5. BEF will:**

1.5.1. Coordinate with CE emergency management and fire department on base emergency response plans and checklists related to radiation.

1.5.2. Provide radiation safety training material for USRs and for users of RAMs and RPDs by annual as low as reasonably achievable (ALARA) training. Approve radiation safety training plans for training provided by others, such as permit RSOs, or USRs.

1.5.3. Conduct the installation radiation dosimetry program, and non-ionizing radiation programs in accordance with Air Force and Federal requirements.

#### **1.6. Unit Commanders/Permitees:**

1.6.1. A permittee is the commander, civilian equivalent, or designated representative of an Air Force organization that owns a RAM requiring a template permit. This individual is responsible for ensuring compliance with all Federal, Air Force, and permit conditions.

1.6.2. Permittees will appoint an individual, in writing, as the permit RSO for approval by AFMSA/SG3PB. Contact BE for specific instructions on approval process prior to procuring item.

1.6.3. Appoint the USR to be responsible for radiation safety within the unit, if unit owns, operates, or works around radiation-producing devices or items, to include lasers and radiofrequency emitters.

1.6.4. Coordinate with the IRSO prior to receiving, possessing, using, distributing, storing, transporting, transferring, or disposing of any RAM, or commodity containing RAM.

1.6.5. Provide required resources for the permit RSO or USR to maintain compliance with this instruction.

1.6.6. Delegate the authority to the permit RSO or USR to suspend operations involving RAMs that pose a significant health risk to personnel, are in clear violation of regulations or requirements, or can negatively impact Air Force operations, materiel, or real estate.

### **1.7. Permit RSO:**

1.7.1. Appointed, in writing, by unit commander (permittee) of squadron owning template permit. Provide a copy of letter of appointment to IRSO.

1.7.2. Certified by IRSO to be permit RSO in accordance with RIC secretariat template permit RSO requirements (training and test).

1.7.3. Ensures radiation safety and compliance for the use of RAMs for which a specific Air Force RAM template permit has been issued by the Air Force RIC.

1.7.4. Ensures permit RAM is not transported or transferred to another organization without prior coordination with the IRSO.

1.7.5. Develops, in coordination with BE/IRSO, written policy for permitted RAM as required by AFI 40-201, paragraph 1.26.7., and detailed in chapter 2 of this instruction.

1.7.6. Maintains a binder that includes all applicable permit documentation (appointment letter, amendments, inspection reports, leak test results, written policy/procedures, and important contact information (Attachment 1)).

1.7.7. Reports accidents or incidents involving RAMs to the IRSO.

### **1.8. Unit (Shop) Safety Representative (USR):**

1.8.1. Must be appointed, in writing, from within the organization to ensure compliance with applicable regulations. The USR appointment letter required by safety meets this requirement. This individual should have the authority to execute the necessary actions to ensure compliance. The appointed individual shall work with the IRSO to ensure compliance with applicable regulations.

1.8.2. Responsible for units owning generally licensed devices (GLD).

1.8.2.1. Shall preserve all labels affixed to the device recognizing the radiation isotope and follow all instructions on the label.

1.8.2.2. Will ensure the device is not transferred to another organization until transfer is approved and coordinated with BE/IRSO.

1.8.2.3. Will ensure maintenance only be completed by the manufacturer of the product. If shipping of device is required, will contact IRSO.

1.8.2.4. Will ensure that GLDs are properly disposed.

1.8.3. Responsible for lasers and radiofrequency radiation.

1.8.3.1. Responsible for all safety requirements regarding hazard class 3B and 4 Lasers operated by their unit, to include conducting and documenting initial and annual training regarding the proper use of lasers and the hazards of lasers. BE can assist with development of training material.

1.8.3.2. Assists the unit commander in developing policies and procedures for nonionizing radiation in accordance with Federal and Air Force regulations, and chapter 6 and 7 of this standard.

1.8.3.3. Reports all suspected laser or radiofrequency radiation exposures to the unit commander.

### **1.9. Installation Contracting Office will:**

1.9.1. Ensure that all contracts contain the terms and conditions the IRSO has determined must be in the contract in order to be in compliance with all applicable statutes, regulations, and instructions for managing radioactive materials in the Air Force. This will include the requirement that non-Air Force organizations, including other DOD organizations, Department of Energy (DOE) organizations, DOE prime contractors, and other contractors that need to use radioactive materials either licensed by the Nuclear Regulatory Commission (NRC) or an Agreement State on the installations, have one of the following:

1.9.1.1. An NRC or Agreement State license. A copy of the NRC Form 241, **NRC Reciprocity Form or equivalent**, must be an adjunct to the agreement state license for those areas of exclusive Federal jurisdiction in agreement states. For those areas of concurrent or proprietary jurisdiction in an agreement state, then the respective agreement state license is a valid authorization.

1.9.1.2. A valid US Navy RAM permit.

1.9.1.3. Written certification from DOE organizations or DOE prime contractors that they are exempt from NRC license requirements.

1.9.1.4. Written approval from the IRSO to transfer, transport, or use temporary storage areas for RAM on the installation.

1.9.2. Provide all design reviews and work order requests involving potential use, movement, or disposal of RAM to the IRSO for review and approval prior to allowing work to commence on contract. Work requests without prior approval of the IRSO will be denied.

1.9.3. In coordination with the IRSO, and in accordance with the terms and conditions of the contract, suspend contractor operations that violate AFI 40-201, a permit or license, or Federal regulations until corrective action is taken.

**1.10. 19 LRS/LGRDDC (Cargo Movement Section) will:**

1.10.1. Prepare and transport RAM shipments in accordance with 10 CFR 71, *Packaging and Transportation of Radioactive Material*; 49 CFR, *Transportation*; and Defense Transportation Regulation (DTR) DOD 4500.9-R-Part II, Cargo Movement, as applicable.

1.10.2. Ensure personnel performing transportation operations (e.g. receipt, shipment, packaging) of RAM comply with training requirements specified in 49 CFR 172.704 and DTR DOD 4500.9-R-Part II.

1.10.3. Not transfer any RAM to units on the installation without prior coordination with the IRSO. Permitted RAM will not be transferred to any organizations without an up-to-date permit, a permit RSO, or the proper identification of radionuclide/quantities of material/devices as authorized on the permit.

