

**BY ORDER OF THE COMMANDER
JOINT BASE ELMENDORF-
RICHARDSON**

**JOINT BASE ELMENDORF-
RICHARDSON INSTRUCTION 48-148**

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Aerospace Medicine

**INSTALLATION IONIZING AND NON-
IONIZING RADIATION SAFETY
PROGRAM**



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This instruction implements Air Force Manual (AFMAN) 40-201, *Radioactive Materials (RAM) Management* and AFMAN 48-148, *Ionizing Radiation Protection*. This instruction applies to all military, civilian, contractor, and other personnel supported by Joint Base Elmendorf-Richardson (JBER) who possess, use, or handle sources of RAM, ionizing radiation producing devices (RPD), lasers, and Electromagnetic Field Radiation (EMFR) emitters within the confines of JBER. This instruction cannot be supplemented or further extended. Ensure all records generated as a result of processes prescribed in this publication adhere to Air Force Instruction (AFI) 33-322, *Records Management and Information Governance Program*, and are disposed in accordance with (IAW) the Air Force Records Disposition Schedule, which is located in the Air Force Records Information Management System. Refer recommended changes and questions about this publication to the office of primary responsibility (OPR), using the Department of the Air Force (DAF) Form 847, *Recommendation for Change of Product*; route DAF Forms 847 from the field through the appropriate functional chain of command. The use of the name or mark of any specific manufacturer, commercial product, commodity, or service in this publication does not imply endorsement by the Department of the Air Force. Compliance with attachments is mandatory.

SUMMARY OF CHANGES

This document is substantially revised and must be completely reviewed. It was updated to reflect changes in the underlying Air Force guidance. Changes include updated policies to all working units on the JBER installation, including, but not limited to Active Duty Air Force, Active Duty Army, Air National Guard, Army National Guard, Army Reserve, Air Reserve and civilians.

Additional changes were made to Roles and Responsibilities, updated regulation references, and added attachments and tables.

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Chapter 1

INTRODUCTION

1.1. Overview. This instruction provides uniform policy, and guidance for the management of all ionizing and non-ionizing radiation-producing sources on JBER. It sets forth how joint base personnel and units will manage programs associated with the safe usage of RAM, ionizing RPDs, laser systems, and EMFR emitters. This program also prescribes how tenant units and non-JBER entities obtain approval to use RAM, ionizing RPDs (e.g., x-ray emitters), laser systems, and EMFR emitters on JBER.

1.1.1. The Laser and Optical Radiation Safety Program incorporates guidance and criteria for the safe use of lasers and laser systems as defined in the American National Standards Institute (ANSI) Z136.1, *For Safe Use of Lasers*, and implements the provisions of the Department of Defense Instruction (DoDI) 6055.15, *Department of Defense (DoD) Laser Protection Program for Military Lasers*.

1.1.2. The EMFR Safety Program implements the provisions of DoDI 6055.11, *Protecting Personnel from Electromagnetic Fields*, which requires compliance with all applicable Federal, ANSI, and Institute of Electrical and Electronics Engineers (IEEE) standards.

1.1.3. The Ionizing Radiation Safety Program implements the provisions of DoDI 6055.08, *Occupational Ionizing Radiation Protection Program*, as well as all applicable Federal and state standards.

1.2. Goal. The goal of the installation radiation protection program is to protect health and prevent injury that could have a debilitating effect on human performance, including keeping ionizing radiation exposures to As Low As Reasonably Achievable (ALARA). This program is designed to define and mitigate ionizing and non-ionizing radiation related risk.

Chapter 2

ROLES AND RESPONSIBILITIES

2.1. Installation Commander:

- 2.1.1. Have overall responsibility for the JBER Radiation Safety program.
- 2.1.2. Appoint, in writing, a qualified Bioenvironmental Engineering (BE) Officer or Technician to be the Installation Radiation Safety Officer (IRSO) to adhere to the duties and responsibilities detailed in AFMAN 48-148 and AFMAN 40-201.
- 2.1.3. Appoint, in writing, a qualified BE Officer or Technician to be the Installation Laser Safety Officer (ILSO) to adhere to the duties and responsibilities detailed in AFI 48-139, *Laser and Optical Radiation Protection Program*.

2.2. Office of the Installation Radiation Safety Officer (IRSO) & Installation Laser Safety Officer (ILSO):

- 2.2.1. Provide trained personnel to serve as primary and alternate IRSO for JBER. This includes fully qualified BE officers with the Air Force Specialty Code (AFSC) 43E3A, Bioenvironmental Engineer or a BE Craftsmen with the AFSC 4B071 that also has IRSO certification.
- 2.2.2. Provide trained personnel to serve as primary and alternate ILSO for JBER. This includes fully qualified BE officers with the AFSC 43E3A or a BE Craftsmen with the AFSC 4B071 that also has ILSO certification.
- 2.2.3. Review and authorize the contractor use of RAM and ionizing RPDs on JBER. The IRSO may perform no-notice inspections of contractor activities using RAM or ionizing RPDs (i.e. x-ray emitters) to ensure no exposure to government personnel from contractor activities.
- 2.2.4. Review and authorize the contractor use of Class 3B and Class 4 lasers on JBER. The ILSO may perform no-notice inspections of contractor activities involving Class 3B and 4 lasers.
- 2.2.5. Review construction projects and facility designs to ensure radiation safety.
- 2.2.6. Adhere to the responsibilities defined for the IRSO, ILSO, and BE as defined in AFMAN 40-201; AFI 48-109, *EMFR Occupational and Environmental Health Program*; DAFMAN 48-125, *Personnel Ionizing Dosimetry*; AFI 48-139; and AFMAN 48-148.
- 2.2.7. Manage the Ionizing Radiation Dosimetry program for the Air Force and the Defense Health Agency (DHA) with the Optically Stimulated Luminescence (OSL) Dosimetry. The OSLs are provided and processed by the United States Air Force (USAF) Radiation Dosimetry Laboratory (RDL) at Wright-Patterson AFB, OH.
 - 2.2.7.1. The IRSO will request priority processing from USAF RDL for dosimeters issued to declared pregnant women or used in planned special exposures.

