



Office of the Director of Police
The University of Texas System
TRAINING BULLETIN 030
Laser Pointer Hazards
September 1, 2021



I. PURPOSE

To provide safety information regarding the hazards associated with laser products used to target law enforcement.

II. DEFINITIONS

Laser - a device that emits light amplified by the stimulated emission of radiation.

Laser pointer – a low-power laser that emits visible light for the purpose of directing attention to a location. Generally small, battery operated, and limited to Class 1, 2, or 3R, and emit 5mW or less.

Handheld or Portable Laser – similar to a laser pointer but are Class 3B or 4 lasers, > 5mW, and intrinsically dangerous to the eye.

Class 1 lasers - usually safe under all conditions of normal use with power that does not exceed 5 milliwatts. This means the maximum permissible exposure cannot be exceeded when viewing a laser with the naked eye.

Class II lasers - output power may be up to 1 milliwatt. This class includes only lasers that emit visible light. The blink reflex of the human eye will prevent eye damage unless the person deliberately stares into the beam for an extended period.

Class 3R lasers – Lasers over the Class 2 limit of 1mW visible light emission, but not over 5mW. Blink reflex or a version response protects in most cases. Injury is possible but very unlikely without deliberate staring.

Class 3B lasers - Intrinsically hazardous to the eye. They can heat skin and materials but are not considered a burn hazard. For visible-light lasers, Class 3B laser output power is between 5 and 499 milliwatts.

Class 4 lasers - the highest and most dangerous class of laser. A class 4 laser of 500 + milliwatts can burn the skin or cause devastating and permanent eye damage as the result of direct, diffused or indirect beam viewing.

Infrared lasers - have wavelengths longer than those of visible light and therefore are generally invisible to the human eye at any power.

Watt (W) - unit of power or energy production rate.

Milliwatt (mW) - one thousandth of a watt.

Meter (m) - unit of length.

Millimeter (mm) - one thousand of a meter.

Micrometer or Micron (um) - one millionth of a meter.

Nanometer (nm) - one billionth of a meter.

Wavelength - distance between signal oscillations. Electromagnetic radiation for lasers consists of wavelengths between 180nm and 1000 um. The visible light region consists of radiation with wavelengths between 400nm and 700 nm. The infrared region of the spectrum consists of radiation with wavelengths between 700 nm and 1 mm.

III. DISCUSSION

Class 3B and Class 4 Lasers products are typically used by the criminal element during riots and other unlawful activity to target law enforcement and pose a significant hazard for direct damage to the eye. The exact severity of damage will be due to many factors: beam power, exposure time, beam movement relative to the eyes, distance from the laser, retinal injury location, and a person's physiological/genetic susceptibility to eye injury.

The United States Food and Drug Administration (FDA) regulates and classifies lasers based on their potential for causing injury, especially eye damage, since the eye is most susceptible to excessive laser light. There are five main classes for lasers: Class 1, Class 2, Class 3R (formerly 3a), Class 3B and Class 4. (the FDA uses roman numerals). The first three classes are relatively safe for eye exposure; the last two are hazardous and can damage photoreceptor cells in your retina. There are also non-visible beam Infrared (IR) Lasers that also could be hazardous depending on the beam wavelength and power.

Safety standards are based on a person's ability to blink and/or turn away from a bright light within 1/4 second. Taking this into account, an accidental exposure to a 5 milliwatt or less beam is considered tolerable, as long as the person is not overriding their blink reflex. However, even blinking and moving may not prevent injury with an exposure above 5 milliwatts. At 150 milliwatts, the beam from a laser can be felt on the skin, depending on the beam focus, and at roughly 500 milliwatts, the laser's beam can be a skin burn hazard if the person is within a few meters of the laser.

In the event of a laser eye exposure it may not be immediately apparent that an eye injury has occurred. As with exposure to any bright light, there may be an "after-image" or ghosting effect in the exposed persons vision. If the after-image does not dissipate within a few minutes you can do a self-check of your vision at the first opportunity (see instructions for a vision self-check). If you continue to see an after-image or vision artifacts hours after the exposure, you may have an eye injury. The only way to determine the extent of an eye injury is a complete eye exam, which may include an Amsler grid test, retina images, and an Optical Coherence Tomography (OCT) scan. The after-image from a laser injury may continue to shrink over a few days.