1.10.4. Develop and implement procedures to prevent the unauthorized transfer of RAM/items of supply containing RAM/or any item of suspect through the Defense Reutilization Management Office (DRMO) system. Establish procedures to notify the IRSO in the event of an incident(s) or the need to perform radiological survey(s) of material that has been identified by DRMO as potentially containing radioactive and/or components.

1.10.5. Ensure radioactive material is stored in a secure location.

**1.11. 19 AW Command Post will:**

1.11.1. Ensure BE and flight medicine are notified immediately if any suspected exposure to radiation, lasers, or radiofrequency radiation is reported.

**1.12. Workplace Supervisors will:**

1.12.1. Identify any use, receipt, or ordering of ionizing or nonionizing radiation in their workplace to BE immediately.

1.12.2. Ensure any planned changes in laser operations are coordinated with their respective USR. The USR will then coordinate with BE prior to becoming operational.

1.12.3. Aid the USR and/or permit RSO in ensuring required warning signs, safety devices, and personal protective equipment (PPE), as recommended/required by BE, are functional and properly worn or placed before beginning work.

**1.13. Individuals will:**

1.13.1. Learn and implement the rules of radiation safety as described in applicable Federal, Air Force, and Little Rock AFB instructions as well as in organizational OIs.

1.13.2. Perform all duties to keep radiation exposures ALARA.

1.13.3. Wear personal monitoring devices if directed by their supervisors and the IRSO.

1.13.4. Wear appropriate protective clothing and equipment as prescribed by supervisors and the IRSO.

1.13.5. Report incidents, accidents, and hazardous conditions immediately to their supervisors.

1.13.6. Not override engineering controls, modify personal protective equipment or tamper with radiation dosimeters or purposely expose radiation dosimeters to radiation or radioactive material.

1.13.7. Inform their supervisors of any changes in equipment, procedures or other factors involving RAMs or RPDs that may alter the radiation safety practices or radiation levels in unrestricted areas.

## Chapter 2

### RADIOACTIVE MATERIALS (RAM)

**2.1. RAM.** RAM are materials whose nuclei, because of their unstable nature, decay by emission of ionizing radiation. The radiation emitted may be alpha or beta particles, gamma or X-rays, or neutrons. If supervisors suspect or have RAM, contact BEF immediately to determine requirements.

**2.2. Template permits.** Template permits are issued for devices or applications that pose relatively little radiological risk and employ standardized permit conditions. Examples of template permits are automatic chemical agent detector alarms (ACADA) containing nickel-63, and Niton x-ray fluorescence (XRF) lead paint analyzers containing cadmium-109.

#### **2.3. RAM Permit Requests.**

2.3.1. All AF organizations must obtain a RAM permit from AFMSA/SP3PB prior to receiving, storing, distributing, using, transferring, or disposing permit required RAM. No organization shall apply for a RAM permit without prior coordination with the IRSO. BE will provide assistance in determining whether the RAM requires a permit.

2.3.2. All template permit requests (new, amendments, renewals, or termination) will be accomplished in accordance with guidance given in AFI 40-201. All requests will be routed through the IRSO who will route the request to AFMSA/SP3PB.

#### **2.4. Recordkeeping.**

2.4.1. See Attachment 3, Table A3.1., for recordkeeping in accordance with AFI 40-201.

2.4.2. Posting notices to workers: the following forms/documents are required to be posted in a conspicuous location where the particular permitted RAM is stored or used: NRC Form 3; supplemental notice; permit; and an emergency contact list (Attachment 1). See Attachment 3 for the supplemental notice.

2.4.3. RAM template permit items must be inventoried in accordance with paragraphs 3.6.2. and 3.6.3. of AFI 40-201.

#### **2.5. General Guidelines.**

2.5.1. All conditions on the permit must be known and followed.

2.5.2. All RAM requiring permit must be secured from unauthorized access or removal.

2.5.3. Permit RSO must notify IRSO within 5 business days when they change their mailing address or when personnel listed on the permit such as users or RSOs permanently cease their duties or change their names. IRSO will notify AFMSA/SP3PB.

2.5.4. Users of permitted RAM shall receive user training (in accordance with permit conditions).

#### **2.6. Disposal/Recycling of RAM.**

2.6.1. Permitted, licensed, and other nonexempt RAM must be disposed of or recycled in accordance with AFI 40-201 and 10 CFR 20, Subpart K, *Waste Disposal*. All requests for disposal/recycling must be coordinated with the IRSO in writing.

2.6.2. Only the permit RSO will work with BE to dispose/recycle RAM.

## **2.7. Generally Licensed Devices (GLD).**

2.7.1. The NRC or agreement state (Arkansas) issues a general license to acquire, receive, use, store, or transfer certain devices that contain RAM which have been manufactured, tested, and labeled by the manufacturer in accordance with the specifications contained in a specific license issued to the manufacturer by the NRC. These devices are labeled as being generally licensed. GLDs do not require a template permit. Examples of GLDs are the APD-2000 chemical agent detector and Ionscan-400B.

2.7.2. GLDs should be purchased using Defense Federal Acquisition Regulations, assigned a National Stock Number, and registered in the Federal Logistics Information System and Hazardous Material Information Resource System. Local purchase of these devices is strongly discouraged. In either case, devices shall be registered in the Air Force logistics system and identified as radioactive. BE will be notified of all GLDs on base.

2.7.3. GLDs will be leak tested biannually. BE will coordinate with shop to perform test. USR and BE will check on/off indicator, if any, when performing biannual leak test.

2.7.4. GLDs must not be stored without use for more than 2 years.

2.7.5. The USR and IRSO will ensure that GLDs are disposed in accordance with AFI 40-201, Attachment 10. GLDs will not be brought to DRMO for disposal.

## **2.8. Radiation Monitoring Equipment.**

2.8.1. Radiation survey meters used for determining compliance with Air Force instructions and Federal regulations must be calibrated according to ANSI guidance at intervals not to exceed one year. Calibration records shall be kept as prescribed in Attachment 7 of AFI 40-201.

## Chapter 3

### NON-DESTRUCTIVE INSPECTION (NDI) OPERATIONS

#### 3.1. Installation NDI Work Center.

3.1.1. Review the safe use and operation of aircraft x-ray equipment operating procedures annually to ensure currency and full compliance with T.O. 33B-1-1, Chapter 6, Section VIII. The operating instruction must be forwarded to BE for approval.

