

Laser Safety

MSC-PRO-43713

Revision 1

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Topic: Worker Protection

**Approved for Public Release;
Further Dissemination Unlimited**

Laser Safety

1.0 PURPOSE

This Level 2 procedure conveys the requirements and responsibilities necessary to implement a *Laser Safety* program in accordance with applicable OSHA, DOE requirements, and External Standards which specify compliance with the technical and exposure limit requirements of ANSI Z136.1-2007 (or most current revision). The requirements apply to all Mission Support Alliance (MSA) facilities using lasers.

2.0 SCOPE

This Level 2 procedure applies to all MSA facilities and operations that purchase and/or use industrial lasers, scientific lasers, laser systems, and devices that emit non-ionizing radiation.

This procedure does not apply to:

1. Lasers in consumer products (such as laser printers and optical disk scanning devices) that are completely enclosed and require no access by users at any time, and
2. Low power non-ionizing sources such as consumer-type microwave ovens.

3.0 IMPLEMENTATION

This procedure is effective upon publication.

4.0 REQUIREMENTS

NOTE: For the tables in this section under the requirement "type" column, "V" means verbatim, and "I" means interpreted.

#	REQUIREMENT	TYPE V, I,	SOURCE
1.	MSA line managers shall ensure that all operations utilizing lasers are evaluated by facility/operation assigned Safety and Health Group industrial hygiene professionals to ensure personnel safety and to determine which additional requirements of this procedure are to be instituted.	I	10CFR851.23 (a)(11)
2.	The Director, Mission Assurance shall appoint a Laser Safety Officer (LSO) with the authority and responsibility to effect the knowledgeable evaluation and control of laser hazards, and the implementation of appropriate control measures, as well as to monitor and enforce compliance with required standards and regulations.	I	10CFR851.23 (a)(11)

NOTE 1: 10CFR851.23(a)(9) identifies American Conference of Governmental Industrial Hygienists (ACGIH), "*Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*" (2005) as the applicable health and safety standard

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incorporated by reference from 10CFR851.27 (a)(2)(v). In keeping with best management practices and to incorporate the most reasonable, adequate, and up to date guidance for purposes of establishing threshold limit values (TLVs) for exposure to laser radiation, American Conference of Governmental Industrial Hygienists (ACGIH), "*Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*" (2009) will be used as the guidance in controlling exposures.

NOTE 2: 10CFR851.23 (a)(11) identifies ANSI Z136.1-2000 as the applicable health and safety standard and by reference from 10CFR851.27 (b)(2). In keeping with best management practices and incorporation of the most reasonable, adequate, and up to date guidance for the safe use of lasers and laser systems, ANSI Z136.1-2007 is being adopted by this procedure.

NOTE 3: Operations, maintenance and service of *laser pointers* are exempt from the requirement for the appointment of an LSO. For these purposes, *laser pointers* are defined as a Class 2 or Class 3R - if the beam diameter is less than 7 mm, formerly class 3a - laser products that are usually hand held and emit a low-divergence visible beam of less than 5 milliwatts and are intended for designating specific objects or images during discussions, lectures or presentations as well as for the aiming of firearms or other visual targeting practice.

NOTE 4: Purchasers of *laser pointers* are strongly encouraged to minimize any risks from *laser pointers* by purchasing the lowest power *laser pointers* available (Class 2) and to seek assistance from their facility/operation industrial hygienist if they have questions regarding *laser pointers*.

3.	The Director, Mission Assurance shall appoint a Laser Safety Officer (LSO) for all circumstances of service of Class 1, Class 2, Class 2M, and Class 3R laser/laser systems which contain an embedded Class 3B or Class 4 laser/laser system, and on all Class 3B or Class 4 laser/laser systems unless the service-performing parties supply their own LSO for the service operations performed in MSA facilities.	I	10CFR851.23 (a) (11)
4.	Line management shall provide the LSO with the training necessary to acquire the knowledge required to evaluate and control laser hazards and shall give the LSO the responsibility and authority to monitor and enforce the control of laser hazards.	I	10CFR851.23 (a) (11)
5.	MSA LSO shall verify laser classifications according to the criteria in Section 3.3 of ANSI Z136-1 (most recent revision) and mechanisms exist to maintain a current inventory of all Class 3R, Class 3B and Class 4 lasers/laser systems by qualified individuals.	I	10CFR851.23 (a) (11)

