BY ORDER OF THE COMMANDER
19TH AIRLIFT WING

LITTLE ROCK AFB INSTRUCTION
48-139

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Aerospace Medicine

LASER AND OPTICAL RADIATION SAFETY PROGRAM

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

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Certified by: 19 MDG/CC
(Col Jennifer Bratz)

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This instruction provides guidance, procedures, precautionary measures, and responsibilities for the use and control of laser systems and acts as a written installation laser and optical radiation safety program policy. This instruction incorporates AFI 48-139, *Laser and Optical Radiation Protection Program* and American National Standards Institute (ANSI) Z136.1 *Safe Use Of Lasers*. It applies to all activities on Little Rock Air Force Base (LRAFB), Arkansas, to include tenant units, as well as, contractors who possess, use, handle, store, or bring radiation sources onto the installation. 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 the AF Form 847 from the field through the appropriate functional chain of command. Ensure all records created as a result of processes prescribed in this publication are maintained in accordance with (IAW) AFMAN 33-322, *Management of Records* and disposed of IAW the Air Force Records Information Management System Records Disposition Schedule. 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 Air Force (AF).

This instruction provides local guidelines and streamlines the execution of laser safety programs at Little Rock Air Force Base. 19AWI 48-148 is henceforth rescinded. The Air Force level instruction still applies and should be reviewed for greater understanding.

APPLICABILITY: Military specific lasers that employ coherent radiation are lasers and laser systems used for combat, combat training, or classified in the interest of national security, and require Air Force Laser System Safety Review Board approval prior to acquisition and/or

employment. Examples include, but are not limited to: laser illuminators, designators, range finders, tactical pointers, tactical lasers, and lasers employed to augment explosive ordnance disposal.

Food and Drug Administration-Compliant lasers and laser systems include medical, industrial, laboratory, and communication lasers and laser systems. Food and Drug Administration-Compliant Lasers must have an accession number issued to the manufacturer or at least have compliance paperwork on file with the Food and Drug Administration for verification. Food and Drug Administration-Compliant lasers and laser systems are fully compliant with 21 CFR Parts 1010 and/or 1040 and do not fall under any category defined as military specific lasers.

1. Responsibilities:

1.1. **19 AW/CC.**

1.1.1. Establishes policies, procedures, and/or instructions to implement the installation's laser and optical radiation protection program.

1.1.2. Designates, in writing, a qualified Bioenvironmental Engineer (AFSC: 43E3X) to serve as the Installation Laser Safety Officer (ILSO) with authority to suspend operations involving lasers or other optical radiation sources that pose a significant health risk to personnel, are in clear violation of regulations or requirements, or can negatively impact AF operations, materiel, or real estate.

1.1.3. The Installation Commander shall serve as the final approval authority for the acquisition of all Food and Drug Administration-Compliant Lasers (or equivalent), unless otherwise delegated.

1.2. **19 MDG/CC.**

1.2.1. Through the 19 MDG Chief of Aerospace Medicine, ensures aircrew only use Laser Eye Protection certified Safe-to-Fly by the applicable Major Command, Combatant Command, Air National Guard, or equivalent.

1.2.2. Through the Occupational and Environmental Health Working Group, reviews and approves recommended medical surveillance examination requirements. An Installation Occupational and Environmental Medicine Consultant, in consultation with an optometrist, shall determine medical examination requirements and frequency for users of optical radiation sources and shall reflect requirements in local regulations.

1.3. **Unit Commander.**

1.3.1. Appoint a Unit Laser Safety Officer (ULSO) if an organization uses Class 3B or 4 lasers.

1.4. **19 OMRS/SGXB - Bioenvironmental Engineering - Installation Laser Safety Officer (ILSO).**

1.4.1. The ILSO can be found in the Bioenvironmental Engineering Flight, which is located in Building 1090 (Medical Clinic) and can be reached at 501-987-7398.

1.4.2. Adheres to the Laser Safety Officer (LSO) duties and responsibilities IAW AFI 48-139 and ANSI Z136.1 and develops and manages an installation laser and optical radiation safety program.

1.4.3. Coordinates suspected laser accidents/incidents. Refer to USAFSAM Laser Injury Guidebook and Bioenvironmental Engineers Guide for Lasers and Optical Radiation for guidance on investigations. Report to the Department of Defense Tri-Service Laser Injury Hotline within three (3) days of incident.