2.2.7.2. When made available by the RDL, the IRSO will review occupational dose monitoring summaries, identifying abnormal exposures, and will conduct an inquiry for any doses that exceed the Investigation Action Level (IAL). Appropriate steps, including process changes or re-training of personnel on dosimeter wear, will be taken following the investigation, as applicable.

2.2.7.3. The IALs that trigger an IRSO investigation are listed in **Table 2.1** below. These do not necessarily coincide with the DHA tiered investigation levels as listed in DHA AI 6055.04, *Radiation Safety Program (RSP) and Radiation Safety Committee (RSC)*, which prompt investigation by the DHA Associate Radiation Safety Officer (ARSO), also known as the 673d Medical Group (673MDG) Unit RSO. Exceedance of the DHA investigation levels should continue to be investigated by the ARSO following DHA policy.

Table 2. 1. IALs for OSL Results (in rem/cSv).

Type of Dose	Quarterly IAL Dose	Quarterly IAL Dose (Pain Management Only)	Monthly IAL during Pregnancy
Total Effective Dose Equivalent (TEDE)	0.375	0.750	0.050
Extremity	3.75	7.5	1.25
Lens of the Eye	1.125	1.125	0.375

2.3. Installation Contracting Office:

2.3.1. Ensure all contractors adhere to federal, military, state, and local regulations regarding the use of RAM or ionizing RPDs on JBER and will obtain IRSO approval at least 30 days prior to a contractor bringing such material or equipment onto the installation.

2.3.2. Ensure all contractors adhere to federal, military, state, and local regulations regarding the use of lasers and optical radiation on JBER and will obtain ILSO approval at least 30 days prior to a contractor bringing a Class 3B or Class 4 laser onto the installation.

2.4. 673d Civil Engineering Group (673CEG):

2.4.1. Ensure the IRSO/ILSO has approved the contractor use of RAM, ionizing RPDs, and Class 3B and Class 4 Lasers prior to their use on base.

2.4.2. Provides all design reviews and work order requests involving potential use, movement or disposal of RAM or RPDs to the IRSO for review and approval prior to allowing work to commence on contract.

2.4.3. Ensures disaster emergency response plans include procedures for incidents involving RAM or the use of radiation exposure devices.

2.5. 673d Medical Group (673MDG):

2.5.1. Ensures all pregnant individuals with potential occupational radiation exposure during their pregnancy are referred to the IRSO. Declared pregnant workers will be enrolled in the Dosimetry Program on a monthly monitoring frequency. Civilian personnel are not required to enroll in the Dosimetry Program but are highly encouraged.

2.5.2. Through the Local Facility ARSO:

2.5.2.1. Coordinate control measures implemented to minimize radiation exposure, as well as enforce proper use and care of the OSL dosimeters.

2.5.2.2. Support disciplinary measures regarding lost or missing dosimeters through 673MDG policy and the 673MDG RSC.

2.5.2.3. Conduct investigations for a Level I exceedance as defined in DHA AI 6055.04.

2.5.3. Through the Local Facility Non-Ionizing Radiation Safety Officer (NIRSO):

2.5.3.1. Will provide a list of sections that have non-ionizing radiation producing equipment (e.g. lasers and EMFR) to the ILSO.

2.5.3.2. Will assist the relevant sections to ensure they have laser safety and/or EMFR safety training and procedures, including the inventory and inspection of associated Personal Protective Equipment (PPE).

2.5.3.3. Support investigations of any mishaps, unusual occurrences or inadvertent exposures to lasers and EMFR IAW DHA AI 6055.03, *Non-Ionizing Radiation Safety Program*.

2.5.4. Medical Logistics will coordinate with the IRSO/ILSO prior to the procurement of radiation-producing equipment, including RAM, ionizing RPDs (e.g. x-ray units), lasers, and EMFR emitters.

2.6. 673d Logistics Readiness Group (673LRG):

2.6.1. Will develop a process to ensure the IRSO/ILSO approves all purchases of radiation-producing equipment, including RAM, ionizing RPDs (e.g. x-ray units), lasers, and EMFR emitters.

2.6.2. The Transportation Management Office (TMO) will coordinate the shipment and receipt of all radioactive materials with the IRSO to ensure proper Department of Transportation (DoT) labeling and handling occurs, as well as verification that receiving organizations are authorized recipients.

