Visible Wavelength Handheld Laser Pointers

FACT SHEET 24-031-0617

Introduction

Recent technological advances have made visible-wavelength laser pointers at lower cost, and higher power, since first introduced in the early 1980s. The purpose of this fact sheet is to provide information on the hazards and effects of visible-wavelength laser pointers.

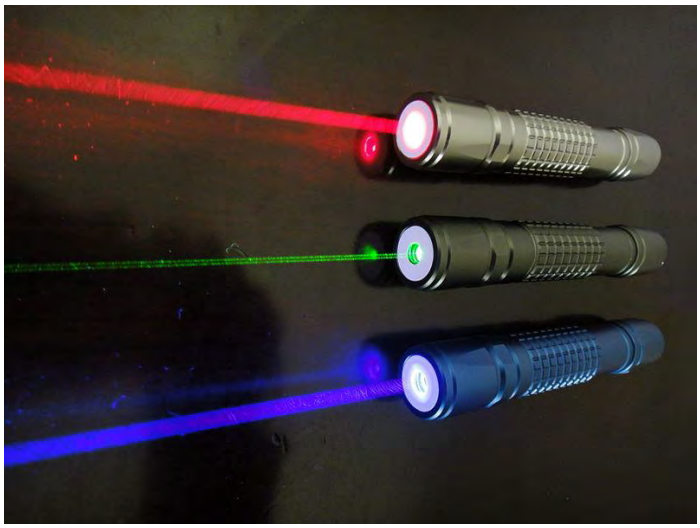

Figure 1: Common Laser Pointers

How are lasers classified and labeled?

Visible wavelength lasers come in several different classes. In order of increasing hazard, they include Class 1, 2, 3R, 3B, and 4. Any visible wavelength laser that is classified 3B or 4 is not recommended as a laser pointer. Class 3R visible-wavelength lasers have an output power less than five milliwatts; anything over this is either a class 3B or 4.

What are the hazards associated with each class?

Only Class 1 lasers are not hazardous. Class 2 and 3R lasers may cause an eye injury; however, our natural reaction to avert our eyes from bright lights normally protects us from injury.

This cannot be said of Class 3B or 4 lasers, which can cause serious permanent damage before a person can even blink their eyes.

How can I safely use a laser pointer?

With any product the potential for injury depends on the product itself and how the product is being used. As the name implies, the intended use for a laser pointer is to direct attention to something. As long as the operator uses the product as it was intended, even a momentary Class 3R laser exposure possesses little risk of injury. One of the best laser safety practices is to never point a laser at anyone.

Are some laser colors brighter than others?

The wavelength (measured in nanometers (nm)) of the light defines the color that we perceive. The most common laser pointers are red (630 nm-670 nm), green (520 nm and 532 nm) and violet (405 nm and 445 nm). Our eyes are most sensitive to green light. Thus a green laser will appear brighter than a red or violet laser, even though the power output is the same.

