Proposed Laser Safety Facts label

Patrick Murphy
Editor, LaserPointerSafety.com
Problems with consumer misuse of visible lasers

- Almost 4,000 reports of lasers aimed at aircraft in the U.S. in 2013

- Increasing reports of consumer injuries from lasers
  - 14 persons in Saudi Arabia (2 of them children)
  - 9-year-old injured in both eyes by his uncle
  - Five children injured in U.K.
Solution must be multi-faceted
About 10 times a night, U.S. pilots report seeing or being illuminated by laser beams. The primary hazard is temporary interference with vision – distraction, glare, flashblindness – during critical phases of flight such as takeoff and landing.

Some ways to help reduce the number and severity of laser pointer/aircraft incidents

Pilot training & glasses
Pilots are the last line of defense
- Provide information on safely reacting to laser illuminations
- Mandatory simulator training with safe bright light
- Cockpit-certified laser blocking glasses for 1st responder pilots
  (Note: Anti-laser glasses are NOT recommended for routine use)

Arrests & prosecution
- Fines and jail for anyone intentionally aiming at aircraft
- News reports of arrests & prosecutions let users know the hazard is serious

Laser labeling
- Manufacturers voluntarily add aircraft safety labels
- Government can write new laws mandating labels

User education
- Educating users via laser sellers’ websites, manuals
- Media coverage of hazards, prohibitions

If the above does not work, **new laws & restrictions** may be necessary

**Limited restrictions**
- Import restrictions to try to keep out illegal lasers
- At locations where misuse is high (beach resorts)
- By age (no public possession by youth, teens)

**General restrictions or ban**
- Nationwide - consider restricting sale and/or possession of consumer handheld lasers above a specified power level
- Exemptions/licenses for legitimate use

Note: Restrictions may not be effective. Australia banned pointers over 1 milliwatt in 2008, yet aircraft incidents rose 27% from 2008 to 2011. A 2013 scientific study concluded that the ban “may have detrimentally affected laser pointer safety within Australia without overtly impacting availability.”

Source: LaserPointerSafety.com
Looking today at laser labeling

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Source: LaserPointerSafety.com
Problems with current labels

- Designed for experts, back when lasers were expensive and bulky
- What does this IEC label mean to consumers?

- What is “Laser 2”? What are the hazards?
Problems with current labels (2)

- What do these labels mean to consumers?

- What is “Laser 4” or “Class IV”?

- What is “direct or scattered radiation”? Do you mean “Don’t look into the light beam, or at the bright dot”??
Problems with current labels (3)

- No warning against aiming at aircraft
  - No indication this is hazardous to pilots
  - No indication this is illegal — the user may be arrested or jailed
Advantages to improved labeling

- Give more information to consumers
  - More hazards, and more specifics on hazards
- Help reduce the number of laser/aircraft incidents
- Make laser/aircraft convictions easier
  - If the user has been specifically warned not to aim at aircraft
Look to current labels for guidance
Current federally-mandated labels

EnergyGuide (FTC/EPA)
Current federally-mandated labels

Nutrition Facts (FDA)
Current federally-mandated labels

**Over-the-Counter Drug Facts**

(FDA)
Current federally-mandated labels

Lighting Facts (FTC and DOE)
Note: They all use specific numbers
Note: They all use specific numbers

![Nutrition Facts](image)

- **Calories:** 250 calories
- **Total Fat:** 12g (18%)
  - Saturated Fat: 3g (15%)
  - Trans Fat: 3g
- **Cholesterol:** 30mg (10%)
- **Sodium:** 470mg (20%)
- **Total Carbohydrate:** 31g (10%)
  - Dietary Fiber: 0g (0%)
  - Sugars: 5g
- **Protein:** 5g
- **Vitamin A:** 4%
- **Vitamin C:** 2%
- **Calcium:** 20%
- **Iron:** 4%

*Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs.*

<table>
<thead>
<tr>
<th>Calories</th>
<th>2,000</th>
<th>2,500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fat</td>
<td>Less than 65g</td>
<td>80g</td>
</tr>
<tr>
<td>Sat Fat</td>
<td>Less than 20g</td>
<td>25g</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>Less than 300mg</td>
<td>300mg</td>
</tr>
<tr>
<td>Sodium</td>
<td>Less than 2,400mg</td>
<td>2,400mg</td>
</tr>
<tr>
<td>Total Carbohydrate</td>
<td>300g</td>
<td>375g</td>
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</table>
Note: They all use specific numbers
Note: They all use specific numbers