2.7. 673d Security Forces Squadron (673SFS):

2.7.1. Will require proof of IRSO/ILSO approval prior to admitting contractors onto JBER with RAM, an ionizing radiation producing device, or a Class 3B or 4 laser system.

2.7.2. Will ensure that personnel issued the Advanced Target Pointer Illuminator Aiming Laser (ATPIAL AN/PEQ-15) keep in the safety screws that lock the user out from using the higher-powered laser modes, unless threat or mission requires their use.

2.8. Unit Commanders.

2.8.1. For all organizations owning or operating RAM or ionizing RPDs, the Unit Commander will designate, in writing, a primary and alternate Unit Radiation Safety Officer (URSO) to establish and manage the unit's radiation safety program.

2.8.2. For all organizations that own or operate Class 3B or Class 4 lasers or military specific lasers, the Unit Commander shall designate in writing a primary and alternate Unit Laser Safety Officer (ULSO) to establish and manage the unit's laser safety program.

2.8.3. Establish a unit Electromagnetic Field (EMF) safety program when determined necessary based on on-site BE health risk assessment. **Note:** Any exposures that exceed those in the lower tier Maximum Permissible Exposure (MPE) (AFI 48-109, Attachment 2) requires the adoption of an EMF safety program.

2.8.4. If a building will be modified or created which contains radioactive producing equipment or material, the IRSO must be notified in advance of construction to assess risk to changes in personnel exposure.

2.9. Unit Laser Safety Officers (ULSO) or Responsible Area Supervisors.

2.9.1. Coordinate with the ILSO prior to new lasers being procured or changes in any laser operating parameters or locations. Hazard assessment surveys must be coordinated for new Class 3B or Class 4, Food and Drug Administration (FDA)-compliant or military specific lasers or laser systems, or new operating conditions, prior to operation and use.

2.9.1.1. For Class 3B and 4 lasers, including enclosed lasers, obtain an approval letter from the ILSO/BE prior to continued operation.

2.9.1.2. Military specific lasers, including those used for aircraft targeting are exempt from the above requirement in 2.8.1.1.

2.9.2. Adhere to ULSO duties outlined in AFI 48-139 to include maintaining a Standard Operating Procedure (SOP) for safe use and maintenance of the system(s) in their unit.

2.9.3. Ensure initial and annual laser safety training for all personnel in the unit with a potential for laser exposure. Training should be recorded on the AF Form 55, *Employee Safety and Health Record*, or an equivalent computer-generated system.

2.9.4. Will ensure all controls recommended by the ILSO and BE are followed. This may include proper warning signs placed around the area to notify others of the hazards. Examples can be found in the attachments.

2.9.5. Will conduct an annual audit of the laser safety program to include a review of the source inventory, training documentation, hazard controls (including PPE), and to ensure that the hazard evaluation conducted by BE reflects the current equipment, facilities, and SOPs.

2.10. Unit Radiation Safety Officers (URSO) or Responsible Area Supervisors:

2.10.1. Must notify IRSO when new RAM or RPD are procured or when any operating parameters/locations are changed.

2.10.2. Establish and manage the unit radiation safety program in accordance with URSO duties as outlined in AFMAN 48-148, to include maintaining SOPs and dosimetry records for applicable unit members. If the URSO is also a Permit RSO, meet requirements as outlined by the Radiation Permit and AFMAN 40-201.

2.10.3. Ensure initial and annual radiation safety training is completed for all personnel in the unit with a potential for radiation exposure. Training should be recorded on the AF Form 55, or an equivalent computer-generated system.

2.10.4. Will ensure all controls recommended by the IRSO and BE are followed. This may include proper warning signs placed around the area to notify others of the hazards. Examples can be found in the attachments.

2.10.5. Will conduct an annual audit of the radiation safety program to include a review of the source inventory, training documentation, hazard controls (including PPE), and to ensure that the hazard evaluation conducted by BE reflects the current equipment, facilities, and SOPs.

2.10.6. For URSOs at units that have Generally Licensed Device(s) (GLD)s, the URSO will facilitate semi-annual, eyes-on inventories of all GLDs by BE personnel so that BE may update the inventory in the Radioactive Materials Management Information System-Web (RAMMIS-W) tool.

2.10.7. For URSOs at units with Aircraft Pods containing radioactive material, the URSO will provide BE semi-annual inventory reports each year, that contain information on the owning unit, isotope (e.g., Am-241), and pod serial number.

2.10.8. For Supervisors at work centers enrolled in the radiation dosimetry program, supervisors will confirm, in writing on the template provided by BE, that they received all assigned dosimeters each quarter and/or each month when pregnant females are enrolled in monthly dosimetry.

2.11. Installation Frequency Manager and Responsible Area Supervisors: will notify IRSO prior to new EMFR systems being procured or changes in any system operating parameters or locations. Hazard assessment surveys must be requested and coordinated for new EMF systems or new operating conditions, prior to operation/use.

2.12. Laser Operators and Ancillary Personnel: Must comply with safety procedures and adhere to all federal, Department of War (DoW), Service and base policies and regulations when working with, or around lasers, laser systems and/or optical radiation producing devices.

2.12.1. Ensure safety devices are in place and functional before starting work.

2.12.2. Energize or work with lasers or laser systems only when authorized.

2.12.3. Notify supervisor or ULSO of any incidents or accidents involving lasers, laser systems or optical radiation producing devices and/or any suspected unsafe condition.