3.1.2. Notify BE if the process or workload changes or they receive new x-ray equipment; as an x-ray scatter survey is required to be performed on all shielded/unshielded facilities when changes are made in shielding, operation, workload, equipment ratings or occupancy of adjacent areas when these changes, in the opinion of the RSO, can adversely affect radiation protection. 3.1.3. Supervisors must inform BE when aircraft x-rays will be taken in a shielded/unshielded building, where an x-ray scatter survey has not been performed by BE. The scatter survey must be completed prior to x-ray operations.

3.1.3. Follow BE recommendations for controls detailed in occupational health survey letters from the BE office.

**3.2. BE.** BE must perform an annual HRA of the NDI workcenter. BE will ensure the following are checked annually from T.O. 33B-1-1, Chapter 6, Section VIII and the results are provided to the unit commander and NDI radiography supervisor:

3.2.1. Verify the adequacy of operating procedures, safety precautions, administrative or physical controls, the presence and proper use of radiation warning signs and signals, and need for additional surveys.

3.2.2. Exposures accumulated in controlled and uncontrolled areas.

3.2.3. Document findings, recommendations, and restrictions.

#### 3.3. General Guidelines.

3.3.1. NDI personnel are required to wear electronic personnel dosimeters (EPD) with each aircraft x-ray session for the entire duration of the session. EPDs will be sent to PMEL for annual calibration.

## Chapter 4

### MEDICAL/DENTAL/VETERINARIAN X-RAY

#### 4.1. Medical/Dental/Veterinarian Services:

4.1.1. Must annually review/update the fluoroscopy operating instruction pertaining to the safe use and operations of x-ray equipment. This instruction must be forwarded to BE for approval.

4.1.2. Notify BE if they receive new x-ray equipment, as an x-ray scatter survey is required to be performed on facilities before the new equipment will be used.

4.1.3. Follow BE recommendations for controls detailed in survey letters from the BE office.

**4.2. BE.** BE must perform an annual HRA of the medical/dental/veterinarian services x-ray operations to ensure adequate controls are in place and to check for any operation changes.

**4.3. Thermoluminescent Dosimeters (TLD).** Medical/dental/veterinarian services wear TLD as required by BE and in accordance with Chapter 5 of this instruction.

## Chapter 5

### THERMOLUMINESCENT DOSIMETRY (TLD)

**5.1. NDI.** NDI personnel are required to wear whole body TLD with each aircraft x-ray session for the entire duration of the session.

**5.2. Medical radiology.** Medical radiology personnel are required to wear whole body and collar TLDs for the entire duration of fluoroscopy process and whole body TLD for the entire duration of the x-ray session.

**5.3. Additional personnel.** As identified by IRSO, additional personnel may be required to wear TLDs. IRSO will take into account historical data, surveillance data, Air Force guidelines, and precedents when deciding who to place on TLDs. Individuals who have the potential to get more than 10% of the annual limit must be on the TLD program.

#### **5.4. General guidelines.**

5.4.1. The workcenter supervisor must ensure TLDs are stored in the area specified by BE to ensure no dose is received. The location must be a clean/dry area away from all x-ray operations. The control badge must remain in this location at all times.

5.4.2. Individuals need to ensure TLDs are kept in the workcenter and not worn outside. Excessive heat and sunlight may potentially damage the TLDs.

5.4.3. TLDs will be exchanged by BE quarterly. The workcenter supervisor must inform BE when a female on the TLD program becomes pregnant. BE will then enroll individual on the TLD monthly monitoring program.

5.4.4. Before being placed on the TLD program individual will provide the required information on the request for initial entry memorandum. This includes the worker's social security number, prior work history regarding radiation, whether the individual moonlights, and verification of initial training. Failure to provide this information will prevent the worker from being added to the base TLD program.

5.4.5. Annually, BE will provide the worker their yearly cumulative dose record. This form will be signed by the IRSO and individual. The form will be maintained in the BE shop and individual's medical record.

#### **5.5. TDY/Deployments.**

5.5.1. Ninety days or less: Individuals will take their dosimeter and a designated transit control dosimeter with them. The accompanying control dosimeter may be issued from spare dosimeters provided to the home base. **Note:** TDY badges should be hand carried onto the aircraft and not allowed to go through the checked and carry-on baggage scanners; the baggage may be subject to X-ray radiation at a level that could damage the TLDs.

5.5.2. TDY/deployed locations with an established dosimetry program: While TDY to a location with an established dosimetry program, individuals will obtain necessary dosimetry at the TDY location. If dosimetry support is provided by other than United States Air Force School of Aerospace Medicine (USAFSAM) Department OEHH, the individual is

responsible for ensuring copies of their dosimetry results are provided to USAFSAM/OEHHD for inclusion in the MRER.

5.5.3. TDY/within CONUS: Locations not having an established dosimetry program: individuals on TDY for periods greater than 90 days to locations without an established dosimetry program will receive dosimetry support from their sponsoring organization for the duration of the TDY. Support will necessitate providing dosimetry controls and ensuring exchanges are made in a timely fashion. Gaining organizations anticipating ongoing requirements of this nature are encouraged to establish their own dosimetry programs.

5.5.4. TDY/OCONUS: Locations not having an established dosimetry program. Individuals on TDY for periods greater than 90 days to locations without an established dosimetry program will receive dosimetry support from the nearest location with an established dosimetry program. USAFSAM/OEHHD will provide additional dosimetry support to the location providing the support to these individuals. These procedures should be established before member departs TDY for OCONUS locations.

**5.6. Personnel Dosimeters.** As of the date of this instruction, the IRSO has set the investigative action level (IAL) for radiation workers at 50 mrem and 10 mrem for a pregnant female. These limits were based on approximately twice the highest level of past quarterly results and the lower limit of detection of the TLD for pregnant workers. The purpose of these limits is to enable the RSO to maintain ALARA exposures. Exceeding these limits does not mean the individual is overexposed. The IRSO will initiate and conduct the investigation and report quarterly, or monthly for pregnant females, if TLD results are at or above these set limits. The IRSO must follow procedures outlined in Chapter 9 of AFMAN 48-125, *Personnel Ionizing Radiation Dosimetry*. The IRSO may change these limits as dictated by professional judgment.