For general use the FDA restricts laser pointers power to under 5 milliwatts, but if the laser is sold for purposes such as burning and cutting, there are no power restrictions. Lasers above 5 milliwatt (classes 3B and 4) are required to have proper labeling, an emission indicator, and an interlock with a key or pin that prevents emission if the pin/key is removed. Lasers above 5 milliwatt cannot be marketed as "laser pointers" or for purposes of surveying, alignment or pointing. Unfortunately, inexpensive class 4 lasers up to 10 watts that pose an extreme eye hazard can be readily purchased from internet providers and are the type of lasers that have been utilized to injure and blind law enforcement as described in the link below.

<https://burninglaserpointer.com/thanos-3000mw-high-power-blue-laser-best-3w-laser-for-burning-stuff.html>

According to the Food and Drug Administration, about 60 percent of lasers they tested in 2018 were over the power listed on the label or the label did not list a power level.

Look for a hazard label which may indicate the hazard class of the laser. Be wary of any laser that just reads Class 3 (III) and doesn't distinguish between Class 3a (IIIa) and Class 3b (IIIb). Below are some tips from the FDA on how to estimate the strength of an unlabeled handheld laser in the field:

- 1) If the laser is small and runs on button batteries, its output probably is less than 5 milliwatts.
- 2) If it is pen-sized and runs on AA or AAA batteries, it's likely to be more powerful and may exceed 5 milliwatts.
- 3) If it is flashlight-sized and runs on a cluster of AA or AAA batteries or runs on lithium batteries, it likely exceeds 5 milliwatts and may even be a Class 4 handheld laser.
- 4) Lasers sold with battery chargers probably drain their batteries quickly and are likely to be overpowered.
- 5) Some lasers are sold with a removable cap that spreads the beam into a pattern. If used without the cap, the beam becomes a single beam that could exceed 5 milliwatts.

IV. CRIMINAL STATUTES

Texas Penal Code §42.13 (2003) Use of Laser Pointers

(a) A person commits an offense if the person knowingly directs a light from a laser pointer at a uniformed safety officer, including a peace officer, security guard, firefighter, emergency medical service worker, or other uniformed municipal, state, or federal officer.

(b) In this section, "laser pointer" means a device that emits a visible light amplified by the stimulated emission of radiation.

(c) An offense under this section is a felony of the third degree if the conduct causes bodily injury to the officer: or is a felony of the first degree if the conduct causes serious bodily injury to the officer.

Texas Penal Code §42.14 (2007) Illumination of Aircraft by Intense Light

(a) A person commits an offense if:

(1) the person intentionally directs a light from a laser pointer or other light source at an aircraft; and

(2) the light has an intensity sufficient to impair the operator's ability to control the aircraft.

(b) It is an affirmative defense to prosecution under this section that the actor was using the light to send an emergency distress signal.

(c) An offense under this section is a Class C misdemeanor unless the intensity of the light impairs the operator's ability to control the aircraft, in which event the offense is a Class A misdemeanor.

(d) If conduct that constitutes an offense under this section also constitutes an offense under any other law, the actor may be prosecuted under this section or the other law.

(e) In this section, "laser pointer" has the meaning assigned by Section 42.13.

18 United State Code 39A - whoever knowingly aims the beam of a laser pointer at an aircraft in the special aircraft jurisdiction of the United States, or at the flight path of such an aircraft, shall be fined up to 250, 000. under this title or imprisoned not more than 5 years, or both.

University of Texas System Code of Conduct

Students involved in the malicious use of laser pointers are subject to the core UT System conduct and discipline policy (section 2.3 (c.) Health and Safety) as outlined in the link below. Individual UT Institutions have the flexibility for more specific prohibitions on laser pointers as their Institution sees fit.

<https://www.utsystem.edu/sites/default/files/documents/general-counsel-documents/2020/student-conduct-and-discipline/studentcodeconductmodelpolicyfinalrevisedjune2020.docx>

V. COUNTERMEASURES

The best defense to deliberate lasing is laser safety eyewear that meets the standard of protection required for the most prevalent laser pointers encountered. Green, Blue, and Violet seem to be the most prolific. The following protective eye wear have advertised specifications that University of Texas Radiation and Laser Safety Office believe will provide the best protection from most laser strikes while allowing an officer to still see well enough to perform their duties, however they have not been field tested by ODOP.