2.13. Radar Operators and Ancillary Personnel: Will comply with safety procedures and adhere to all federal, DoW, Service and base policies and regulations when working with, or around radar systems and/or EMFR producing devices.

2.13.1. Ensure safety devices are in place and functional before starting work.

2.13.2. Notify supervisor or IRSO of any incidents or accidents involving EMFR and/or any suspected unsafe condition.

2.14. Radiation Workers: Must comply with safety procedure and adhere to all federal, DoW, Service and base policies and regulations when working with, or around RAM and/or RPDs.

2.14.1. Ensure safety devices are in place and functional before beginning work.

2.14.2. Perform operations in a manner that maintains doses are ALARA.

2.14.3. Notify supervisor or URSO of any incidents or accidents involving radiation and/or any suspected unsafe condition.

Chapter 3

INCIDENTS AND ACCIDENTS INVOLVING IONIZING AND NON-IONIZING RADIATION

3.1. Non-Ionizing Radiation: Laser/Optical Radiation and Electro Magnetic Frequency Radiation (EMFR). Any incident or accident involving a suspected non-ionizing radiation overexposure, negative impacts to mission operations, or personal injury/equipment damage must be investigated and documented.

3.1.1. General Requirements. Upon suspicion of non-ionizing radiation overexposure:

3.1.1.1. Individuals potentially overexposed must notify their supervisor. The supervisor must immediately notify ULISO of the potential overexposure.

3.1.1.2. Responsible area supervisors or the ULISO will immediately stop operations and leave all settings in place for investigation to occur. For mission critical operations which cannot be delayed for an investigation, responsible area supervisors or the ULISO must contact BE to determine necessary information required to recreate the incident, and all information will be recorded prior to resuming operations.

3.1.2. Air Force Personnel. Supervisors or the ULISO must immediately notify their unit commander, ILSO/IRSO or BE, Wing Safety, and Public Health of all potential radiation over exposures.

3.1.2.1. The ILSO/IRSO or BE will conduct notifications, investigations, and reporting IAW AFI 48-109 or AFI 48-139.

3.1.2.2. The ILSO/IRSO or BE will report all incidents and accidents to the Tri-Service Laser Injury hotline (800) 473-3549 or the DoD EMF Injury Hotline (800) 473-3764 or the Nuclear Regulatory Commission (NRC) (301) 816-5100, the Pacific Air Forces (PACAF) BE, and Air Force Medical Command Bioenvironmental Engineering Division (AFMED/SG3PB).

3.1.3. Army Personnel. Supervisors or URSOs must notify their unit commander, United States Army Alaska (USARAK) Safety, and BE of all potential radiation over exposures.

3.1.3.1. Notifications, investigations, and reporting will be conducted IAW Army Regulation (AR) 385-10, *The Army Safety and Occupational Health Program*.

3.1.3.2. USARAK Safety will report all incidents or accidents to the U.S. Army Public Health Command and the Tri-Service Vision Conservation and Readiness Program or all laser eye injury.

3.2. Ionizing Radiation: Radioactive Materials and Radiation Producing Devices. Any incident or accident involving a suspected ionizing radiation overexposure, negative impacts to mission operations, or personal injury/equipment damage must be investigated and documented.

3.2.1. General Requirements. Upon suspicion of ionizing radiation overexposure:

3.2.1.1. Upon suspicion of radiation overexposure from RPDs (e.g., x-ray machines for industrial, medical, and research, accelerators, electron microscopes, and neutron generators), responsible area supervisors or URSO must:

3.2.1.1.1. Immediately stop operations, shut off device, and leave all settings in place for investigation to occur.

3.2.1.1.2. For mission critical operations which cannot be delayed for an investigation, responsible area supervisors or URSO will contact IRSO to determine necessary information required to recreate the incident, and all information must be recorded prior to resuming operations

3.2.2. Air Force Personnel. Supervisors or URSO must notify their unit commander, IRSO, Safety, and Public Health of all potential radiation over exposures.

3.2.2.1. Determinations of overexposures will be investigated and reported IAW AFMAN 40-201 and AFMAN 48-148.

3.2.2.2. IRSO will notify the 673MDG Commander of potential radiation overexposure and work with the URSO and the unit commander to remove the individual from all future duties with potential radiation exposure.

3.2.3. Army Personnel. Supervisors or URSO must notify their unit commander, USARAK Safety, and BE of all potential radiation over exposures.

3.2.3.1. Determinations of overexposures will be investigated and reported IAW AR 385-10.

3.2.3.2. USARAK Safety will report all incidents or accidents to the Defense Centers for Public Health-Aberdeen (DCPH-A).

3.3. Incident Response to Damaged Tritium Source.

3.3.1. General Requirements. Should a device containing Tritium become damaged, notify other personnel in the area and instruct nonessential personnel to leave the area. Notify the URSO immediately. URSO will notify IRSO and Safety as soon as practical.

3.3.1.1. Place the damaged commodity in a double plastic bag and label "Broken Tritium Device – [device National Stock Number (NSN)]-Do Not Open". Damaged commodities may be taken to 773d Logistics Readiness Squadron (773LRS) at Building 804 or 796 for storage while waiting for results from contamination swipe surveys.