<table>
<thead>
<tr>
<th>Light Output (Lumens)</th>
<th>345</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watts</td>
<td>8</td>
</tr>
<tr>
<td>Lumens per Watt (Efficacy)</td>
<td>46</td>
</tr>
<tr>
<td>Color Accuracy</td>
<td>64</td>
</tr>
</tbody>
</table>

Color Accuracy
Color Rendering Index (CRI)

<table>
<thead>
<tr>
<th>Light Color</th>
<th>Correlated Color Temperature (CCT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm White</td>
<td>2600K 3200K 4500K 6500K</td>
</tr>
<tr>
<td>Bright White</td>
<td>3054 (Warm White)</td>
</tr>
<tr>
<td>Daylight</td>
<td></td>
</tr>
</tbody>
</table>

All results are according to IESNA LM-79-2006: Approved Method for the Electrical and Photometric Testing of Solid-State Lighting.
The proposed Laser Safety Facts label
Laser Safety Facts label

Currently intended for consumer pointers, handhelds, and projectors that emit visible laser beams
Legally required safety label

**Diode Laser**

Max. output power: < 1 milliwatt  
Wavelength: 400-700 nanometers (visible light)  
Min. divergence: 0.5 milliradian  
Output: Continuous (CW)  
Laser hazard classification: Class 2

**Laser Safety Facts**

**Laser hazards**

Eye injury from beam  
Do not look into the direct or reflected beam; can cause eye injury up to 50 ft (15 m) away.

Visual interference (glare) with pilots and drivers  
Interferes with vision up to 1050 ft (320 m) away. Can be a distraction up to 2 miles (3.2 km) away. NEVER point any laser towards aircraft or vehicles; it is unsafe and illegal.

**Safe use guidance**

Class 2 lasers are considered safe for accidental eye exposure.  
Do not look or stare into beam. Do not aim at aircraft. This is not a toy. Always supervise children.

**Additional safety information online**

Scan the QR code above, or visit LaserSafety.info/2

**Manufacturer:** [Insert manufacturer name, address, country of origin or import, contact info such as website or phone number; optional UL or similar listing. Text font is Franklin Gothic Book; boldface is Franklin Gothic Demi.]
Legally required safety label

Can use any legally valid graphic format
Legally required safety label

Can use any legally valid graphic format
**Legally required safety label**

**Laser parameters**
(includes minimum divergence)
Legally required safety label

Laser parameters
(includes minimum divergence)

Title, and QR code for website

Laser Safety Facts

Laser hazards
- Eye injury from beam
- Visual interference (glare) with pilots and drivers

Safe use guidance
- Class 2 lasers are considered safe for accidental eye exposure.
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Laser parameters
(includes minimum divergence)

Laser hazards

Legally required safety label
Legally required safety label

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Title, and QR code for website

Laser hazards

Safe use guidance
Legally required safety label

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Title, and QR code for website

Laser hazards

Safe use guidance

Where to find additional info

**Diode Laser**

Max. output power: ≤ 1 milliwatt
Wavelength: 400-700 nanometers (visible light)
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Manufacturer: [Insert manufacturer name, address, country of origin or import, contact info such as website or phone number; optional UL or similar listing. Text font is Franklin Gothic Book; boldface is Franklin Gothic Demi.]
Intended for use on:

- Large lasers such as laser show projectors
- Outer packaging or hang tag
- User manual
- Marketing brochures, websites, etc.
Note: Uses specific numbers

CLASS 2 LASER PRODUCT

Diode Laser
Max. output power: < 1 milliwatt
Wavelength: 400-700 nanometers (visible light)
Min. divergence: 0.5 milliradian
Output: Continuous (CW)
Laser hazard classification: Class 2

Laser Safety Facts

Laser hazards
Eye Injury from beam:
Do not look into the direct or reflected beam; can cause eye injury up to 50 ft (15 m) away.

Visual Interference (glares) with pilots and drivers
Interferes with vision up to 1050 ft (320 m) away. Can be a distraction up to 2 miles (3.2 km) away. **NEVER point any laser towards aircraft or vehicles; it is unsafe and illegal.**

Safe use guidance
Class 2 lasers are considered safe for accidental eye exposure. Do not look or stare into beam. Do not aim at aircraft. **This is not a toy.** Always supervise children.