1. NOIR Laser Shield- <https://noirlaser.com/laser-pointer-hazard>
2. Revision- <https://www.revisionmilitary.com/en/eyewear/laser>
3. Laser Safety Eyewear- <https://www.lasersafety.com/eyewear/laserpointerprotection/>

VI. RESOURCES

University of Texas Austin Radiation and Laser Safety

United States Food and Drug Administration

Texas Penal Code

Federal Aviation Administration

United States Criminal Code

Los Angeles Sheriff's Department Laser Safety Video <https://youtu.be/2RrR0Tc1w90>

Texas Department of Public Safety

University of Texas System Office of General Counsel



Laser Exposure Self
Check card.pdf

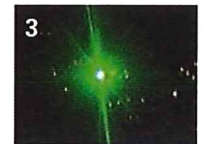
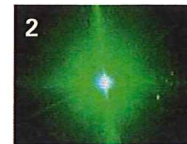
AVIATION LASER EXPOSURE SELF-ASSESSMENT (ALESA)



This self-assessment is designed to aid pilots, air-traffic controllers, or flight crew members who have been exposed to a laser beam in making a decision on whether or not to see an eye specialist.

The eye specialist may be either an optometrist or ophthalmologist. It is extremely unlikely that a laser beam exposure will result in permanent eye damage. Eye discomfort and irritation during the exposure is common and rubbing your eye can result in an abrasion that may be painful.

If you have experienced one or more of the following after a laser beam exposure please consult an eye specialist: Eye problems – swelling, pain, itching, watering, discharge, dryness or redness of the eye. Visual disturbance – blurring, black spot, trouble reading, loss of peripheral vision, floaters, halos, poor night vision, sensitivity to light. These symptoms may not appear until hours after the incident and may not be related directly to laser exposure but could reflect other eye issues perhaps not previously noticed.



1. Flash blindness

A visual impairment during and after exposure to a very bright light. It may last for seconds or minutes.

2. Glare

Difficulty seeing in the presence of a bright light.

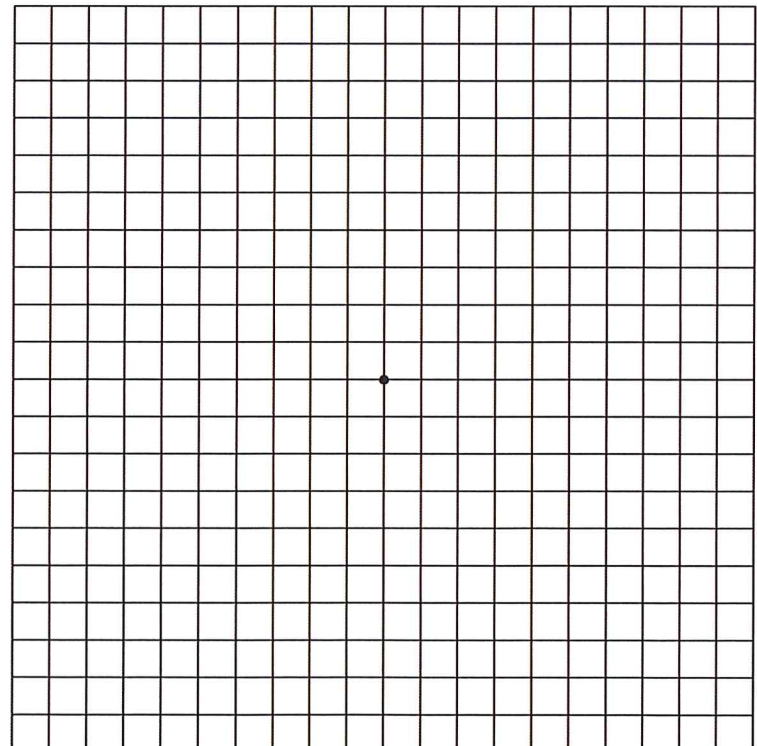
3. Distraction

A light bright enough to disrupt attention.

While viewing the grid from 30cm in front of your eyes, please test one eye at a time to answer the following questions:

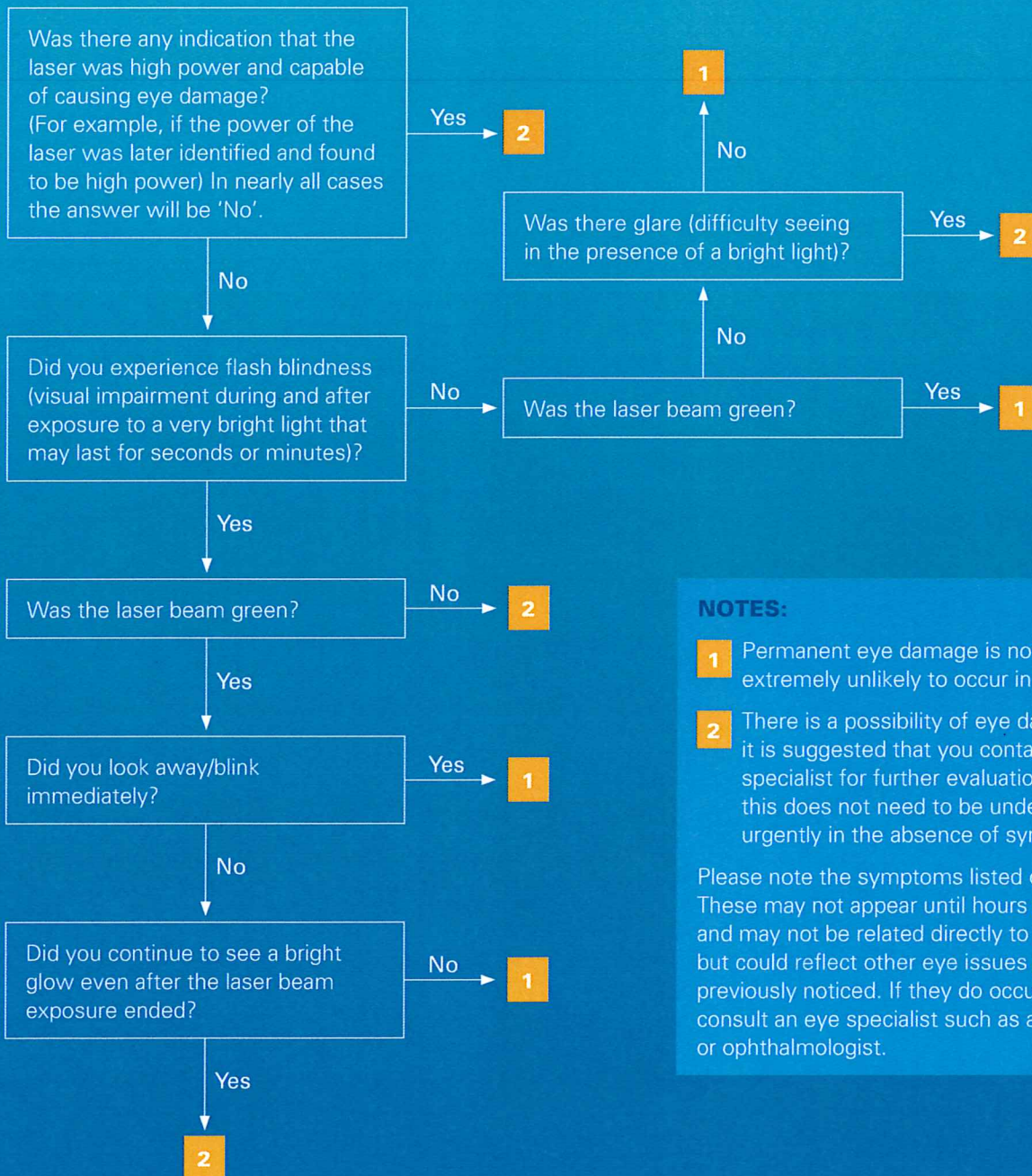
1. Can you see a dot in the centre of the grid?
2. While looking at the centre dot, can you see all four sides and corners of the grid?
3. While looking at the centre dot, do all of the lines appear straight with no distortions or blank or faded areas?

If you answered **YES** to all three questions then please turn to page 2. If you answered **NO** to any of the above questions then you may wish to remove yourself from flying or controlling duties as soon as it is safe to do so and consult an eye specialist.



The dimensions of the grid should be 10cm x 10cm.

In some circumstances it may be possible to have retinal damage without obvious symptoms. The relevance of this is uncertain in the absence of abnormal visual signs (e.g. answering “yes” to all three Amsler Grid questions on page 1) as it is unlikely to have an operational impact or be amenable to treatment. The following is designed to aid a pilot or ATCO in deciding whether or not an assessment should be sought with an optometrist or ophthalmologist after an exposure.



NOTES:

- 1** Permanent eye damage is not known or is extremely unlikely to occur in this situation.
- 2** There is a possibility of eye damage and it is suggested that you contact an eye specialist for further evaluation although this does not need to be undertaken urgently in the absence of symptoms.

Please note the symptoms listed on page one. These may not appear until hours after exposure and may not be related directly to laser exposure but could reflect other eye issues perhaps not previously noticed. If they do occur then please consult an eye specialist such as an optometrist or ophthalmologist.