3.3.1.2. If outer clothing is contaminated (phosphor powder from source visible on clothing), remove clothing and place in plastic bag. Label the bag as: "Contaminated Tritium Material."

3.3.1.3. Wash suspected contaminated body areas with soap and lukewarm water.

3.3.2. Contamination swipe survey. IRSO will perform a swipe survey.

3.3.2.1. If swipe results are less than 10,000 disintegrations per minute (dpm)/100 centimeters squared (cm²) in a controlled area or 1,000 dpm/100 cm² for an uncontrolled area, no action is required, and the area/commodity can be released for normal operations.

3.3.2.2. If swipe results are greater than 10,000 dpm/100 cm² in a controlled area or 1,000 dpm/100 cm² for an uncontrolled area, perform decontamination of equipment or areas. Designate equipment that cannot be economically decontaminated as radioactive waste and notify the item manager for final disposition.

3.3.3. **Bioassay.** When a bioassay is required/requested, urine sample collection should be performed between 4 and 24 hours after a suspected exposure to tritium. **Note:** If swipe sampling contamination survey results indicate contamination levels greater than 1 million dpm/100 cm² bioassays are required for individuals handling the item/commodity.

3.3.3.1. The ideal sample collection time is between 4 to 5 hours after the suspected exposure, and after discarding the first void.

3.3.3.2. Bioassay will be performed at the direction of the IRSO and in coordination with the 673MDG Laboratory Services.

DANIEL C. WERNER, Colonel, USAF
Commander

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

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

21 CFR Part 1040, *Performance Standards for Light-Emitting Products*

21 CFR §1040.10, *Laser Products*

21 CFR §1040.11, *Specific Purpose Laser Products*

Public Law 109-58, *Energy Policy Act of 2005*

DoDI 6055.08, *Occupational Ionizing Radiation Protection Program*, 09 April 2021

DoDI 6055.11, *Protecting Personnel from Electromagnetic Fields*, 12 May 2021

DoDI 6055.15, *DoD Laser Protection Program for Military Lasers*, 25 August 2023

DHA AI 6055.03, *Non-Ionizing Radiation Safety Program*, 1 February 2024

DHA AI 6055.04, *Radiation Safety Program (RSP) and Radiation Safety Committee (RSC)*, 16 January 2025

AFI 33-322, *Records Management and Information Governance Program*, 23 March 2020

AFI 48-109, *Electromagnetic Field Radiation (EMFR) Occupational and Environmental Health Program*, 1 August 2014

AFI 48-139, *Laser and Optical Radiation Protection Program*, 30 September 2014

AFMAN 40-201, *Radioactive Materials (RAM) Management*, 29 March 2019

AFMAN 48-148, *Ionizing Radiation Protection*, 20 July 2020

DAFPD 40-2, *Radioactive Materials*, 19 December 2024

DAFMAN 48-125, *Personnel Ionizing Radiation Dosimetry*, 27 October 2020

AR 385-10, *The Army Safety and Occupational Health Program*, 24 July 2023

ANSI Z136.1, *For Safe Use of Lasers*, 2014

ANSI Z535, *Safety Signs and Colors*, 2011

Prescribed Forms

None

Adopted Forms

AF Form 55, *Employee Safety and Health Record*

DAF Form 847, *Recommendation for Change of Product*

Abbreviations and Acronyms

AFI—Air Force Instruction

AFMAN—Air Force Manual
AFSC—Air Force Specialty Code
AI—Administrative Instruction
ALARA—As Low As Reasonably Achievable
ANSI—American National Standards Institute
AR—Army Regulation
ARSO—Associate Radiation Safety Officer
ATPIAL AN/PEQ-15—Advanced Target Pointer Illuminator Aiming Laser
BE—Bioenvironmental Engineering
CFR—Code of Federal Regulations
cm²—Centimeter Squared
cpm—Counts per Minute
CPR—Cardiopulmonary Resuscitation
DAF—Department of the Air Force
DAFMAN—Department of the Air Force Manual
DAFPD—Department of the Air Force Policy Directive
DCPH-A—Defense Centers for Public Health-Aberdeen
DHA—Defense Health Agency
DoD—Department of Defense
DoDI—Department of Defense Instruction
DOT—Department of Transportation
DoW—Department of War
dpm—Disintegrations Per Minute
EMF—Electromagnetic Field
EMFR—Electromagnetic Field Radiation
FDA—Food and Drug Administration
GLD—Generally Licensed Device
Gy—Gray
IAL—Investigation Action Level
IAW—In Accordance With
IEEE—Institute of Electrical and Electronics Engineers
ILSO—Installation Laser Safety Officer