Additional safety information online
Scan the QR code above, or visit LaserSafety.info/2
Labels for smaller lasers
For smaller lasers

- Can use existing labels, plus...
  - Add the URL web address (LaserSafety.info)
  - If there is room, add a QR or Data Matrix barcode
  - For outdoor lasers, add a warning against aiming at aircraft
Examples

- For laser pointers and portable handheld lasers
- Contains aircraft warnings
Examples

- For non-outdoor, non-portable lasers
- Does NOT contain aircraft warnings
The QR code
QR code = website address

= LSF.ME/2

This automatically redirects to LaserSafetyFacts.com/2, a web page about Class 2 laser hazards
Use a smartphone or tablet to scan...
...and automatically be taken to a web page
The QR code

- Takes the user to a website page with more detailed safety information
- Can also get there by typing a human-readable URL such as LaserSafety.info/2
Why a website page?

- Contains additional hazard information, diagrams
- Uniform consistency for all lasers
- Easy to update as needed
- Solves the problem of lost user manuals
- Can contain links to sites such as FDA
Problem:
No space on small lasers
QR codes cannot be read if too curved

- This cannot be scanned if more than 1/3 the cylinder diameter
To help with small lasers...

- Uses a different encoding called Data Matrix or DM
  - Rectangular format
- Helps solve problem of distorted QM codes on cylinders

Data Matrix code for LSF.ME/3R
QR and DM codes, and where they redirect
LSF.ME/2

These automatically redirect to LaserSafetyFacts.com/2, a web page about Class 2 laser hazards
LSF.ME/3R

These automatically redirect to LaserSafetyFacts.com/3R, a web page about Class 3R laser hazards
These automatically redirect to LaserSafetyFacts.com/3B, a web page about Class 3B laser hazards.
These automatically redirect to LaserSafetyFacts.com/4, a web page about Class 4 laser hazards.
The webpage:
“An LSO course for this laser”
Class 4 laser safety information

WHAT IS A CLASS 4 LASER?

Class 4 lasers are hazardous for eye exposure. They can burn skin and materials, especially dark and/or lightweight surfaces at close range. They should be used with extreme care.

For visible-light lasers, Class 4 lasers' have an output power 500 milliwatts and above. There is no upper limit for Class 4 -- this is the most hazardous laser classification.
SAFE USE GUIDANCE - GENERAL

Class 4 visible-beam lasers are high powered. A Class 4 laser can cause a significant eye injury if the direct or reflected beam enters the eye.

Even looking at the diffuse reflection of a laser "dot" from a Class 4 beam, for too many seconds, may cause an eye injury. **Do not stare at the laser dot on a wall or other surface.**

A Class 4 laser can be a distraction, glare or flashblindness hazard for pilots and drivers. It may also be a potential eye injury hazard for low- and/or slow-flying pilots. **NEVER aim any laser towards an aircraft or vehicle.**

ONLY FOR USE BY RESPONSIBLE PERSONS
This is not a toy. Children should never be permitted to use Class 4 lasers. **Any teenager using a Class 4 laser should be continuously supervised by a responsible adult.** A number of teenagers have caused eye injuries to themselves or others by misusing Class 3B and Class 4 lasers.

DO NOT USE AS A LASER POINTER
Class 4 lasers are too powerful to be used as pointers. Some Class 4 lasers may look like pointers, but these should **not** be used for pointing purposes. If a Class 4 laser is used for other purposes such as popping balloons, burning objects, etc., use it with care.
CLASS 4 LASER HAZARDS

INJURY TO PERSONS & ANIMALS (PETS)

EYE INJURY HAZARD -- DIRECT AND REFLECTED BEAM
Class 4 visible-light lasers are significantly hazardous for eye exposure. A person cannot turn away or blink fast enough to prevent eye injury from a Class 4 laser.

Prevent all eye exposure to beams from Class 4 lasers. This includes accidental exposures -- be careful to keep the beam away from eyes and faces.

Also, remember that reflections off mirrors, glass, and shiny surfaces can be just as hazardous as the direct beam. Avoid reflected Class 4 beams.

The Nominal Ocular Hazard Distance (NOHD) for a 1000 milliwatt (1 Watt) visible-beam laser with 1 milliradian divergence is 740 ft (225 m). The NOHD for a 10 Watt laser is 2300 ft (710 m).

If you are closer than the NOHD to the laser, there is a possibility of retinal damage if the direct or reflected beam enters your eye. The closer you are to the laser and the longer the beam is in the eye, the greater the chance of injury.