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6.	The LSO shall specify and document control measures for beam and non-beam hazards, as necessary, to comply with technical and exposure limit requirements of ANSI Z136.1-2007 (most recent edition), NFPA 115, and, for construction work, as necessary to comply with 29CFR 1926.54 and/or 29CFR 1926.102.	I	10CFR851.23 (a)(11); 29CFR 1926.52; 29CFR 1926.102;
7.	The LSO shall ensure that, when employees have direct ocular (eye) or skin exposures, the more stringent of the ANSI Z136.1 (most recent version) or ACGIH exposure limits are observed.	I	10CFR851.23 (a)(11)
8.	Warning signs and labels meeting the requirements of Section 4.7 of ANSI Z136.1 (most recent edition) shall be utilized for all operations of Class 2, Class 2M, Class 3R, Class 3B and Class 4 lasers or laser systems.	I	10CFR851.23 (a)(11)
9.	Line managers shall ensure that Employee Job Task Analyses (EJTAs) are modified so as to indicate that an employee works with or around a Class 3B or Class 4 laser and is, therefore, enrolled in the Hanford <i>Laser Vision Medical Program</i> .	I	10CFR851.23 (a)(11)

5.0 PROCESS

The Director, Safety, Health and Quality has authority over the Laser Safety program and the MSA facilities and operations that use or subcontract services for laser systems. The LSO is the Laser Safety Program Manager as well as the Interpretive Authority/Subject Matter Expert (IA/SME) for Laser Operations.

5.1 Laser Safety Program

<i>Actionee</i>	<i>Step</i>	<i>Action</i>
Director, Mission Assurance	1.	Appoint a Laser Safety Officer (LSO) with the authority and responsibility to effect the knowledgeable evaluation and control of laser hazards, and the implementation of appropriate control measures, as well as to monitor and enforce compliance with required standards and regulations.
Laser Safety Officer	2.	Ensure uniform requirements for a Laser Safety program are established.
	3.	Ensure proper interfaces occur between the Site Occupational Medical Services Provider (OMSP) and the LSO on any inquiries relating to the use of lasers/laser systems.
	4.	Designate Laser Safety Program coordinators at facilities and operations utilizing laser/laser system installations.

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NOTE: *Laser Safety Program coordinators will usually be an engineer or supervisor directly responsible for the operations and maintenance of the laser/laser system installation.*

5. Maintain direct authority over the Laser Safety Program and site participants.
6. Recommend improvements in the Laser Safety program to Director, Safety, Health and Quality.
7. Review any new requests for lasers/laser systems and provide oversight and concurrence before final approval is granted.
8. Interface with the Client and Stakeholders regarding the Laser Safety Program and classification of lasers and laser systems.
9. Act as the Laser Safety Program Interpretive Authority.
10. Provide technical assistance as requested or needed with Clients and Stakeholders.
LSO/S&H Group Industrial Hygienists
11. Employee Job Task Analysis of users (i.e., operators, technicians, engineers, maintenance and service personnel) of Class 3B or 4 Lasers/Laser Systems shall have the other exposure information tab Laser question marked yes and submitted to the site occupational medical department to schedule a laser vision examination.
Facility or Project Managers/S&H Group Industrial Hygienists
12. Control measures shall be used to reduce or eliminate the possibility of employee exposure to laser radiation and to other hazards associated with the operation of laser systems, both during normal usage and maintenance.

NOTE: *Many accidents involving lasers result from non-beam hazards. To ensure that these hazards are adequately identified and addressed, Safety & Health personnel shall perform necessary hazard evaluations.*

13. Appropriate personal protective equipment, approved by the laser safety officer, is required to be worn whenever there is potential for exposure to the laser beam.
14. Spectators are not allowed into laser controlled areas without management approval.

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5.2 Laser Selection and Procurement

NOTE: *Acquisition is limited to models approved by the LSO and program management.*

<i>Actionee</i>	<i>Step</i>	<i>Action</i>
Facility or Project Management	1.	All purchase requisitions for lasers and associated safety equipment are submitted to the LSO for approval.
	2.	Subcontracts for vendors that perform maintenance and service on any vendors on any Class 2, Class 2M, Class 3R, Class 3B and Class 4 lasers or laser systems must be reviewed by the LSO.
Laser Safety Program Coordinators	3.	Assure that the installations of laser equipment meets the minimum criteria listed in the checklist provided in Table 2, prior to operations authorization.