IR—Infrared

IRSO—Installation Radiation Safety Officer

JBER—Joint Base Elmendorf-Richardson

MPE—Maximum Permissible Exposure

mrem—Millirem

mSv—Millisievert

NIRSO—Non-Ionizing Radiation Safety Officer

NRC—Nuclear Regulatory Commission

NSN—National Stock Number

OPR—Office of Primary Responsibility

OSL—Optically Stimulated Luminescence

PACAF—Pacific Air Forces

PPE—Personal Protective Equipment

RAM—Radioactive Material

RAMMIS-W—Radioactive Materials Management Information System-Web

RDL—Radiation Dosimetry Laboratory

RPD—Radiation Producing Device

RSC—Radiation Safety Committee

RSP—Radiation Safety Program

SNM—Special Nuclear Material

SOP—Standard Operating Procedure

TEDE—Total Effective Dose Equivalent

TMO—Transportation Management Office

ULSO—Unit Laser Safety Officer

URSO—Unit Radiation Safety Officer

USAFSAM—U.S. Air Force School of Aerospace Medicine

USARAK—United States Army Alaska

Office Symbols

673CEG—673d Civil Engineering Group

673LRG—673d Logistics Readiness Group

673MDG—673d Medical Group

673SFS—673d Security Forces Squadron

773LRS—773d Logistics Readiness Squadron

AFMED/SG3PB—Air Force Medical Command Bioenvironmental Engineering Division

Terms

As Low As Reasonably Achievable (ALARA)—The act of making every reasonable effort to maintain exposures to radiation as far below established dose limits as is practical and consistent with the purpose for which the licensed activity is undertaken. ALARA takes into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest.

Bioassay (radio bioassay)—The determination of kinds, quantities or concentrations, and in some cases, the locations of radioactive material in the human body, whether by direct measurement (in vivo bioassay) or by indirect analysis and evaluation of materials excreted or removed from the human body (in vitro bioassay).

Byproduct Material—Any radioactive material (except source or special nuclear material (SNM)) yielded in, or made radioactive by, exposure to the radiation incident to the process of producing or using source or SNM. The definition of byproduct material has changed with Public Law 109-58, *Energy Policy Act of 2005*, to include some forms of naturally occurring or accelerator produced radioactive material (reference DAFPD 40-2, *Radioactive Materials*).

Declared Pregnant Individuals—All pregnant Army and Air Force military occupational radiation workers. Also Army and Air Force civilian occupational radiation workers who have voluntarily informed their workplace supervisor or primary care manager, in writing, of their pregnancy and the estimated date of conception. The declaration remains in effect until the declared pregnant woman withdraws the declaration in writing or is no longer pregnant.

Dosimeter—A device that detects and measures accumulated ionizing radiation dose received by occupationally-exposed individuals.

Electromagnetic Radiation—The propagation of energy in the form of electromagnetic waves through space. (Not intended to describe propagation along waveguides and other transmission lines).

Exclusion Zone—A region around a transmitting antenna where the general public or occupational workers are not allowed to enter or remain for protracted periods of time as the regulated EMF exposure levels would be exceeded inside this zone

Gray (Gy)—A unit of absorbed radiation equal to the dose of one joule of energy absorbed per kilogram of matter, or 100 rad.

High Radiation Area—An area accessible to individuals in which radiation levels from radiation sources external to the body could result in an individual receiving a dose equivalent in excess of 1 mSv (0.1 rem) in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.

Installation Laser Safety Officer (ILSO)—An individual, normally a health physicist, bioenvironmental engineer, Department of the Army or Air Force civilian, or a qualified BE craftsman designated in writing by the installation commander to manage the laser safety program for the installation.

Installation Radiation Safety Officer (IRSO)—An individual, normally a health physicist, bioenvironmental engineer, Department of the Army or Air Force civilian, or a qualified BE craftsman designated in writing by the installation commander to manage the radiation safety program for the installation.

Ionizing Radiation—Any electromagnetic or particulate radiation capable of producing ions, directly or indirectly in its passage through matter. Ionizing radiation includes gamma rays, x-rays, alpha particles, beta particles, neutrons, protons and other particles and electromagnetic waves capable of producing ions.

Laser—An acronym for Light Amplification by Stimulated Emission of Radiation. Any device that can be made to produce or amplify electromagnetic radiation in the x-ray, ultraviolet, visible, and infrared or other portions of the spectrum by the process of controlled stimulated emission of photons.

Licensed Material—Source material, special nuclear material, or byproduct material received, possessed, used, transferred, or disposed of under a general or specific license issued by the Nuclear Regulatory Commission.

Maximum Permissible Exposure (MPE)—The level of laser radiation to which a person may be exposed without hazardous effect or adverse biological changes in the eye or skin.

Military Specific Lasers—Lasers designed for actual combat, combat training operations, or classified in the interest of national security. Exempted from FDA requirements of 21 CFR, Part 1040, Section 1040.10, *Laser Products* and 21 CFR, Part 1040, Section 1040.11, *Specific Purpose Laser Products*.

rad—An absorbed dose of 1 rad means that 1 gram of material absorbed 100 ergs of energy (a small but measurable amount) as a result of exposure to radiation.

Radiation (ionizing radiation)—Alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. Radiation, as used in 10 CFR Part 20, *Standards for Protection Against Radiation*, does not include non-ionizing radiation, such as radio waves, microwaves, or visible, infrared, or ultraviolet light.

Radiation Area—An area accessible to individuals in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.005 rem (0.05 mSv) in 1 hour at 30 cm from the radiation source or from any surface that the radiation penetrates.

Radiation Sources—Radioactive material, equipment, or devices which spontaneously generate or are capable of generating ionizing radiation. Examples include nuclear reactors, medical and dental radiographic and fluoroscopic x-ray systems, particle generators and accelerators, certain electromagnetic generators operating at electrical potentials that result in the production of x-rays, x-ray diffraction, industrial radiographic and spectrographic equipment, electron microscopes, electron-beam welding, melting, and cutting equipment, nuclear moisture or density gauges, byproduct and source materials, SNMs, natural or accelerator-produced radioactive materials, materials containing induced or deposited radioactivity and radioactive commodities.