Because there is no upper limit for Class 4 lasers, it is possible for the NOHD to be a mile or more, although this is unlikely for consumer-grade handheld laser products.
EYE INJURY HAZARD - DIFFUSE REFLECTION
The scattered light from the laser "dot" as viewed on a surface, can be an eye hazard. Avoid looking directly at the laser dot for more than a few seconds. The light is too bright if you see a sustained afterimage, lasting more than about 10 seconds.

The more powerful the laser, and the closer your eye is to the laser dot, the greater the chance of injury. This can occur during certain actions, such as aligning the beam or trying to hold the laser dot on a fixed location in order to burn a material.

- Looking at the laser dot from a 1,000 milliwatt (1 Watt) Class 4 blue (445 nm) laser beam for more than 1 minute is an eye hazard within 1.5 ft (44 cm) of the laser.
- Looking at the laser dot from a 10,000 milliwatt (10 Watt) Class 4 blue (445 nm) laser beam for more than 1 minute is an eye hazard within 4.5 ft (1.4 m) of the laser. Even just for 10 seconds, viewing the laser dot is a hazard within 1.8 ft (0.6 m).

If you must look at the laser dot for relatively long periods of time within the hazard distances, use laser protective eyewear as discussed elsewhere on this page.
SKIN INJURY (BURNS)

A Class 4 laser beam can burn skin and some materials. The more powerful the laser, the faster the burn will occur. In some cases, the burn may be almost instantaneous.

- A 1000 milliwatt (1 Watt) Class 4 laser beam is a skin injury hazard within 39 in (1 meter) of the laser.

Avoid skin exposure to a Class 4 laser beam, especially at close range. A skin burn can be very painful, can take long to heal, and can leave a permanent scar.

MATERIALS DAMAGE AND BURNING

A Class 4 laser beam can cause materials to smolder or burn, especially at close range. Keep the beam moving to avoid burning materials at close range. Dark materials which absorb heat, and lightweight materials such as paper and fabric, are most easily burned by visible laser beams.

- A 1000 milliwatt (1 Watt) Class 4 laser beam is considered a burn hazard within 26 inches (67 cm) of the laser.
AIRCRAFT AND VEHICLE SAFETY

LASERS CAN INTERFERE WITH PILOTS, DRIVERS
NEVER aim any laser towards an aircraft or vehicle that is in motion. The bright light can flashblind, cause glare, or distract the pilot or driver.

- A 1000 mW (1 Watt) Class 4 laser beam can temporarily flashblind a pilot or driver, causing afterimages, within 0.7 miles (1.1 km) of the laser.
- It can cause glare, blocking a pilot or driver's vision, within 3.1 miles (5 km) of the laser.
- It can cause distraction, being brighter than surrounding lights, within 31 miles (50 km) of the laser.

The above calculations are for a 555 nanometer green laser with 1 milliradian divergence. This gives the longest (most hazardous) visual interference distances. For other colors such as red and blue pointers, the visual interference distances would be less. For red, divide the distance by about 5 to get an approximation. For blue, divide the distance by about 20.

Never aim a laser at or near an aircraft, no matter what its color or power.
LASING AIRCRAFT AND VEHICLES IS ILLEGAL
In the U.S., aiming a laser at or near the flight path of an aircraft is a federal felony, punishable by up to 5 years in jail and a fine of up to $250,000. Other countries, and U.S. states have similar laws for interfering with safety, that may also be used to arrest, fine or imprison a person for aiming at aircraft and vehicles.

The power of the laser does not matter. Aiming ANY laser at an aircraft or vehicle is illegal. Persons misusing Class 3B and 4 lasers are especially likely to be caught because the beam is very visible from the air. It is easy for police aircraft to trace the beam back to the perpetrator's location.

See this page for a selected list of the many persons who have been jailed and/or fined for aiming lasers at aircraft.
SAFE USE GUIDANCE - LASER PROTECTIVE EYEWEAR (GLASSES)

Laser glasses or goggles should be used when working with Class 4 lasers, especially at close range (within a few yards or meters). They should be selected to protect against the laser's power and wavelength.

The eyewear should not block out all of the laser's light. This is because it is necessary to see where the laser "dot" is, to safely work with the laser. Because the eyewear is blocking some or perhaps all of the laser's light (for example, a hazardous reflection) you still should use caution even when using laser protective eyewear.

As you are using the laser, any other persons in the area should also have the same type of laser protective eyewear as you.