## Chapter 6

### LASER SAFETY PROGRAM

**6.1. Laser classification.** Laser classification is currently outdated in AFI 41-137. The following are the updated classifications in accordance with ANSI Z136.1 2007. Classifications provide a practical means for delineating the degree of hazard and specifying appropriate controls for each classification. Attachment 4, table 2 provides requirements and a description of each laser class

6.1.1. BE must be notified of any unit owning or operating a class three or four laser, for addition to base laser inventory. Classification can be found labeled on the equipment or in the manual. BE will routinely assess and document potential laser hazards in industrial workplaces in accordance with their surveillance schedule. Workers will notify BE prior to purchase of class three or four lasers for approval.

#### **6.2. Laser Safety Training and Controls.**

6.2.1. Refer to attachment 5 for the areas to be covered by laser safety training. Annual laser safety is required for users of Class 3B and 4 lasers. This training shall be documented on the AF Form 55, **Employee Safety and Health Record**, authorized versions, or an equivalent computer-generated product.

6.2.2. Protective equipment.

6.2.2.1. Enclosure of the laser equipment or beam path is the preferred method of control, since the enclosure will isolate or minimize the hazard. Though enclosure is the optimal method of control, this method may not be warranted for some systems and facilities (i.e., laser ranges and laser pointers).

6.2.2.2. BE will recommend the appropriate laser protective eyewear and skin protection, if required, for each laser system. Not all lasers will require protective eyewear. There is no single eyewear adequate for all lasers. Users should not utilize protective eyewear not certified for use by BE.

#### **6.3. Medical surveillance.**

6.3.1. Medical surveillance requirements are limited to personnel who work in a hazardous laser environment on a weekly basis. These personnel include, but are not limited to, laboratory personnel, aircrew, and laser range personnel. Personnel working on less hazardous laser classes, as defined by the ANSI Standard Z136.1, do not require medical surveillance and will be considered incidental personnel.

6.3.2. Supervisors will ensure that personnel who work with the most hazardous laser classes, as defined by the ANSI Standard Z136.1, report to public health (PH) services upon initial assignment. PH will review individual medical records and make referrals for required medical surveillance.

6.3.3. Pre- and post-employment medical examinations will be performed only before an individual's initial assignment to laser duties and as soon as practical subsequent to actual termination of duties involving lasers (i.e., permanent change of station or permanent change of assignment, retirement, or separation). Periodic examinations are not required. Following

any suspected laser injury, the pertinent examinations, as determined by an appropriately qualified provider (e.g., optometrist/ophthalmologist) will be performed.

6.3.4. Minimum exam requirements are provided in the following paragraphs. Complete details on the listed exams are provided in ANSI Z136.1., appendix E. The Air Force post-employment exam will follow the same requirements as the pre-employment exam.

6.3.4.1. Ocular history: Review past ocular history and family history for any conditions related to the eyes.

6.3.4.2. Visual acuity: Best corrected, distant and near vision should be measured.

6.3.4.3. Macular function: Test macular function with an Amsler grid using appropriate optical correction to determine if distortion or scotomas exist.

6.3.4.4. Color vision: Use a pseudo-isochromatic plate test (red/green and/or blue/yellow) or similar color vision test to document color vision discrimination.

6.3.4.5. If any nonocular abnormalities are found, a more extensive examination will be conducted to determine underlying pathology.

**6.4. Laser overexposures:** The main symptoms of laser injury are pain and a reduction in the clarity of vision. It may not be known that lasers are in use; therefore, medical personnel should suspect that personnel may have been exposed to lasers if the individual reports seeing bright flashes of light, experiences eye discomfort and poor vision, and has a feeling of unexplained heat. Obvious lesions such as corneal burns, retinal injury, retinal hemorrhage, and skin burns make the diagnosis of injury from lasers more certain.

6.4.1. USRs and supervisors of individuals exposed to laser radiation will follow procedures in paragraph 2.6.2. of AFOSH Std 48-139, *Laser Radiation Protection Program*.

6.4.1.1. Individuals exposed will seek medical care, without delay, at their host medical unit emergency treatment facility. The laser hotline (1-800-473-3549) should be called ASAP because immediate indicated care is critical. The individual's supervisor will be notified immediately and ensure action is taken to prevent injury to other personnel. The individual will be re-examined within 72 hours.

6.4.1.2. The immediate supervisor will immediately notify the unit commander, USR and IRSO. The IRSO will notify wing safety, public health (PH) services, staff judge advocate, and MAJCOM medical staff immediately. Within 24 hours the BE will also notify the Tri-Service Laser Radiation Hotline. Tri-service Laser Radiation Hotline personnel will notify USAFSAM/AFC. PH will ensure the AFSAS, OSHA 300 log, report is initiated by the attending physician and forwarded to BE.

6.4.1.3. The USR will keep the unit commander and other unit personnel informed of actions being taken or required as part of the medical investigation.

6.4.1.4. If it is known or suspected that a defect of any kind in a laser may have caused the injury, the laser shall be immediately taken out of service until the deficiency has been corrected.

6.4.2. BE will perform notification procedures and investigation in accordance with *paragraph 2.6.3. of AFOSH Std 48-139*.

## Chapter 7

### RADIO FREQUENCY RADIATION (RFR) SAFETY PROGRAM

**7.1. Recognizing RFR systems.** Recognition of RFR systems will be accomplished during BE routine workplace surveillance. Shop supervisors should notify BE of any RFR systems acquired between these periodic surveys. BE will evaluate all RFR systems on base that are owned and operated by avionics shops, communication facilities, industrial processes, and medical facilities.

**7.2. BE will.**

7.2.1. Evaluate identified RFR systems to determine whether a system is hazardous. A hazardous system is one capable of producing levels above the RFR exposure limit in areas accessible by personnel. BE evaluation may include, but is not limited to, visual examination, theoretical calculations, comparison to similar systems, and survey measurements as necessary.

7.2.2. BE will provide control recommendations for hazardous RFR systems.

**7.3. RFR Exposures.** An individual may be exposed to the RFR exposure limit without exhibiting any damaging biological effects. The level incorporates, at minimum, a safety factor of 10 times below the threshold for occurrence of biological effects in humans. Limits can be found in AFOSHSTD 48-9.

7.3.1. RFR exposure levels are established for controlled and uncontrolled environments. Controlled environments are workplace areas in which personnel are aware of the presence of RFR in their work area. Uncontrolled environments are those areas in which individuals have no knowledge or control of their exposure to RFR.