Radiation Worker—An individual who may be occupationally exposed to ionizing radiation in the course of their duties or designated by the IRSO. For the purposes of this instruction, the term radiation worker does not broadly include contractors.

Restricted Area—An area to which access is limited by the licensee for the purpose of protecting individuals against undue risks from exposure to radiation sources and radioactive materials. Restricted area does not include areas used as residential quarters, but separate rooms in a residential building may be set apart as a restricted area.

Unit Laser Safety Officer (ULSO)—The person that the commander designates, in writing, as the person responsible for implementing the organization's or unit's laser safety program and enforcing control of laser hazards within their area of responsibility. The term "Laser Safety Officer" is a functional title and does not denote a commissioned status or specialty code. The ULSO must have the education, training, and professional experience needed for the job.

Unit Radiation Safety Officer (URSO)—The person that the commander designates, in writing, as the person responsible for the organization or unit radiation safety program. The term "Radiation Safety Officer" is a functional title and does not denote a commissioned status or specialty code. The URSO must have the education, training, and professional experience needed for the job.

Visitor—A person who does not normally work in an Air Force controlled radiation area, but who may be authorized to enter the area by the IRSO providing that suitable dosimetry and/or protective equipment is available.

Attachment 2

REQUIREMENTS FOR LASER AREAS

Table A2.1. Summary of Laser Area Warning Requirements.

Required Elements	LASER Classification					Comments And References
	2	2M	3R	3B	4	
Personnel Annual Training*	x	x	x	x	x	Per AFI 48-139
Visible Warning Devices				x	x	Per 21 CFR 1040, <i>Performance Standards for Light-Emitting Products</i>
Audible Warning Devices				x	x	Per 21 CFR 1040
Appropriately Designed Signs	x	x	x	x	x	Per ANSI Z535, <i>Safety Signs and Colors</i> , requirements.
Safety Alert Symbol on Signs	x	x	x	x	x	Alert symbol required on all Caution, Warning & Danger Signs.
Laser Radiation Hazard Safety Symbol	x	x	x	x	x	Laser sun burst is required on all signs per ANSI Z535.
Area Warning Sign Signal Words	x	x	x	x	x	Signs required: Danger, Warning, Caution.
Area Warning Sign Purpose				x	x	Warns of the presence of a laser hazard in the area.
Signal Word “Danger”					x	Per ANSI Z535
Signal Word “Warning”				x	x	Per ANSI Z535
Signal Word “Caution”	x	x	x			Per ANSI Z535
Message Panel Information	x	x	x	x	x	Per ANSI Z535. Includes hazard class, precautionary instructions or protective action, and name and contact information for the ULISO.
Warning Label		x	x	x	x	Per 21 CFR 1040. Class label with symbols and specific words.
Protective Housing	x	x	x	x	x	Per 21 CFR 1040. Specific words depending on internal laser.
Conduit Label		x	x	x	x	Per 21 CFR 1040
Service Access Panel	x	x	x	x	x	Per 21 CFR 1040. Label required if removal permits access to laser.

Optical Fiber Transmission			x	x	x	Per 21 CFR 1040. Words required if disconnect is not in a laser control area.
Note: All Signs must be displayed in locations where they will best serve to warn onlookers. *See figure A2.5 for a breakdown of required training topics						

Figure A2.1. Sample Compliant Sign Breakdown.



Figure A2.2. Example Caution Sign for Class 2, Class 2M, and Class 3R Lasers.



Figure A2.3. Example Warning Sign for Class 3B and Class 4 Laser Controlled Area.

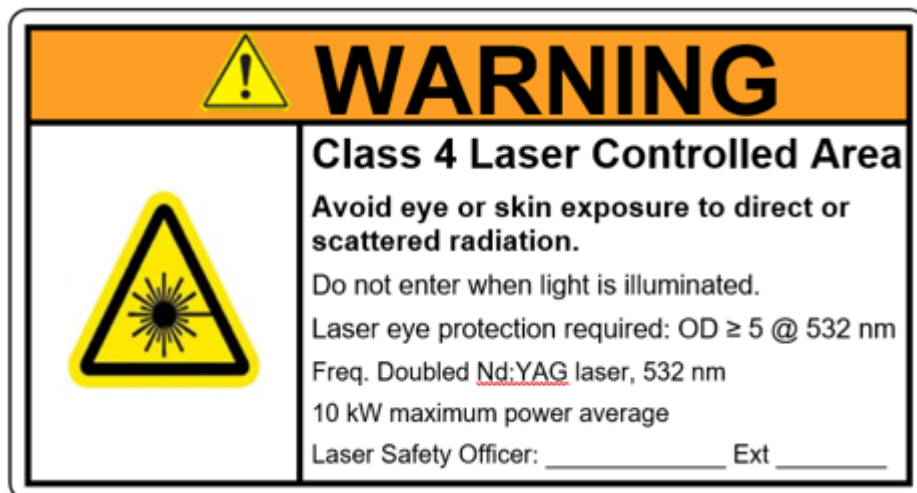


Figure A2.4. Example Danger Sign for Class 4 Laser Controlled Areas.