DO NOT USE SUNGLASSES FOR LASER PROTECTION
Sunglasses are NOT laser protective eyewear. They are not rated (e.g., with Optical Density) to ensure light-attenuating protection. Most will not block enough laser light to significantly reduce hazardous exposures.
SAFE USE GUIDANCE - LASER PROJECTORS

If this laser product is a projector for displays or laser shows, please be aware of the following:

NOT INTENDED FOR AUDIENCE SCANNING
Scanning the laser beam, by moving it quickly in various patterns such as lines or circles, does NOT significantly reduce hazards.

Do not aim this laser projector directly at any person or audience area. Deliberate scanning onto an audience with a Class 3B or 4 laser is inherently hazardous.

Because the labels on consumer lasers may give incorrect information -- the wrong Class or the wrong power -- do NOT rely on the label for any safety-critical calculations. Any laser aimed into an audience-accessible area must be measured with appropriate equipment by a qualified Laser Safety Officer. The LSO will determine the laser's Nominal Ocular Hazard Distance. The audience must be further than this distance. The LSO will also determine any other safety measures to be taken; for example, continuous supervision of the area, emergency stop buttons, etc.

In addition, in the U.S. and many countries and venues, special permission is required before ANY human access to Class 3B or 4 laser beams is allowed -- even if the audience is further than the NOHD. For example, the U.S. FDA requires submission and FDA approval of an audience scanning variance.
U.S. REGULATORY INFORMATION
Lasers used for demonstrations, shows, displays and entertainment are highly regulated in the U.S. Both the laser projection device and the way in which it is used (the laser show) must be certified to the Food and Drug Administration. This is for ANY laser show even if the laser beam is kept away from audience areas. Generally, shows in a private home with friends and family are not covered but all other demonstrations, shows, displays, etc. done with a Class 3B or 4 laser would require the user to submit a variance, and get FDA approval before the show can proceed.

Do not perform any public demonstration, show, display or entertainment with this laser projector, without having a variance from FDA. More information is at [link goes here].

In addition to federal laws, some states and jurisdictions also regulate laser equipment and/or usage. More information is at [link goes here].

U.K. REGULATORY INFORMATION
At the national level, laser show safety advice is given by Public Health England, formerly the Health Protection Agency. On their website they give the following guidance (as of Feb. 1 2014):

The NRPB, now the Radiation Protection Division of the Health Protection Agency, has undertaken considerable research into the use of lasers in the entertainment industry. Some situations have given cause for concern, mainly because the potential or actual exposure of people, including the audience, has not been properly assessed. The use of lasers may be covered by conditions on the premises under the Licensing Act, which is enforced by the local council (district, unitary or other authority). HPA advice to such councils is that a risk assessment should be carried out to demonstrate that people are not exposed to unacceptable risks. Assessment of laser display effects used for intentionally scanning the audience is time-consuming and complex. HPA experience is that such assessments are rarely satisfactorily undertaken and the practice should not routinely take place.

COUNTRIES OTHER THAN THE U.S. AND U.K.
Many other countries and jurisdictions have regulations regarding laser show and display usage. Venues such as concert halls may have their own requirements.

Contact all appropriate authorities to ensure your laser show meets venue and government requirements.
Three types of QR codes
Class code

- Goes to pages for Class 2, 3R, 3B or 4 lasers

LSE.ME/2

- These are generic pages for any laser of this class
Freeform Parameter code

- Use to encode any laser. Example:

  ![QR Code](LSF.ME/PR_635-900-532-700-445-500_15_CW_4)

- Decoded by the webpage; gives specific hazard distances for that particular laser
Shortener code

- 5-characters; goes to a specific Freeform Parameter page

Left: LSF.ME/34567

- Used so that the QR code “dots” can be larger and easier to scan
Making it easy to provide laser safety information on product websites
Standard icon for webpages

- Put on a product’s webpage, to lead to the complete safety information for that laser
- Goes to the appropriate LaserSafetyFacts.com page
Sample website usage

The new Arctic is more intense than ever before, with over 2,000mW of fully variable power, all-new modes, and a laser power indicator. Prepare to witness what the next generation of ultimate laser technology can do.