1.4.4. Ensures each unit employing military specific lasers maintains a copy of the AF Laser System Safety Review Board approval letter and hazard evaluation or safety summary for each system type.

1.4.5. Either provides or ensures the ULSO training is IAW this instruction and ANSI Z136. Training topics vary by laser classification (see Attachment 5). Assist ULSOs in creating standard operating procedures (SOP) and any review of controlling documents prior to startup of new laser operations.

1.4.6. Exercises authority granted by the installation commander to suspend installation operations. Reports deviations from this instruction to the unit commander and higher headquarters, as appropriate.

1.4.7. Maintains evaluations of hazardous laser and optical radiation equipment. Depending on the equipment, a list of evaluated hazardous Class 3B and 4 lasers could include nomenclature, classification, wavelength, unit of assignment, nominal ocular hazard distance (NOHD), or other hazard descriptors. Obtains a consolidated list of potentially hazardous lasers consisting of evaluated Class 3B and 4 un-embedded/unenclosed lasers and laser systems. This consolidated list may come from lists provided by ULSOs or unit safety representatives.

1.4.8. Enters information on laser hazards and exposures in the Defense Occupational and Environmental Health Readiness System as part of routine occupational and environmental health threat surveillance.

1.4.9. Recommend appropriate administrative, engineering, and personal protective equipment controls, such as laser eye protection optical density (OD), to stay below the maximum permissible exposure (MPE) limit.

1.4.10. The ILSO will conduct a hazard evaluation and establish controls prior to use or maintenance of all Class 3B or 4 Food and Drug Administration-Compliant Lasers or military specific lasers. This requirement shall include embedded Class 3B and 4 lasers if the use or maintenance could potentially expose personnel. Additionally, this requirement applies to the equivalent lasers and laser systems classified under prior ANSI, International Electrotechnical Commission, or Food and Drug Administration classification schemes.

1.4.11. The ILSO should make recommendations for approval/disapproval to the Installation Commander regarding all Food and Drug Administration-Compliant Lasers.

1.5. **Unit Laser Safety Officer (ULSO), Workplace Supervisor, Worker.**

1.5.1. Refer to Attachments **2-5** for general program requirements.

1.5.2. If an organization uses Class 3B or 4 lasers, the Laser Safety Officer (LSO) at each level (ILSO and ULSO) shall be appointed by the commander at the appropriate level.

1.5.3. LSO training requirements are based upon the primary mission of the unit to which the LSO is assigned and require varying levels of knowledge and training for each area. In consultation with the ILSO, the ULSO shall determine what, if any, training is commensurate with the laser hazards accessible at the unit level. Due to the nature of laser systems and operations currently on LRAFB, the appointed ULSO shall be trained by the ILSO. The ULSO will then be able to provide annual laser safety training to its unit's workers (AFI 48-139, paragraph 2.17.9). The training requirements shall be coordinated with the ILSO.

1.5.4. Develops and manages a unit laser and optical radiation safety program. Coordinates with the ILSO as needed to maintain safe operation, administrative, engineering, and personal protective equipment controls, and to create SOPs and any review of controlling documents prior to startup of new laser operations. Contact the ILSO to help determine the laser classification.

1.5.5. Acts as a point of contact for the unit on laser and other optical radiation safety matters and maintains lines of communication with the ILSO, Wing Safety, and Public Health personnel. Coordinates suspected laser and Ultra-Violet lamp accidents/incidents with the ILSO, Wing Safety, etc.

1.5.6. Maintains a copy of the AF Laser System Safety Review Board approval letter and hazard evaluation for each type of military specific laser acquired by the unit (if applicable). Military specific lasers shall adhere to approved user operating instructions and technical orders.

1.5.7. Prior to any commercial off the shelf laser purchases (such as laser etchers), coordinates with the ILSO and workplace supervisor to determine any safety requirements and to ensure compliance with 21 CFR 1040.

1.5.8. Ensures users, including visitors, of any Class 1M, 2M, 3R, 3B or 4 laser, military specific laser, or optical radiation sources are trained upon initial assignment to the unit and annually thereafter. This extends to those individuals that conduct routine maintenance on any Class 3B or 4 embedded lasers. Documents laser safety training.

1.5.9. Consult with the ILSO for laser use on ranges, laser devices potentially directed at targets above the horizon, laser directed energy weapons, and combat simulation lasers.

1.5.10. Class 3B and 4 lasers used in the medical setting must also adhere to ANSI Z136.3. *Safe Use of Lasers in Healthcare.* Contact the ILSO for additional information.