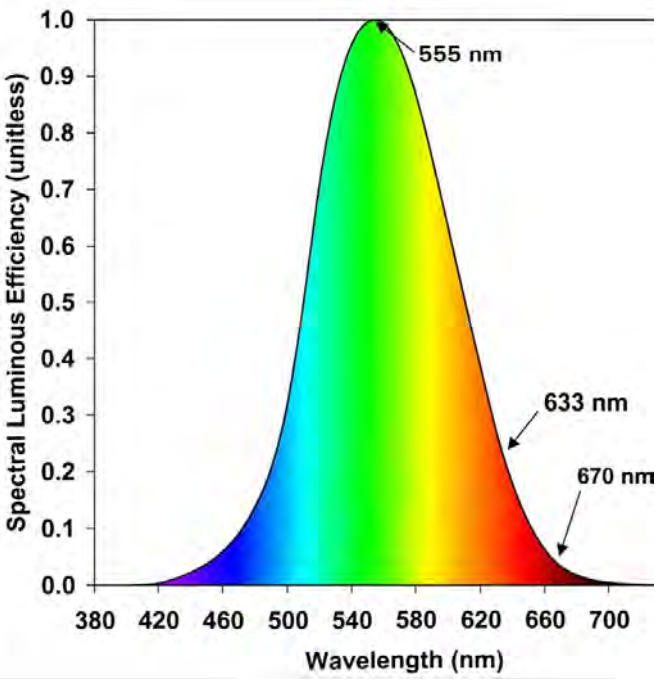

Figure 2: This graph shows how a human eye responds to the different wavelengths (colors) of light.

Army Public Health Center, Nonionizing Radiation Division (NRD)
5158 Blackhawk Road, Attn: MCHB-PH-NIR
Aberdeen Proving Ground, MD 21010-5403
DSN 584-3932 or Commercial (410) 436-3932
https://usaphc.amedd.army.mil/organization/hq/dohs/Pages/Nonionizing.aspx

What are some additional concerns regarding laser classification and hazards?

Most 3R laser pointers manufactured outside the United States are actually 3B lasers. In a 2013 study by the National Institute of Standards and Technology (NIST), researchers randomly selected and tested 122 commercial lasers from outside the U.S. They found that 90 percent of green pointers were out of compliance with federal safety regulations, which require all commercial laser pointers to be no greater than 3R.

Additionally, some of these lasers improperly produce unintended wavelengths. These additional wavelengths are often outside of the wavelengths that our eyes can detect and could potentially be hazardous to our vision.

Purchasing a laser that is manufactured in the U.S. is a good way to ensure that the laser is correctly classified because of the strict regulations on laser manufacturing implemented by the U.S. Food and Drug Administration.

Are there penalties for improper use of a laser pointer?

In the United States, it is legal to own a laser at any power. However, there are illegal actions that one can do with lasers.

Figure 3: Photo provided by the FBI shows the effects of a laser pointer has when aimed at an aircraft cockpit.

Never point a laser at an aircraft. Public Law 112-95-Feb. 2012 Sec. 311 prohibits anyone in the United States from knowingly aiming a laser beam (of any classification) at an aircraft. The perpetrator shall be fined up to $250,000 and imprisoned up to 5 years.

Additional legal restrictions on lasers vary from state to state. In some states it is illegal to shine a laser pointer at the operator of a motor vehicle. In some states it is illegal for minors to possess laser pointers. It is important and prudent to keep laser pointers away from children and educate them about the dangers associated with them.

What are the possible visual effects from a laser pointer?

Our blink reflex makes permanent retinal damage from laser pointers highly unlikely. Nevertheless, these lasers can still cause afterimages, flash blindness, glare, dazzle and/or startle.

- **Afterimage.** A transient image that persists in one's vision after a bright source of illumination has been removed.
- **Flashblindness.** A visual interference effect that persists as an afterimage after an intense source of illumination has been removed.
- **Glare.** Obscuration of an object in a person's field of vision due to a bright light source located near the same line-of-sight.
- **Dazzle.** A temporary loss of clear vision from looking at a bright light source.
- **Startle.** An involuntary movement or reaction resulting from a sudden or unexpected stimulus, such as a bright light abruptly appearing in one's field of view.

Further Information

For further information about laser pointers contact the Nonionizing Radiation Division at 410-436-3932. If you have any doubt that the classification of your handheld DOD laser pointer is correct we can perform an evaluation for you.

References

- *ANSI Z136.6 American National Standard for Safe Use of Lasers Outdoors*. Orlando, FL: Laser Inst. of America, 2005.
- Hadler, Joshua, Edna Tobares, and Marla Dowell. "Random testing reveals excessive power in commercial laser pointers." *Journal of Laser Applications* 25, no. 3 (May 01, 2013). doi:10.2351/1.4798455.
- Public Law 112-95, Sec. 311, FAA Modernization and Reform Act of 2012, Feb. 2012.