1.0 PURPOSE

The Laser Safety Program has been developed to provide guidance and oversight for the safe use of lasers and laser systems being utilized by the Latent Print Unit at the Department of Emergency Services and Public Protection's Division of Scientific Services (DSS).

2.0 SCOPE

The Laser Safety Program applies to all latent print examiners and those DSS employees who may require access to the Latent Print Unit's laser.

3.0 RESPONSIBILITY

3.1 Laser Safety Officer (LSO)

a) The Latent Print Unit supervisor/lead shall be responsible for obtaining and providing classification information concerning the Unit's laser system;
b) Implement or provide laser safety training;
c) Determine necessary safety information (evaluation and control measures) critical for the implementation of the DSS Latent Print Unit's laser system as specified by OSHA Section III: Chapter 6 Laser Hazards;
d) Provide information concerning the purchase of necessary laser safety materials (signs, labels, safety eyewear, etc);
e) Monitor and enforce program requirement;
f) Conduct annual review and survey of the laser safety program and make appropriate changes if necessary (see 6.7).

3.2 Laser Users:

a) Know all laboratory hazards and laboratory procedures for the safe use of laser(s) and laser system(s) in the work area;
b) Attend required training(s) as specified by a supervisor or the LSO;
c) Complete all aspects of laser usage in accordance with the laser safety program and good safety practices;
d) Use all personal protective equipment as specified in prescribed training or required by a supervisor or the LSO;
e) Immediately notify a supervisor, the LSO or section safety officer of any hazards encountered.

4.0 REFERENCES

OSHA Section III: Chapter 6 Laser Hazards
National Institute of Health Laser Safety Program
NIST Laser Safety Program

5.0 DEFINITIONS

Accessible Emission Limit (AEL): The maximum accessible emission level permitted within a particular laser hazard class.

Authorized Personnel: Any individual approved to work with a laser or laser system.

Aversion Response: An involuntary movement of either the head and /or eye to avoid exposure to a visible laser beam.

Blink Reflex: The involuntary closing and opening of the eye(s) as a result of external stimulation.

Continuous Wave (CW): A laser beam with an output greater than 0.25 seconds.

Controlled Area is an area or location, such as a safe room, which encompasses or contains the hazardous conditions of an operating laser.

Diffuse Reflection: The reflecting of a laser beam in many directions by a surface.

Divergence: The splitting of a laser beam so that the beam diameter increases with distance traveled.

Embedded Laser: A laser of a specific class that is reduced to a lower class due to the mechanisms and devices (engineering controls) that remove potential for contact.

Fail-Safe Interlock: An engineering control where the failure of a single mechanical or electrical component of the interlock will cause the system to go into, or remain in, a safe mode.

Infrared: In this standard, the region of the electromagnetic spectrum between the long- wavelength extreme of the visible spectrum (about 0.7 m) and the shortest microwaves (about 1 mm).

Interlock: See "Fail-Safe Interlock"

Intrabeam viewing: The viewing condition whereby the eye is exposed to all or part of a laser beam.

LSO: Laser Safety Officer

LSP: Laser Safety Program

Maximum permissible exposure (MPE): The level of laser radiation to which an unprotected person may be exposed without adverse biological changes in the eye or skin.

Nominal Hazard Zone (NHZ): The space within which the level of the direct, reflected, or scattered radiation may exceed the applicable MPE. Exposure levels beyond the boundary of the NHZ are below the appropriate MPE.

Non-Beam Hazard: A class of hazards that result from factors other than direct human exposure to a laser beam.

Protective Housing: An enclosure that surrounds the laser or laser system and prevents access to laser radiation above the applicable MPE. The aperture through which the useful beam is emitted is not part of the protective housing. The protective housing limits access to other associated radiant energy emissions and to electrical hazards associated with components and terminals, and may enclose associated optics and a workstation.

Specular Reflection: A mirror-like reflection.

Temporary Controlled Area is a temporary area or safe room which encompasses or contains the hazardous conditions of an operating laser. It is not a permanent or semi-permanent area or location.

Thermal Effect: Temperature elevation caused by exposure to a laser beam.

Threshold Limit (TL): The term is applied to laser protective eyewear filters, protective windows, and barriers. The TL penetration of a laser protective device. This is generally related by the Threshold Limit (TL) of the protective device, expressed in W cm -2 or J cm -2 . It is the maximum average irradiance or radiant exposure at a given beam diameter for which a laser protective device provides adequate

beam resistance. Thus, laser exposures delivered on the protective device at or below the TL will limit beam penetration to levels at or below the applicable MPE.