7.3.2. There is no special RFR exposure limits for pregnant females. Any level RFR environment that is safe for the mother is also safe for the developing embryo or fetus. Pregnant workers will follow the requirements in their profile.

**7.4. Mandatory Posting Requirements.**

7.4.1. Appropriate warning signs will be placed at all access points to controlled areas where RFR levels exceed the limit; signs will be visible from all directions of approach. BE will determine need for posting in areas where RFR levels may exceed the controlled exposure limit.

7.4.2. Workplace supervisors will ensure required warning signs, safety devices, and PPE recommended/required by BE are functional and properly worn or placed before beginning work.

**7.5. RFR Safety Training.**

7.5.1. Workplace supervisors will ensure workers who work regularly with or around RFR systems determined by BE as hazardous are trained on RFR safety upon initial assignment to the unit and annually thereafter. The workplace supervisor may contact BE to obtain training material. BE will review RFR safety materials and training documentation during routine workplace surveillance.

7.5.2. The training plan will include, but is not limited to: locations where the permissible exposure limit (PEL) can be exceeded, any new equipment/modifications or changes that can effect previously identified hazardous areas, control measures that must be observed by workers to avoid personal exposure, an overview of biological effects that can result from exposure to RFR, and exposure incident reporting procedures and follow-up technical and medical investigation process.

7.5.3. Initial and annual training must be documented to show that employees are adequately trained. This training shall be documented on the AF Form 55, **Employee Safety and Health Record**, authorized versions, or an equivalent computer-generated product.

**7.6. Low Power RFR.** The latest version of IEEE C95.1 has updated recommendations on low power exclusion requirements. In accordance with this guidance, whole body exposure limits for uncontrolled areas will not be exceeded if the power of the source does not exceed 5.6W. BE will take this into consideration when determining whether RFR systems are hazardous.

**7.7. RFR Overexposure:** May produce reddened or burned skin. Workers may hear “clicking” or “popping.” Symptoms of shock and burns may be evident and should be treated accordingly.

7.7.1. Once a responsible area supervisor has been notified of an individual(s) overexposure to RFR they must refer the individual to seek medical care within 72 hours of incident. The responsible area supervisor is also responsible for reporting the incident to BE.

7.7.2. BE will perform investigation and reporting in accordance with paragraph 3.5.2. and attachment 2 of AFOSH Std 48-9, *Radio Frequency Radiation (RFR) Safety Program*.

## Chapter 8

### ALARA CONCEPT

#### 8.1. ALARA concept.

8.1.1. Developed in response to epidemiological and historical radiation dose data which suggests that no level of ionizing radiation exposure is entirely risk-free. Although there are federal regulations that specify acceptable, conservative levels to ensure low risk of adverse health effects, it is prudent to reduce exposures to the lowest levels reasonably achievable, thereby lowering the health risk associated with that exposure. As a result, it is Air Force policy that all exposures to ionizing radiation be ALARA.

8.1.2. There should be no exposure to ionizing radiation without an expected benefit, and the dose received should be the lowest possible, consistent with the state of technology, cost, and operational requirements.

8.1.3. The ALARA concept does not apply to lasers or RFR systems.

8.1.4. In an effort to ensure exposures are maintained ALARA, the IRSO will conduct, document, and report periodic program reviews to the occupational health working group (OHWG) or aerospace medicine council (AMC).

#### 8.2. General guidelines.

8.2.1. Organizations requiring annual ALARA training will be identified by BE through routine HRAs. Contact BE regarding requests for ALARA training.

8.2.2. BE will provide each organization training material specific to the unit's occupational radiation hazard.

8.2.3. Shop supervisors will be responsible for ensuring this training is documented on the AF Form 55, **Employee Safety and Health Record**, authorized versions, or an equivalent computer-generated product.

8.2.4. Shop supervisors will ensure new workers are briefed on presence of radiation and review the ALARA training information in attachment 6 of this instruction.

#### 8.3. NDI annual/refresher training include:

8.3.1. Topics specified in 10 CFR 19.12.

8.3.2. Deficiencies identified during periodic quality audits of the radiation protection program and unit training inspections.

8.3.3. Review of accidents and unusual events.

8.3.4. Review of dosimetry results (emphasizing dose reduction and ALARA)

8.3.5. Review of basic radiation safety principles, operations, emergency procedures, new safety regulations, license requirements, and other pertinent information.

## Chapter 9

### HISTORICAL OFFICE/STATIC DISPLAY MANAGER

**9.1. Radiation in museum-accessioned historical property.** As of the date of this instruction, there is no detectable radiation on any of the historical property located on base. If radiation is ever discovered in museum-accessioned historical property, whether aerospace vehicle or any other artifact, BE will be notified. BE will conduct a survey of any new items.

**9.2. Handling of artifacts.** Handling of artifacts that contain RAM is not authorized. All entries made into static display aircraft must be coordinated with the IRSO.

**9.3. Radiation exposure.** All displays that contain RAM should be designed to keep exposure levels to visitors and staff ALARA. The IRSO will be the final authority on whether emissions from any exhibit are within safe limits.

## Chapter 10

### OVEREXPOSURE PROCEDURES

#### 10.1. General guidelines.

10.1.1. Every incident involving a suspected radiation overexposure to personnel covered by this instruction will be investigated and documented.

10.1.2. Immediately upon suspected overexposure BE/IRSO and medical personnel will be contacted.

#### 10.2. Ionizing Radiation Overexposure: Acute health effects include burns, nausea, weakness, hair loss, skin burns, or diminished organ function.

10.2.1. The IRSO, once notified, will be responsible for up channeling any ionizing radiation overexposure investigation notification and will forward all reports and documentation required to the appropriate higher agencies in accordance with attachment 11 of AFI 40-201, *Managing Radioactive Material in the US Air Force*.

10.2.2. Permitted RAM: The permittee (unit commander) is responsible for ensuring an investigation and a prepared report on events that involve permitted RAM is completed. The permit RSO, assisted by the IRSO, normally performs the investigation.

10.2.3. Non-permitted RAM: The commander of the affected organization is responsible for ensuring the investigation and report have been completed.

#### 10.3. Nonionizing radiation overexposure. Refer to Chapters 6 and 7 of this instruction for nonionizing radiation overexposure requirements.