5.3 Use and Maintenance of Lasers

<i>Actionee</i>	<i>Step</i>	<i>Action</i>
Facility or Project Management/ LSO	1.	Establish requirements for proper maintenance of equipment and supplies.
LSO	2.	Ensure that all projects and operations with Class 1, Class 2, Class 2M, and Class 3R laser/laser systems which contain an embedded Class 3B or Class 4 laser/laser system, and on all Class 3B or Class 4 laser/laser systems have a designated Laser Safety Program coordinators at facilities and operations that utilize lasers/laser systems.
Laser Safety Program Coordinators	3.	Assure Lasers and laser systems are inspected, appropriately maintained and marked, including facility Laser Hazard Warning signs on a periodic basis and in accordance with manufacturer's specific recommendations or LSO approved procedures when applicable.

NOTE: *These inspections should be captured in the facility periodic inspection per [MSC-PRO-7652](#), Safety and Health Inspections.*

Facility or Project Management	4.	Ensure that all Lasers are maintained as required by manufacturer, or in those instances that require reclassification during maintenance or servicing by the LSO.
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5.4 Laser Training

<i>Actionee</i>	<i>Step</i>	<i>Action</i>
Facility or Project Management/LSO	1.	Assure adequate safety education and training is provided to users of lasers/laser systems.
LSO	2.	Ensure that all safety education and training includes applicable total laser hazard evaluations and the control measures for those hazards.
Facility Management	3.	Implement and administer the Laser/laser system training program.
Training Activity Responsible Manager/LSO	4.	Authorize training, equivalencies for portions of the Laser/Laser system training based on the trainee's previous training and/or experience in accordance with MSC-PRO-179 , <i>Obtaining Training Equivalencies, Waivers, and Extensions</i> .
	5.	Ensure applicable training and qualification of all Laser Instructors, and Laser/laser system operators.
	6.	Ensure that auditable copies of training documentation are maintained by Training Records.
	7.	Maintain all training equipment and supplies.
Training Records/Systems	8.	Maintain laser safety training records per MSC-PRO-249 , <i>Training Records Administration</i> .
LSO	9.	Provide training assessments and evaluation for the laser/laser system installation training program.

5.5 Laser Reporting

<i>Actionee</i>	<i>Step</i>	<i>Action</i>
Laser Safety Program Coordinator	1.	Ensure records are maintained showing the make, model, type and location of all lasers/laser system installations, as required by MSC-PRO-10588 , <i>Records Management Processes</i> .
	2.	Provide information about the make, model, type and location of lasers/laser systems to the Laser Safety Officer and provide updates as changes to laser/laser system installations occur.

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<i>Actionee</i>	<i>Step</i>	<i>Action</i>
LSO	3.	Any accident involving a laser is promptly reported to the LSO (in addition to other notifications required by occurrence reporting procedures).
	4.	Ensure information is made available at the program, project, and operations level to support the Laser Safety Program.
	5.	Ensure that information is disseminated to all projects and operations with Lasers/Laser system installations in the event of Lessons Learned, equipment recalls, or program requirement changes.
	6.	Maintain a listing of Laser Safety Program Coordinators to assist in the investigation of suspected or actual laser-induced injuries.

6.0 RECORD IDENTIFICATION

Records Capture Table

Name of Document	Submittal Responsibility	Retention Responsibility
Laser/Laser System Inventories	Laser Safety Program Coordinator	Laser Safety Program Coordinator
Laser Safety Program Coordinators	Laser Safety Officer	Laser Safety Officer

7.0 REFERENCES

7.1 Source References

10CFR851.23, Worker Safety and Health Program,

Title 29, Code of Federal Regulations, Part 1926.54 (29 CFR 1926.54), *Non-ionizing Radiation*

Title 29, Code of Federal Regulations, Part 1926.102 (29 CFR 1926.102), *Eye and Face protection*

7.2 Working References

American Conference of Governmental Industrial Hygienists (ACGIH), "*Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*" (2009)

American National Standards Institute (ANSI), ANSI Z136.1-2007 (or most recent version), *American National Standard for Safe Use of Lasers*

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American National Standards Institute (ANSI), ANSI Z136.6-2005 (or most recent version),
American National Standard for Safe Use of Lasers Outdoors

National Fire Protection Association (NFPA), *NFPA 115* (2008 or most recent revision),
Standard for Laser Fire Protection