1.6. **19 CONS - Base Contracting.**

1.6.1. Informs contractors to notify the ILSO, at least 30 days in advance, of a contractor performing operations using military specific lasers or Class 3B or 4 laser systems that impact AF property or personnel. Notifies the ILSO prior to a contractor bringing Class 3B or 4 lasers on the installation and provides laser hazard and control information to the ILSO and/or ULSO for authorization prior to use.

1.6.2. All solicitations for goods or services that use or contain Class 1M, 2M, 3R, 3B, or 4 lasers or military-specific lasers, to include commercial-off-the-shelf lasers, must be approved by the ILSO prior to award and procurement.

2. Medical Surveillance for Laser Users.

2.1. Any medical examination requirements are limited to personnel who routinely work in a laser environment with potential exposure to Class 3B or 4 lasers as either defined within the job description or on a greater than once a month basis.

2.1.1. Users include operators, technicians, engineers, and maintenance/service personnel, etc., working with or around these lasers. Specific personnel working in a laser-operating environment, who may be exposed to laser emissions include, but are not limited to, laboratory, aircrew, combat control teams, special operations forces, and laser range personnel.

2.1.2. Personnel who do not routinely operate in a laser environment may be considered incidental personnel not requiring examination. Consult with the ILSO for medical requirements.

2.1.3. Personnel who work with lasers that are embedded or encased limiting the potential exposure hazard to that of a lower class laser are not subject to a higher level of medical surveillance.

2.2. Medical Examination Requirements and Frequency for Lasers and Laser Systems. Refer to DoD 6055.05M, “Occupational Medical Examinations and Surveillance Manual,” the USAFSAM Laser Injury Guidebook, and/or the Bioenvironmental Engineers Guide for Lasers and Optical Radiation for guidance.

JOHN M. SCHUTTE Colonel, USAF
Commander

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AFI 48-139, *Laser and Optical Radiation Protection Program*, 22 April 2020

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

ANSI Z136.3. *Safe Use of Lasers in Healthcare,* 2018

DoD 6055.05-M, *Occupational Medical Examinations and Surveillance Manual*, 2 May 2017

Abbreviations and Acronyms

ANSI—American National Standard Institute

CFR—Code of Federal Regulation

IAW—In Accordance With

ILSO—Installation Laser Safety Officer

LRAFB—Little Rock Air Force Base

LSO—Laser Safety Officer

MTF—Military Treatment Facility

NHZ—Nominal Hazard Zone

NOHD—Nominal Ocular Hazard Distance

OD—Optical Density

OPR—Office of Primary Responsibility

SOP—Standard Operating Procedure

USAF—United States Air Force

USAFSAM—United States Air Force School of Aerospace Medicine

Term

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.

Laser Safety Officer (LSO)—An individual designated in writing whom is responsible for implementing a laser safety program and enforcing control of laser hazards within their area of responsibility.

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.

Nominal Ocular Hazard Distance (NOHD)—The distance from the output aperture along beam propagation beyond which irradiance or radiant exposure is not expected to exceed the appropriate

MPE for unobstructed viewing by the human eye. The NOHD may increase with the use of aided viewing.

Radiation—For the purposes of this regulation, unless otherwise specified, ionizing radiation and specific, medical uses of non-ionizing radiation, such as radio- or microwaves, or visible, infrared, or ultraviolet light.

Attachment 2

UNIT LASER SAFETY PROGRAM REQUIREMENTS

Table A2.1. Unit Laser Safety Program Requirements.

Class	ULSO	Training	Inventory	Eye Exam	SOP	Laser Eye Protection
1						
1M		X				
2						
2M		X				
3R		X				
3B	X	X	X	X	X	X
4	X	X	X	X	X	X

Note: Class 3B or 4 lasers that are enclosed/embedded and reduced to a lower class will assume the requirements of the lower class laser unless personnel routinely access the enclosure to work on/with the Class 3B or 4 laser. Even if the Class 3B or 4 laser is enclosed/embedded, it will still need to be inventoried.

Attachment 3

UNIT LEVEL LASER SAFETY OPERATING INSTRUCTION OUTLINE

A3.1. Operating Instruction shall have the following main sections. The sub-bullets are suggested discussion points to expand on inside the section.

A3.1.1. Program Overview.

A3.1.1.1. What lasers do you have, what hazard class are they, what is the wavelength of the laser?