BRIAN S. ROBINSON, Colonel, USAF  
Commander, 19 Airlift Wing

## Attachment 1

## GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

**References**

AFI 40-201, *Managing Radioactive Materials in the Air Force*, 16 March 2011

AFI 48-148, *Ionizing Radiation Protection*, 12 October 2001

AFMAN 33-363, *Management of Records*, 01 March 2008

AFMAN 48-125, *Personnel Ionizing Radiation Dosimetry*, 07 August 2006

AFOSHSTD 48-139, *Laser Radiation Protection Program*, 10 December 1999

AFOSHSTD 48-9, *Radio Frequency Radiation Safety Program*, 01 August 1997

AFPD 48-1, *Aerospace Medicine Program*, 03 October 2005

ANSI Standard Z136.1, *American National Standard for Safe Use of Lasers*, 25 September 2007

DODI 6055.8, *Occupational Radiation Program*, 15 December 2009

IEEE Standard C95.7-2005, *IEEE Recommended Practice for Radio Frequency Safety Programs*, 22 March 2006

Bioenvironmental Engineer's Guide to Ionizing Radiation, 1 October 2005

T.O. 33B-1-1, *Nondestructive Inspection Method*, 1 October 2009

**Prescribed Forms**

None

**Adopted Forms**

AF Form 847, *Recommendation for Change of Publication*

**Abbreviations and Acronyms**

**ACADA**— Automatic Chemical Agent Detector Alarms

**AF**— Air Force

**AFB**— Air Force Base

**AFI**— Air Force Instruction

**AFMAN**— Air Force Manual

**AFOSH**— Air Force Occupational Safety and Health

**AMC**— Air Mobility Command

**AMCI**— Air Mobility Command Instruction

**AFPD**— Air Force Policy Directive

**ALARA**— As Low As Reasonably Achievable

**AMDS**— Aerospace Medicine Squadron

**ANSI**— American National Standards Institute  
**ATWG**— Anti-Terrorism Work Group  
**BE**— Bioenvironmental Engineer  
**BEF**— Bioenvironmental Engineer Flight  
**DOE**— Department of Energy  
**DRMO**— Defense Reutilization Management Office  
**EMWG**— Emergency Management Working Group  
**EPD**— Electronic Personal Dosimeter  
**ESOHC**— Environmental Safety and Occupation Health Council  
**GLD**— Generally Licensed Device  
**HRA**— Health Risk Assessment  
**IAL**— Investigative Action Level  
**IEEE**— Institute of Electrical and Electronics Engineers  
**IMT**— Information Management Tool (IMT has been converted to Form)  
**IRSO**— Installation Radiation Safety Officer  
**OHWG**— Occupational and Health Working Group  
**OPR**— Office of Primary Responsibility  
**NDI**— Non-Destructive Inspection  
**NRC**— Nuclear Regulatory Commission  
**PEL**— Permissible Exposure Limit  
**PH**— Public Health  
**PPE**— Personal Protective Equipment  
**RAM**— Radioactive Material  
**RDS**— Records Disposition Schedule  
**RFR**— Radio Frequency Radiation  
**RIC**— Radioisotope Committee  
**RPD**— Radiation Producing Devices  
**RSO**— Radiation Safety Officer  
**TLD**— Thermoluminescent Dosimetry  
**TWG**— Threat Working Group

**USAFSAM**— United States Air Force School of Aerospace Medicine

**USR**— Unit Safety Representative

**XRF**— X-ray Fluorescence

## Attachment 2

## PERMIT RSO CONTACT INFORMATION

Name	Phone Number
IRSO	501-987-7398
AF Medical Service Agency (AFMSA) Radiation Program	DSN: 425-6308/6340
U.S. Nuclear Regulatory Commission (NRC), Region IV	(800) 952-9677
NRC Safety Hotline	(800) 695-7403
Environmental Safety Occupational Health (ESOH) Service Center	DSN: 240-5454
Radioisotope Committee (RIC) Secretariat Representative, 24 Hours on Call	Commercial: 210-536-3278, DSN 240-3278
United States Air Force School of Aerospace Medicine (USAFSAM) Health Physics Branch	Commercial: 210-536-3486 DSN 240-3486
USAFSAM Radioanalytical Branch	Commercial: 210-536-2061 DSN 240-2061
USAFSAM Radiation Dosimetry Branch	Commercial: 210-536-5569 DSN 240-5569
AFMOA/SGOR (RIC)	DSN 297-4307, 4308, 4309, Commercial: 202-536-XXX
AFMOA/SGOR (RIC), After Hours	1-888-425-3861 (BEEPER), 1-888-506-0382
Base Command Post	501-987-3200

## Attachment 3

## PERMIT RAM RECORDKEEPING

Table A3.1. Record Retention Requirements.

Required record	Record Maintenance	Notes	CFR
Provisions of Radiation Protection Program	Until permit termination		10 CFR Part 20.2102(b)
Annual Audit, Reviews of Radiation Protection Program	3 years after record made		10 CFR Part 20.2102(b)
Surveys, Inventories, and Calibrations	3 years after record is made		10 CFR Part 20.2103(a)
Leak Tests	3 years after test was conducted.		
NRC Form 4	Until permit termination	Dose estimate of prior occupational exposure	10 CFR Part 20.2104 (f)
Accident and Incident reports and records	Permanent archival storage.		
Decommissioning Records	Until site released for unrestricted use. Permanent archival storage is required for large decommissioning efforts that are compliant with NUREG 1757, Vol 3.	Can transfer to new permit. Include records of spills, as built drawings, restricted areas, cost estimates, etc.	10 CFR 30.35 (g) 10 CFR 30.36 10 CFR 30.51
Receipt or Transfer of Permitted Material	As long as possessed, and three years after disposal or transfer	Unless otherwise specified.	10 CFR 30.51 (a) (1)(2)
Disposal of Permitted Material	Until permit termination or three years, whichever is longer.	Disposal records of significant magnitude or cost (e.g. site decommissioning wastes): Permanent Archival Record.	10 CFR Part 20.2108 10 CFR 30.51 (a)(3)
Records relating to the treatment and/or disposition of low level radioactive materials and Mixed waste	50 years	Prescribed retention period for specified environmental planning documents.	Rule 17 of the Air Force Records Disposition Schedule

Sealed Source Leak Tests and On/Off Mechanism and Indicator	3 years after last leak check / mechanism check or till transfer or disposal	Removal, installation, shielding or containment	10 CFR Part 31.5 (c) (4) i. and ii.
Records of Shipment of Radioactive Material Shipped Under 10 CFR Part 71 Rules	3 years after shipment	Does not include Radioactive Material exemption under 10 CFR Part 71.10 (low level, such as less than type A)	10 CFR Part 71.91 (a)
Duties and responsibilities of RSO	Duration of permit		10 CFR 35.2025(b)
Radiation survey instrument calibrations	3 years		10 CFR 35.2061

#### Attachment 4

### PERMIT RAM POSTING NOTICES TO WORKERS

Each permittee shall post a supplemental notice that contains, at a minimum, the information given on the sample notice of this attachment.