Choose a Laser Color:

- **700mW+**

$299.95

Add Expanded Lens Kit

Add to Cart
Additional features at LaserSafetyFacts.com
Other features of the website

- General overview of laser classes and corresponding hazards
Eye injury hazard

<table>
<thead>
<tr>
<th>Class</th>
<th>Power, milliwatts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 2</td>
<td>0-1 mW</td>
</tr>
<tr>
<td>Class 3R</td>
<td>1-5 mW</td>
</tr>
<tr>
<td>Class 3B</td>
<td>5 - 500 mW</td>
</tr>
<tr>
<td>Class 4</td>
<td>500 mW+</td>
</tr>
</tbody>
</table>

*Eye injury hazard descriptions above are valid for exposures relatively close to the laser. Because the beam spreads, less light will enter the pupil at greater distances. The hazard decreases the farther a person is from the laser, and the shorter the exposure time (e.g., do not deliberately look or stare into the beam). For example, a 1mW Class 2 laser beam is eye safe for unintentional exposures after about 2 ft (7 m), a 5mW Class 3R beam is eye safe after about 52 ft (16 m), a 500 mW Class 3B beam is eye safe after about 520 ft (160 m), and a 1500 mW Class 4 beam is eye safe after about 900 ft (275 m). (Calculations are for visible light, a 1 milliradian beam, and a 1/4 second Maximum Permissible Exposure limit.)
<table>
<thead>
<tr>
<th>ANSI and IEC laser classification</th>
<th>Class 1</th>
<th>Class 2</th>
<th>Class 3</th>
<th>Class 4</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sub-class</td>
<td>Class 1M</td>
<td>Class 2M</td>
<td>Class 3A</td>
<td>Class 3B</td>
<td></td>
</tr>
<tr>
<td>U.S. FDA laser classification</td>
<td>Class I</td>
<td>Class II</td>
<td>Class IIIa</td>
<td>Class IIIb</td>
<td></td>
</tr>
<tr>
<td>Human-accessible laser power</td>
<td>For visible light, emits beam less than 0.039 milliwatts, or beam of any power is inside device and is not accessible during operation. No special caution/warning indication</td>
<td>Emits visible beam of less than 1 milliwatt. No special caution/warning indication</td>
<td>For visible light, emits beam between 1 and 4.999 milliwatts.</td>
<td>For visible light, emits beam of 500 milliwatts (1/2 Watt) or more</td>
<td>Non-visible lasers emitting infrared or ultraviolet are now preferred over older FDA Roman numeral classes</td>
</tr>
<tr>
<td>Caution/warning indication</td>
<td>DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS</td>
<td>DO NOT STARE INTO BEAM</td>
<td>AVOID DIRECT EYE EXPOSURE</td>
<td>AVOID EXPOSURE TO DIRECT OR SCATTERED RADIATION</td>
<td>For visible-light lasers, the word &quot;light&quot; can be used instead of &quot;radiation&quot;. The latter is more accurate for lasers emitting infrared and ultraviolet radiation.</td>
</tr>
<tr>
<td>Label descriptive text</td>
<td></td>
<td></td>
<td>CAUTION</td>
<td>WARNING</td>
<td>DANGER</td>
</tr>
</tbody>
</table>

**EYE AND SKIN HAZARDS**

- **Eye hazard for intraocular exposure (having a direct or reflected beam enter the eye)**:
  - Class 1: Safe, even for long-term intentional viewing. For visible light, usually applies when the laser is enclosed inside a device (e.g., CD or DVD player) with no human access to laser light.
  - Class 2: May be hazardous if viewed with optical instruments such as binoculars or eye loupe.
  - Class 3: Unintentional or accidental exposure to direct or reflected beam has a low risk. Avoid intentional exposure to direct or reflected beam.
  - Class 4: Eye hazard; avoid exposure to direct or reflected beam.

- **Maximum or typical Nominal Ocular Hazard Distance** (for 1 milliradian beam, exposure time less than 1/4 second):
  - Class 1: NOHD of 0.99 mW beam: 23 ft (7 m)
  - Class 2: NOHD of 4.99 mW beam: 52 ft (16 m)
  - Class 3: NOHD of 499.9 mW beam: 520 ft (160 m)
  - Class 4: NOHD of 1000 mW (1 Watt) beam: 733 ft (224 m). NOHD of 10 W beam: 2320 ft (710 m)

  Avoid eye exposure to a direct or reflected laser beam, within the NOHD. The closer you are to the laser, the greater the chance of hazard and the more serious the injury potential.