Ultraviolet radiation: In this standard, electromagnetic radiation with wavelengths between 0.18 and 0.40 m (shorter than those of visible radiation).

Wavelength: The distance in the line of advance of a sinusoidal wave from any one point to the next point of corresponding phase (e.g., the distance from one peak to the next).

6.0 PROGRAM

6.1 Laser Safety Program

The Laser Safety Program (LSP) is established to promote health and safety in the use of Class 4 lasers by the Latent Print Unit of the Department of Emergency Services and Public Protection's Division of Scientific Services (DSS). The LSP is administered by the laser safety officer (LSO). The LSP at DSS is a program with a mandate to ensure the proper training for all users and ensure the proper response to accidents and incidents involving the DSS Latent Print Unit laser.

6.2 Laser Classification

A. **Class 1** cannot emit laser radiation at known hazard levels (typically continuous wave: cw 0.4 μW at visible wavelengths). Users of Class I laser products are generally exempt from radiation hazard controls during operation and maintenance (but not necessarily during service). Since lasers are not classified on beam access during service, most Class I industrial lasers will consist of a higher class (high power) laser enclosed in a properly interlocked and labeled protective enclosure. In some cases, the enclosure may be a room (walk-in protective housing) which requires a means to prevent operation when operators are inside the room.

B. **Class 1A** a special designation that is based upon a 1000-second exposure and applies only to lasers that are "not intended for viewing" such as a supermarket laser scanner. The upper power limit of Class I.A. is 4.0 mW. The emission from a Class I.A. laser is defined such that the emission does not exceed the Class I limit for emission duration of 1000 seconds.

C. **Class 2** low-power visible lasers that emit above Class I levels but at a radiant power not above 1 mW. The concept is that the human aversion reaction to bright light will protect a person. Only limited controls are specified.

D. Class 3A intermediate power lasers (cw: 1-5 mW). Only hazardous for intrabeam viewing. Some limited controls are usually recommended.

E. Class 3B moderate power lasers (cw: 5-500 mW, pulsed: 10 J/cm^2 or the diffuse reflection limit, whichever is lower). In general Class IIIB lasers will not be a fire hazard, nor are they generally capable of producing a hazardous diffuse reflection. Specific controls are recommended.

F. Class 4 High power lasers (cw: 500 mW, pulsed: 10 J/cm^2 or the diffuse reflection limit) are hazardous to view under any condition (directly or diffusely scattered) and are a potential fire hazard and a skin hazard. Significant controls are required of Class IV laser facilities.

6.3 Laser Hazard Control Measures

A. Controls for Class 3b and Class 4 Lasers

1. Posting – At minimum, the entryway of a controlled laser safety area hereinafter referred to as "Controlled Area" must be posted for the class of laser, laser power, and laser wavelength(s) of the laser being utilized in that area. Additionally, it may be necessary to post inside the laser safety area to further define the hazard.

2. Authorization – Only individuals who have been trained by a designated official may enter and utilize a laser of class 3b or 4. No other individuals shall have the means to utilize the laser or laser system. The DSS Latent Print Unit laser is a class 4 laser.

3. Beam trajectory and control – The laser may only be utilized after the beam manner is well characterized and understood. The beam should be controlled to not be at either standing or sitting height of the operator. A laser beam will not be directed at any individual. Additionally, an appropriate beam stop must be utilized to terminate the beam. The DSS Latent Print Unit dual beam laser can have its beam terminated by the use of the supplied "Enable" Key. The DSS Latent Print Unit dual beam laser utilizes a diffused beam.

4. Non-beam hazards – All non-laser materials that have the potential to come into contact with the laser beam must be analyzed to determine if any hazards are created upon contact over a period of time. When no written information is available to describe conditions created by contact,

the responsible party should assume a hazardous product and ensure a proper means to eliminate the hazard. The most common means of controlling non-beam hazards is the use of local exhaust ventilation, essentially a mechanical means of purging an atmosphere through the use of controlled, directional air flow. This is necessary for beams that will be utilized for industrial purposes such as cutting or etching metal or other materials.