#### SUPPLEMENTARY NOTICE TO NRC FORM 3

US Air Force Radioactive Material Permit No. \_\_\_\_\_ (Note 2) issued under the Air Force's Nuclear Regulatory Commission Master Materials License No. 42-23539-01AFP authorizes use of radioactive materials at this location.

Contact \_\_\_\_\_ (Note 3) to see a copy of the permit, amendments and supporting documents including Title 10 Code of Federal Regulations Parts 19, 20 and 21, AFI 40-201, and all operating procedures applicable to permitted activities. The Air Force Master Materials License, amendments, and supporting application is maintained by the USAF Radioisotope Committee Secretariat at Bolling Air Force Base, Washington, D.C. These documents are available for viewing at the USAF Radioisotope Committee Secretariat office. The USAF Radioisotope Committee Secretariat may be contacted by writing to AFMOA/SGPR, 110 Luke Ave, Room 405, Bolling AFB DC 20032-7050, DSN 297-4300, Commercial (202) 767-4300, or the Bolling AFB Command Post 202-767-4011; DSN 297-4011.

#### SECTION 206 OF THE ENERGY REORGANIZATION ACT OF 1974

##### Notification to Commission of Noncompliance

Any individual director, or responsible officer of a firm constructing, owning, operating, or supplying the components of any facility or activity that is licensed or otherwise regulated pursuant to the Atomic Energy Act of 1954 as amended (42 U.S.C. 2011 et seq.), or pursuant to this chapter, who obtains information reasonably indicating that such facility or activity or basic components supplied to such facility or activity -

- (1) Fails to comply with the Atomic Energy Act of 1954, as amended, or any applicable rule, regulation, order, or license of the Commission relating to substantial safety hazards, or
- (2) Contains a defect that could create a substantial safety hazard, as defined by regulations that the Commission shall promulgate, shall immediately notify the Commission of such failure to comply, of such defect, unless such person has actual knowledge that the Commission has been adequately informed of such defect or failure to comply.

Notes:

2. Enter the applicable permit number or numbers
3. Enter the individual, organizational office symbol, address, and telephone extension

## Attachment 5

## LASER CLASSIFICATION

Table A5.1. Requirements by Laser Classification.

Class	Procedural & Administrative Controls	Training	Medical Surveillance	Unit Safety Representative
1	Not Required	Not Required	Not Required	Not Required
1M	Required	Application Dependent (2)	Application Dependent (2)	Application Dependent (2)
2	Not Required (1)	Not Required (1)	Not Required	Not Required
2M	Required	Application Dependent (2)	Application Dependent (2)	Application Dependent (2)
3R	Not Required (1)	Not Required (1)	Not Required	Not Required (1)
3B	Required	Required	Suggested	Required
4	Required	Required	Suggested	Required

Note: During maintenance and service the classification associated with the maximum level of accessible laser radiation shall be used to determine the applicable control measures. 1) Not required except for conditions of intentional intrabeam exposure applications. 2) Certain uses of Class 1M or 2M lasers or laser systems that exceed Class 1 or Class 2 because they do not satisfy Measurement Condition 1 may require hazard evaluation and/or manufacturer's information (see Section 4.1.1.3).

Class 1 laser: Considered to be incapable of producing damaging radiation levels during operation, and is exempt from any control measures or other forms of surveillance. An example of a Class 1 laser is a laser printer.

Class 1M laser: Considered to be incapable of producing hazardous exposure conditions during normal operation unless the beam is viewed with an optical instrument, and is exempt from any control measures other than to prevent potentially hazardous optically aided viewing; and is exempt from other forms of surveillance.

Class 2 laser: Emits visible light and eye protection is normally afforded by the aversion response (blinking, looking away from bright light). Many laser pointers are class 2.

Class 2M laser: Emits visible light and eye protection is normally afforded by the aversion response, however Class 2M is potentially hazardous if viewed with certain optical aids.

Class 3 laser (medium-power): May be hazardous under direct viewing conditions, but the laser light scattered off an object is not normally a hazard. It is not normally a fire hazard. There are two subclasses, 3R and 3B. The old classification 3A is similar, but not the same as 3R. An example of a class 3B laser is the Adhura First Defender, a chemical detector used in emergency response.

Class 4 laser (high-power): Is a hazard to the eye or skin from direct beam and scatter light may be hazardous. It may pose a fire hazard. A class 4 laser may also produce additional hazards, such as laser generated air contaminants. Low Altitude Navigation and Targeting Infrared for Night (LANTIRN) systems are an example of a system containing a class 4 laser.

**Attachment 6****LASER SAFETY TRAINING**

I. For user personnel routinely working with or potentially exposed to Class 3B or Class 4 laser radiation:

- (a) Fundamentals of laser operation (physical principles, construction, etc.)
- (b) Bioeffects of laser radiation on the eye and skin
- (c) Significance of specular and diffuse reflections
- (d) Non-beam hazards of lasers [physical and chemical agents. Non-beam hazards may occur when a material is exposed to a laser beam (e.g., fire or airborne contaminants); when materials used to generate the beam (e.g., flow-through gases, dyes and solvents) are released into the atmosphere; or when individuals contact system components (e.g., shock or electrocution)]
- (e) Laser and laser system classifications
- (f) Control measures
- (g) Overall responsibilities of management and employee
- (h) Medical surveillance practices (if applicable)
- (i) Cardiopulmonary resuscitation for personnel servicing or working on lasers with exposed high voltages and/or the capability of producing potentially lethal electrical currents

II. For the LSO or other individual responsible for the laser safety program, evaluation of hazards, and implementation of control measures, or any others if directed by management to obtain a thorough knowledge of laser safety:

- (a) The topics in section (I)
- (b) Laser terminology
- (c) Types of lasers, wavelengths, pulse shapes, modes, power/energy
- (d) Basic radiometric units and measurement devices
- (e) MPEs
- (f) Laser hazard evaluations and other calculations

## Attachment 7

### ALARA TRAINING

ALARA: All ionizing radiation exposures must be minimized or kept As Low As Reasonably Achievable. Ionizing radiation must be strictly controlled to prevent over exposures.