- **Eye hazard for diffuse reflection exposure (looking at the laser "dot" scattered off a surface)**:
  - Class 1: Consult an LSO as described in the Technical Note below.
  - Class 2: Consult an LSO as described in the Technical Note below.
  - Class 3: Generally safe. Avoid staring at the laser "dot" on a surface for many seconds at close range. To avoid injury, do not stare at laser "dot" on a surface. The light is too bright if you see a sustained afterimage, lasting more than about 10 seconds.
  - Class 4: Consult an LSO as described in the Technical Note below.

- **Skin burn hazard**:
  - Class 1: None
  - Class 2: Consult an LSO.
  - Class 3: Consult an LSO.
  - Class 4: Consult an LSO.

- **Materials burn hazard**:
  - Class 1: None
  - Class 2: Consult an LSO.
  - Class 3: Consult an LSO.
  - Class 4: Consult an LSO.
Other features of the website

- Comparison of 6 labeling programs:
  - EnergyGuide,
  - Nutrition Facts,
  - OTC Drug Facts,
  - Lighting Facts (FTC),
  - Lighting Facts (DOE),
  - Laser Safety Facts
<table>
<thead>
<tr>
<th><strong>EnergyGuide</strong></th>
<th><strong>Nutrition Facts</strong></th>
<th><strong>Over-The-Counter Drug Facts</strong></th>
<th><strong>Lighting Facts (FTC)</strong></th>
<th><strong>Lighting Facts (DOE)</strong></th>
<th><strong>Laser Safety Facts</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="https://example.com/energyguide" alt="EnergyGuide" /></td>
<td><img src="https://example.com/nutritionfacts" alt="Nutrition Facts" /></td>
<td><img src="https://example.com/drugfacts" alt="Drug Facts" /></td>
<td><img src="https://example.com/lightingfacts-ftc" alt="Lighting Facts FTC" /></td>
<td><img src="https://example.com/lightingfacts-doe" alt="Lighting Facts DOE" /></td>
<td><img src="https://example.com/lasersafetyfacts" alt="Laser Safety Facts" /></td>
</tr>
<tr>
<td><strong>Sample label</strong></td>
<td><strong>Estimate Yearly Operating Cost</strong></td>
<td><strong>Drug Facts</strong></td>
<td><strong>Lighting Facts</strong></td>
<td><strong>Voluntary, intended for retail buyers, utilities, and lighting pros. Covers all LED lighting products</strong></td>
<td><strong>Proposal for standards bodies, FDA or other</strong></td>
</tr>
<tr>
<td><strong>Lead agency</strong></td>
<td><strong>Federal Trade Commission, based on Department of Energy test procedures</strong></td>
<td><strong>Food and Drug Administration</strong></td>
<td><strong>Federal Trade Commission</strong></td>
<td><strong>Department of Energy</strong></td>
<td><strong>2013/2014 (goal)</strong></td>
</tr>
<tr>
<td><strong>U.S. law or regulation</strong></td>
<td><strong>16 CFR 305</strong></td>
<td><strong>Nutrition Labeling and Education Act</strong></td>
<td><strong>21 CFR 101</strong></td>
<td><strong>16 CFR 305.2 and 305.3</strong></td>
<td><strong>Expected to incorporate labeling requirements of IEC and ANSI as applicable. Small changes may be made for readability or additional consumer information.</strong></td>
</tr>
<tr>
<td><strong>Interface with standards organizations such as ANSI</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong><a href="http://www.laserharmonization.org/labeling/isotag.html">http://www.laserharmonization.org/labeling/isotag.html</a></strong></td>
<td></td>
</tr>
<tr>
<td><strong>What is covered?</strong></td>
<td><strong>Clothes washers, refrigerators, freezers, televisions, water heaters, dishwashers, room air conditioners, furnaces, boilers, heat pumps, and pool heaters.</strong></td>
<td><strong>Pre-packaged foods, and foods sold that make nutrition claims. Exempt: restaurants, carry-out, bakery, deli, foods with no nutrition (coffee, spices), dietary supplements, fresh produce and seafood (voluntary program of shelf signs), donated free food (only food “offered for sale” is covered).</strong></td>
<td><strong>Over 100,000 over-the-counter drugs.</strong></td>
<td><strong>Required for packaging of lamps with medium screw bases, including incandescent, CFLs and LEDs</strong></td>
<td><strong>Voluntary for LED lighting products. Intended for retail buyers, utilities and lighting professionals to evaluate LED (“solid-state lighting”) product performance.</strong></td>
</tr>
<tr>
<td><strong>What information is required on the label?</strong></td>
<td><strong>Varies with product. Sample: Manufacturer name, model number, capacity or size, estimated annual operating costs, comparison to similar models, estimated electricity costs.</strong></td>
<td><strong>On Nutrition Label: Standard serving size, calories, total fat, sodium, carbohydrates, protein, calories from fat, saturated fat, trans fat, cholesterol, sodium, dietary fiber, sugars, vitamin A, vitamin C, calcium, iron.</strong></td>
<td><strong>Active ingredients: purpose of the product; uses of the product; specific warnings including when it should not be used, when a doctor should be consulted, and side effects; dosage instructions, inactive ingredients.</strong></td>
<td><strong>Light output in lumens, estimated annual energy cost, life of lamp, color temperature, wattage, testing procedure, registration number (in label program), brand, model number, type.</strong></td>
<td><strong>Standards or government mandated safety label plus laser parameters (including minimum divergence), laser hazards listing, safe use guidance, device-specific guidance (such as for laser projectors), QR code and URL for more info, optional manufacturer info and contact.</strong></td>
</tr>
<tr>
<td><strong>Does the label include a link to a website?</strong></td>
<td><strong>Yes: “For more information, visit <a href="http://www.ftc.gov/energy%E2%80%9D">www.ftc.gov/energy”</a></strong></td>
<td><strong>No</strong></td>
<td><strong>Apparently not</strong></td>
<td><strong>For CFLs: “Contains Mercury / For more on clean up and safe disposal, visit epa.gov/efh.”</strong></td>
<td><strong>“Visit <a href="http://www.lightingfacts.com">www.lightingfacts.com</a> for the Label Reference Guide”</strong></td>
</tr>
<tr>
<td><strong>Where is the label required on the packaging?</strong></td>
<td><strong>The “Information Panel” which is the panel immediately to the right of the Principal Display Panel.</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>On outer (retail) packaging; marketing materials including websites, brochures, catalogs; temporary or permanent label on device (if device is large enough) or on a “hanging tag”, as information in the user manual.</strong></td>
</tr>
</tbody>
</table>
Laser Safety Facts label status
Laser safety information status