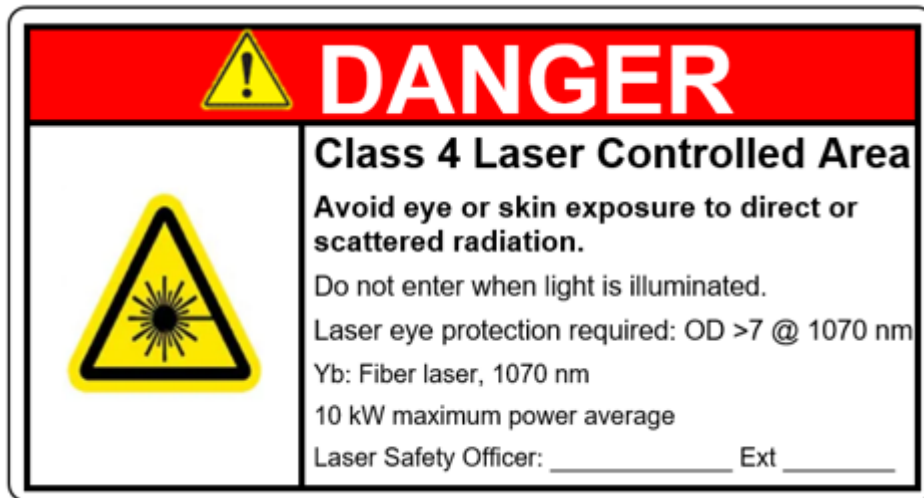


Figure A2.5. Excerpt on Annual Laser Safety Training Requirements from the USAFSAM Technical Guide for Laser Safety Programs.

Training

Table 3. AFI 48-139 and ANSI Z136.1 Required Laser Safety Training Topics¹

Topic	ULSO/ ILSO	User Training: Laser Class		
		3B/4	2**/2M	1M/3R
Laser terminology	X			
Types of lasers, wavelengths, pulse shapes, modes, power/energy	X			
MPEs	X			
Laser hazard evaluations and other calculations	X			
Fundamentals of laser operation	X	X		
Bioeffects of lasers on the eye and skin	X	X		
Specular and diffuse reflections	X	X		
Non-beam hazards of lasers	X	X		
Laser classification and hazards of each Class	X	X	X	X
Control measures	X	X	X	X
Responsibilities	X	X		
Medical exam requirements	X	X		
CPR (for work on high voltage lasers)	X	X		
Simple explanation of lasers	X		X	X
Compare lasers with regular light	X		X	X
Human aversion response	X		X	
Nature of near IR laser beams	X			X
Explanation of optics increasing the hazard	X			X
Precautions for use	X			X
Procedures for suspected laser incident	X	X	X	X
Industrial laser safety	X*			
Research laser safety	X*			
Medical laser safety	X*			
Range laser safety	X*			
Aircrew laser safety	X*			
Tactical laser safety	X*			

¹For ULSOs in units with these types of lasers, see the *Bioenvironmental Engineers Guide for Lasers and Optical Radiation* for further details

**Training for Class 2 laser users is optional

Attachment 3

APPROPRIATE WARNING SIGNS FOR HAZARDOUS ELECTROMAGNETIC FIELD RADIATION (EMFR) AREAS

Figure A3.1. Example Appropriate Signs for Hazardous EMFR Areas.



A3.1. Exclusion Zone signs:

A3.1.1. The "**NOTICE**" sign may be used in areas where EMFR fields exceed the MPE limits for the general public in uncontrolled areas. These limits are called "Lower Tier" in reference (a).

A3.1.2. The "**CAUTION**" sign is appropriate where individuals may have access to areas in which the EMFR fields exceed the occupational MPE limits in controlled areas. These limits are called "Upper Tier" in reference (a).

A3.1.3. The "**WARNING**" sign should be used in those areas, very near EMFR sources, in which EMFR fields may substantially exceed the controlled environment MPE limits by ten times or more.

Attachment 4

APPROPRIATE WARNING SIGNS FOR IONIZING RADIATION AREAS

A4.1. All areas and equipment in which radioactive material is stored and used must be posted [labeled] with a sign reading. Caution - Radioactive Material that includes the conventional three-blade radiation symbol [trefoil]. The blades of the symbol must be magenta, black, or purple on a yellow background.

Figure A4.1. Example Trefoil Sign.



A4.2. Signs are posted at each entrance to an area where radioactive material is used or stored in. Any equipment or container used for temporary or long-term handling or storage of radioactive material may also be required to be labeled with the Caution - Radioactive Material label. These areas will likely be restricted areas.

A4.2.1. **“Caution, Radioactive Material”**: any area or room in which there is an amount of used or stored licensed material exceeding 10 times the quantity of such material specified in Appendix C to Title 10 CFR Part 20.

A4.2.2. **“Caution, Radiation Area”**: an area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 5 mrem in 1 hour at 30 cm from the radiation source or from any surface that radiation penetrates.

A4.2.3. **“Caution, High Radiation Area” or “Danger, High Radiation Area”**: 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 cm from the radiation source or from any surface that radiation penetrates.

A4.2.4. **“Contaminated Area or Equipment”**: Loose contamination from 200 – 20,000 counts per minute (cpm).

A4.2.5. **“Fixed Contamination”**: Fixed Contamination > 200 cpm.