A3.1.1.2. What is the NOHD?

A3.1.1.3. Identify the unit laser safety officer.

A3.1.2. Administrative Controls.

A3.1.2.1. Lasers must be secured when not in use. Store in room, vault xxx.

A3.1.2.2. Safety Training.

A3.1.2.2.1. Personnel receive Laser Safety Training when gained and annually thereafter.

A3.1.2.2.2. Training topics and slides provided by ILSO.

A3.1.2.2.3. Training documented on Form 55 or equivalent.

A3.1.2.2.4. Training material located at this folder._____

A3.1.3. Engineering Controls.

A3.1.3.1. Identify interlocks, dummy loads, if applicable. If not, mention that there are no engineering controls in place.

A3.1.4. Personal Protective Equipment Controls.

A3.1.4.1. Do you have laser eye protection? If so, list by wavelength and OD.

A3.1.4.2. How to store and inspect laser eye protection.

A3.1.5. Maintain Safe Operations.

A3.1.5.1. Don’t point at people or above horizon.

A3.1.5.2. If you think you are exposed, seek medical attention and inform ILSO.

A3.1.5.3. No binoculars or magnifying optics when using lasers without consulting ILSO.

A3.1.5.4. Cover or remove reflective surfaces when lasers are in use (e.g. mirrors, glass, cell phone screens, watches, rings, etc.).

A3.1.5.5. Any additional instructions from the manufacturer’s instruction manual.

Attachment 4

LASER SAFETY CONTROLS

Figure A4.1. Laser Safety Controls.

Control measures	1	1M	2	2M	3R	3B	4
Laser outdoor controls	·	NHZ	XNHZ	·NHZ	XNHZ	XNHZ	XNHZ
Temporary laser controlled area	b	b	b	b	b	--	--
Remote firing & monitoring	--	--	--	--	--	--	·
Labels	--	X	X	X	X	X	X
Area posting	--	--	·	·	·	X	X
SOPs	--	--	--	--	--	X	X
Output emission limitations	--	--	--	--	--LSO determines--		
Education and training	--	X	·	X	X	X	X
Authorized personnel	--	--	--	--	--	X	X
Alignment procedures	--	X	X	X	X	X	X
Eye protection	--	★	--	★	★	X	X
Spectator control	--	·	--	·	--	◇	X
Service personnel	b	b	b	b	b	X	X
Skin protection	--	--	--	--	--	X	X
Laser fiber optics trans system	--	--	--	·	X	X	X

Key:

X	=	Shall
a.	=	Shall if embedded Class 3R, Class 3B
b.	=	If Class 3b or 4
--	=	Shall if embedded Class 3B or Class 4
·	=	No requirement
◇	=	Should
NHZ	=	Shall if MPE is exceeded Nominal hazard zone analysis required
★	=	If using collecting optics

Figure A4.2. Laser Safety Controls (con't).

Control measures	1	1M	2	2M	3R	3B	4
Laser outdoor controls	·	NHZ	XNHZ	·NHZ	XNHZ	XNHZ	XNHZ
Temporary laser controlled area	b	b	b	b	b	--	--
Remote firing & monitoring	--	--	--	--	--	--	·
Labels	--	X	X	X	X	X	X
Area posting	--	--	·	·	·	X	X
SOPs	--	--	--	--	--	X	X
Output emission limitations	--	--	--	--	--LSO determines--		
Education and training	--	X	·	X	X	X	X
Authorized personnel	--	--	--	--	--	X	X
Alignment procedures	--	X	X	X	X	X	X
Eye protection	--	★	--	★	★	X	X
Spectator control	--	·	--	·	--	◇	X
Service personnel	b	b	b	b	b	X	X
Skin protection	--	--	--	--	--	X	X
Laser fiber optics trans system	--	--	--	·	X	X	X

Key:

X	=	Shall
a.	=	Shall if embedded Class 3R, Class 3B
b.	=	If Class 3b or 4
--	=	Shall if embedded Class 3B or Class 4
·	=	No requirement
◇	=	Should
NHZ	=	Shall if MPE is exceeded Nominal hazard zone analysis required
★	=	If using collecting optics

Attachment 5

LASER SAFETY TRAINING TOPICS.

Figure A5.1. Laser Safety Training Topics from AFI48-139.

Table 3. AFI 48-139 and ANSI Z136.1 Required Laser Safety Training Topics[1]

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