TYPES OF RADIATION: Forms of ionizing radiation include x-rays, gamma rays, alpha particles, beta particles, and neutron particles.

(Everyone is exposed to naturally occurring background radiation. ALARA training, however, seeks to control and limit only occupational exposures to ionizing radiation.)

SOURCES OF IONIZING RADIATION: X-ray equipment and radioactive material. Radioactive material can be found in such items as compasses, smoke detectors, and electron tubes. Radioactive material can also be used as calibration sources for radiation monitoring instruments.

RADIATION EXPOSURE (Objects): Normally items exposed to radiation do not become radioactive unless exposed to extremely high radiation levels.

RADIATION EXPOSURE (People): Concerns about radiation exposure focus mainly on 1) large doses, 2) repeated exposures, 3) when large portions of body exposed, and when 4) sensitive tissues are exposed.

RADIATION EXPOSURE (Health): Ionizing radiation can change cellular DNA and cause cell death, tumors, cancer, and mutations.

CONTROL MEASURES: Four control measures will help radiation workers to keep exposures ALARA. The four control measures include 1) time, 2) distance, 3) shielding, and 4) contamination control.

TIME: Exposure to ionizing radiation is cumulative over time. Workplace administrative controls must be used to limit the amount of time workers are exposed to radiation. Examples of work practices used to limit worker's radiation exposure time include 1) rehearsing a radiation operation, 2) adjusting a source's power output to only what is needed, 3) careful management of "on" times, and 4) prevent unnecessary "retakes."

DISTANCE: increasing the worker's distance from the source can minimize Exposure to ionizing radiation. According to the Inverse Square Law, doubling the distance from the source reduces radiation exposure by a factor of four. To maintain worker's exposure ALARA, 1) keep personnel as far from the source as possible, 2) establish and maintain controlled areas, 3) direct beams away from potentially occupied areas.

SHIELDING: shielding should be placed between the source and personnel. The denser the shielding material, the more radiation will be absorbed. Shielding should be used to protect potentially occupied areas adjacent to ionizing radiation operations. Care should be taken to ensure building renovations do not compromise shielding. BE will conduct scatter surveys to ensure shielding is adequate, inform BE if processes/location changes. Proper use and maintenance of collimators will restrict the beam to only the area of interest. When required, personnel should make use of personal protective equipment (PPE) such as lead aprons, which will provide shielding from ionizing radiation.

CONTAMINATION CONTROL: If a radiation source is broken or leaking, workers must contact the Base Radiation Safety Officer (RSO may be contacted during duty hours by calling [DSN 731-7398](tel:DSN731-7398). After duty hours the RSO may be contacted by calling [cell# 425-7163](tel:cell425-7163), or by calling the Command Post (DSN 731-3200), or the Clinic. Personnel should also make use of PPE to prevent contamination of skin, clothing, and to guard against ingestion of radioactive particles.

WORKPLACE ASSESSMENT: Bioenvironmental Engineering must perform a radiation exposure assessment during initial operations involving ionizing radiation. Data gathered during this

assessment must be re-validated annually. This assessment will also include exposures to the public in areas adjacent to the radiation operation.

**EXPOSURE LIMITS:** a) Workers = 5 REM per year, b) Pregnant Workers = 0.5 REM per year, c) Public = 0.1 REM per year. If excessive exposures are identified, the Base RSO will recommend exposure controls such as engineering controls, PPE, and administrative (work practice) controls. All radiation exposures must be considered if personnel perform work, involving ionizing radiation, for an employer outside the Air Force. They must report these “moonlighting” exposures to the base RSO as well.

### **INFORMATION FOR WORKERS ON TLD PROGRAM**

**THERMOLUMINESCENT DOSIMETRY (TLD):** TLD badges (or rings) are issued and worn to determine an individual’s exposure to ionizing radiation. TLD badges can be issued on a monthly or quarterly basis. Pregnant workers will be monitored on a monthly basis. Radiation exposures are documented on three forms. The AL Form 1499-1 documents an individual’s exposures for the last monitoring period. The AL Form 1499-2 documents an individual’s year to date radiation exposures. The AF Form 1527 is sent at the end of the year. The AF Form 1527 is signed by the Base RSO and is sent to the individual to review.

**TLDs (Types):** Whole body badge is worn above the hips but below the shoulders (front) and under PPE such as lead aprons. When the TLD is not worn it should be stored with the Control Badge in an area that is not subject to workplace radiation. The control badge is used to measure naturally occurring background radiation levels. Background radiation levels, recorded by the control badge, will be subtracted from a worker’s TLD measurement to determine occupational radiation exposure. A worker’s TLD should not be exposed to sunlight or excessive heat. Electronic Personnel Dosimeters (EPDs) are used for personnel monitoring in high radiation areas and are worn in conjunction with TLDs.

**SUSPECTED OVEREXPOSURE INCIDENT:** During a potential problem, cease all operations, secure the area, seek medical assistance, contact your supervisor/Unit RSO or safety rep, and contact the Base RSO ([DSN 731-7398](tel:731-7398) or after hours call cell# 425-7163). Each individual must complete a statement of events which must include 1) operating parameters, 2) distances, 3) observations, 4) times, and 5) conditions. All suspected overexposures must be reported and investigated.

**FEMALE RADIATION WORKERS:** The developing fetus is highly susceptible to ionizing radiation, especially in the first trimester. Women who suspect they are pregnant must have a blood test so they can be enrolled in the Air Force Fetal Protection Program. The program requires the workplace to be evaluated to identify factors may adversely affect the pregnancy. Based on workplace factors, work restrictions may be required. Women who require medical x-ray examinations are asked and often tested to ensure they are not pregnant.

**QUESTIONS:** Seek your Supervisor; contact the Base RSO, or Bioenvironmental Engineering. Bioenvironmental Engineering will have workplace information and documentation about the radiation exposure potential. You may also review the Base Radiation Safety Instruction, AFI 40-201, Technical Orders, Radioactive Material Permits, and 10 CFR 20, Standards for Protection against Radiation.