5. Personal Protective Equipment (PPE) – All class 3b and 4 laser usage areas must have a written document providing the required PPE to be used while working with the laser. The most common PPE for use with lasers is protective eye wear. It is critical that eye wear be appropriate to the laser used. All PPE must be inspected before use for conditions that would negate the effectiveness of the protective device.

6. Containment – All class 3b and 4 laser(s) and laser system(s) should utilize a means of containment that fully encloses the beam path and any potential reflections of the beam off of surfaces. Building materials utilized in a laser area(s) should be analyzed for reflective potential, and when possible altered to decrease reflectance to as low a level as achievable. Windows to spaces outside of the laser area should be removed or covered to block transmission of the laser. Engineering controls like laser activation entry lights and key switches should be used at all times to ensure effective containment and control. The DSS Latent Print Unit utilizes an enable key in addition to an interlock installed to the doorway of the controlled area.

7. Rapid Egress and Emergency Access – All class 4 laser area(s) must have a controlled means of rapid egress and admittance for emergency conditions. The controlled area will not be locked when the dual beam laser is in use.

6.5 Laser Related Non-Beam Hazards & Control Measures

A. Electrical Hazards – Many incidents and accidents related to laser(s) and laser system(s) stems not from the laser beam, but from user interaction with electrical components required for the laser to function. Most class 3b and 4 lasers utilize high voltages and large capacitors which have a high potential for electrical accidents. DSS employees will not disassemble the Laser Unit. Only authorized service technicians may disassemble the laser unit.

B. Laser Dyes – Dyes used as lasing mediums are often classified as toxic, carcinogenic and/or flammable. These chemicals must be handled appropriately and material safety data sheets for each must be on file within the laser use area. The DSS Latent Print Unit dual beam laser does not use toxic, carcinogenic and/or flammable lasing mediums.

C. Laser Generated Air Contaminants (LGAC) – Contact between a laser beam and a material can cause specific; yet, sometimes unknown contaminants to be released into the atmosphere of the laser use area. Periodically this release of air contaminate may occur without noticeable signs, such as smoking of the material contacted. Proper room ventilation or local exhaust ventilation is critical in any laser use area, and must be evaluated before the installation of a class 3b or 4 laser. The use of respiratory protection is not an accepted means of controlling the generated airborne hazard. The DSS Latent Print Unit dual beam laser utilizes a diffused beam and is not manufactured for industrial cutting or etching purposes, therefore this hazard is not present.

D. UV, Visible-Radiation and Plasma Emissions – Evaluations for the discharge of radiation, both visible and UV; and, plasma formation must be completed before the use of a class 3b or 4 laser. Identification of any of these conditions requires a review of the PPE used for skin protection to ensure adequate safety coverage. Additionally, laser and laser system components must be periodically surveyed for damage from these conditions. The DSS Latent Print Unit dual beam laser emits in the visible color spectrum at 445nm and 532nm respectively and therefore this hazard is not present. However the DSS Latent Print Unit dual beam laser will be visually inspected on an annual basis for signs of damage or wear.

6.6 Laser Safety Training

All users must successfully complete Laser Safety Training before using a class 3b or 4 laser or laser system. Refresher training shall be mandatory on a yearly basis.

6.7 Laser Safety Review &Survey

A laser safety review and survey shall be completed annually for all class 3b and 4 laser and laser systems by the LSO. The results of the safety review and survey shall be maintained by the LSO.

The following posting and security checks will be completed:

Safety Program Review:

a. Review Safety Program to determine if is meets OSHA laser safety guidelines.

Label and Security:

a. Are entrances properly posted?
b. Is room security adequate?
c. Is there a laser status indicator outside of room?
d. Is laser class posted?
e. Is Danger Class 4 Laser In Use Placard Posted?

Laser Unit Safety Controls:

f. Is protective housing secure?
g. Is beam shutoff (enable switch) working properly?
h. Is beam indicator working properly?

Engineering Safety Controls

i. It there an entry way interlock switch installed to terminate the laser beam?
j. Is there a visual or audio warning when laser is active?
k. Are reflective materials removed from beam path?
l. Are appropriate goggles available both in and outside of the controlled area?
m. Does the laser unit show any signs of wear or damage that would require servicing?

6.8. Medical Surveillance and Laser Accidents

a. In the event of any accidents or incidents involving a class 3b or 4 laser, the user shall immediately notify their supervisor/lead. The supervisor lead shall notify the Deputy Director of Identification Services and the Safety Officer.
b. The injured employee shall receive immediate medical attention.