- Has been reviewed by selected individuals including Greg Makhov
- Looking to groups such as SAE G-10T, ANSI for any additional review, suggestions, etc.
- In July 2014, a major manufacturer of handheld lasers planned to add this to their product line
Adoption status

- Currently voluntary
  - Intended for manufacturers and marketing materials

- Could become a standard such as ANSI or IEC
  - If so, perhaps run by a non-profit group such as Laser Institute of America

- Could become a legal requirement
  - If so, Congress must enact legislation giving FDA authority and funding
Functional status

- LaserSafetyFacts.com works right now
  - Can add QR or DM code to any visible consumer laser
  - Pages already exist for Class 2, 3R, 3B and 4 lasers
  - Freeform Parameter pages can be easily created, for specific lasers
  - Downloadable labels are at the website
  - Any manufacturer or marketer can add these
Functional status (2)

- Need to add coding to automatically interpret Freeform Parameter pages
  - These can be manually added now
  - Automatic coding is more efficient
Design status

- Design has been reviewed by Burkey Belser of Greenfield/Belser
  - He has agreed to help work on the Laser Safety Facts label
  - He is familiar with federal requirements for label programs
Summary
- Detailed label on packaging, marketing materials
- Can be affixed to larger lasers such as projectors
- Labels for smaller lasers
- Human-readable URL plus QR or DM code
- Includes aircraft hazard warning
- Both labels link to a webpage
- Contains detailed information about hazards, and safe use guidance

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**Laser Safety Facts**

**Laser hazards**
- Eye injury from beam
  - Do not look into the direct or reflected beam; can cause eye injury up to 50 ft (15 m) away.
- Visual interference (glare) with pilots and drivers
  - Interferes with vision up to 1050 ft (320 m) away. Can be a distraction up to 2 miles (3.2 km) away. **NEVER point any laser towards aircraft or vehicles: it is unsafe and illegal.**

**Safe use guidance**
- Class 2 lasers are considered safe for accidental eye exposure. The laser is safe at all distances. It is not a laser beam. This is a class 2 label. Class 2 lasers are not hazardous under normal operation.
A key tool to inform users

- Help prevent eye injuries
- Help prevent laser/aircraft illuminations
- Provide detailed information for persons who need this (schools, non-LSOs, etc.)
- Can be used right now
Questions?