[MSC-PRO-7652](#), *Safety and Health Inspections*

[MSC-PRO-179](#), *Obtaining Training Equivalencies, Waivers, and Extensions*

[MSC-PRO-077](#), *Reporting, Investigating, and Managing Health, Safety and Property/Vehicle Events*

[MSC-PRO-249](#), *Training Records Administration*

[MSC-PRO-10588](#), *Records Management Processes*

[MSC-RD-11058](#), *Occupational Medical Qualification and Monitoring.*

Table 1. Comparison of National and International Standards for Classification

Class	IEC 60825 (Amend. 2)	U.S. :FDA/CDRH	ANSI-Z136.1
Class 1	Any laser or laser system containing a laser that cannot emit laser radiation at levels that are known to cause eye or skin injury during normal operation. This does not apply to service periods requiring access to Class 1 enclosures containing higher-class lasers.		
Class 1M	Not known to cause eye or skin damage unless collecting optics are used.	N/A	Considered incapable of producing hazardous exposure unless viewed with collecting optics.
Class 2a	N/A	Visible lasers that are not intended for viewing and cannot produce any known eye or skin injury during operation based on a maximum exposure time of 1000 seconds.	N/A

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Class 2	Visible lasers considered incapable of emitting laser radiation at levels that are known to cause skin or eye injury within the time period of the human eye aversion response (.25 seconds).		
Class 2M	Not known to cause eye or skin damage within the aversion response time unless collecting optics are used.	N/A	Emits in the visible portion of the spectrum, and is potentially hazardous if viewed with collecting optics.
Class 3a	N/A	Lasers similar to Class 2 with the exception that collecting optics cannot be used to directly view the beam. Visible only.	N/A
Class 3R	Replaces Class 3a and has different limits. Up to 5 times the Class 2 limit for visible and 5 times the Class 1 limits for some invisible.	N/A	A laser system that is potentially hazardous under some direct and specular reflection viewing condition if the eye is appropriately focused and stable.
Class 3B	Medium-powered lasers (visible or invisible regions) that present a potential eye hazard for intrabeam (direct) or specular (mirror-like) conditions. Class 3B lasers do not present a diffuse (scatter) hazard or significant skin hazard except for higher powered 3B lasers operating at certain wavelength regions.		
Class 4	High-powered lasers (visible or invisible) considered to present potential acute hazard to the eye and skin for both direct (intrabeam) and scatter (diffused) conditions. Also have potential hazard considerations for fire (ignition) and byproduct emissions from target or process materials.		

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Establishment	Comments
One person shall act as the Laser Safety Program Coordinator and ensure that each installation is operated safely according to this procedure and guidance of the LSO.	
Before the installation of any laser equipment (other than sealed units in consumer products), the LSO is contacted and LSO approval for installation is obtained.	
Any laser installation modifications must be approved by the LSO and the appropriate engineering organization prior to such changes being initiated.	
Classifying and Controlling (Refer to Table 1)	
The classification level is established for each laser installation, according to the risk presented, from class 1 (no risk under normal operating conditions) through class 4 (hazard from direct and diffuse reflections) according to ANSI Z136.1, for each laser installation. If necessary, the LSO delegates the responsibility for implementing and following appropriate classification procedures to other persons specifically trained in laser safety or optical engineering.	
That appropriate control measures from ANSI Z136.1 for each laser installation are specified and implemented. When appropriate, alternate control measures that provide equivalent protection may be specified and implemented with the approval of the LSO.	
Before working with class 3b or 4 lasers, and promptly after any suspected eye exposure, ensure personnel who may be exposed to laser radiation complete a laser eye examination.	
Controls for non-beam laser hazards are specified and implemented, when applicable, such as: <ul style="list-style-type: none"> • Fire and electrical hazards • Electrocutation from imbedded capacitors • Laser generated airborne contaminants (LGACs) • Collateral and plasma radiation • Explosion hazards (high pressure arc lamps, filament lamps, and capacitor banks) • Compressed gases • Solvents • Laser dyes (some dyes are carcinogenic) 	

NOTE: Before each use, check MSC Docs Online to ensure this copy is current.

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	<ul style="list-style-type: none">• Noise and other ergonomic problems• Ultraviolet and radio frequency radiation.• Mechanical Hazards (Limited Space)• Noise• Robotic-hazards• Waste disposal• Ergonomics	
Supervising and Operations		
	Written standard operating procedures, including laser-specific safety requirements are prepared and applied.	
	Standard operating procedures are reviewed and approved by the LSO.	