

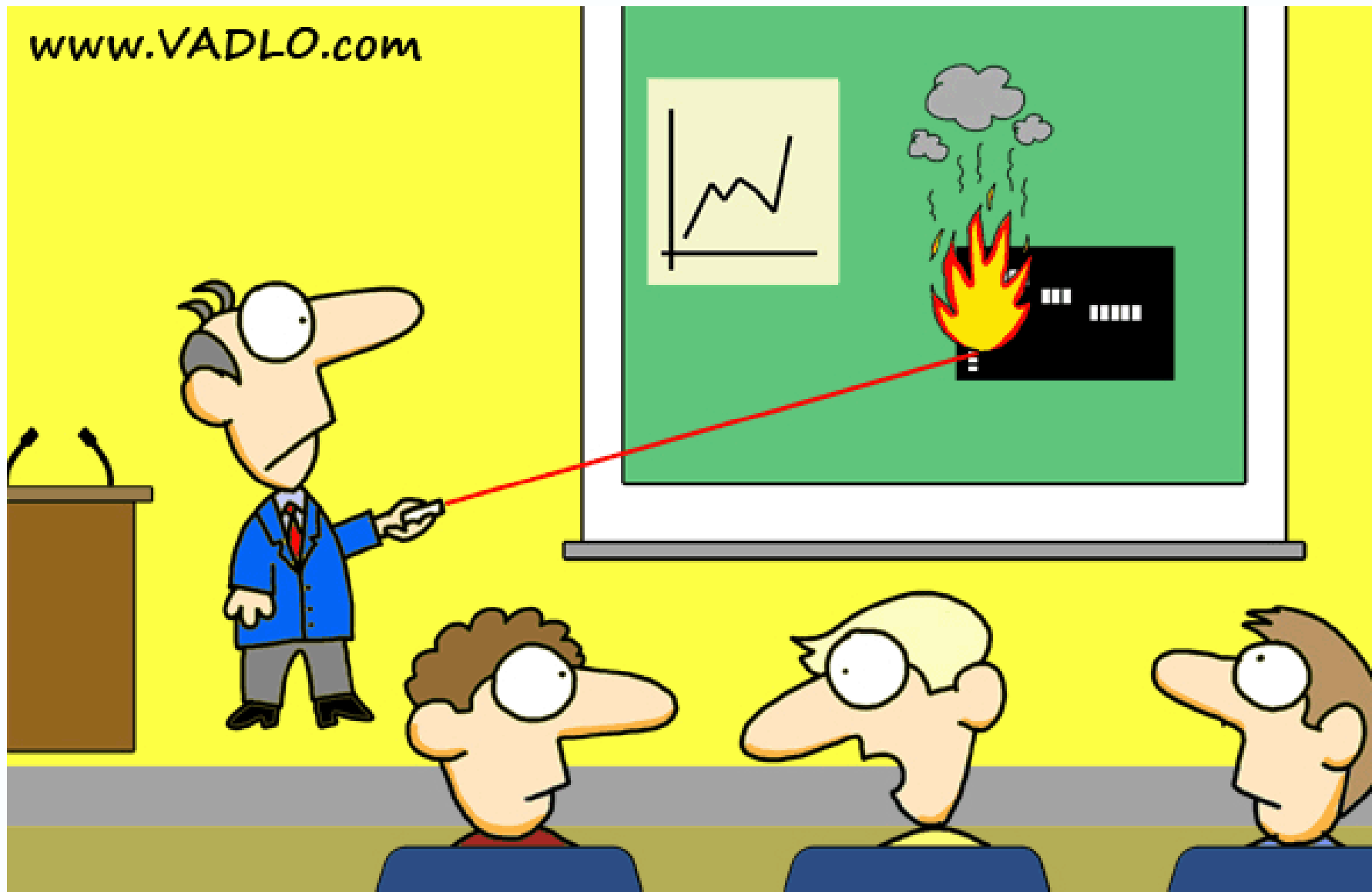
Lasers: Aren't Always what they Seem

ARPANSA Licence Holder's Forum – Melbourne June 2015

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Australian Radiation Protection and Nuclear Safety Regulations 1999

4 Kinds of apparatus that are controlled apparatus

(2) Apparatus is controlled if:

a) The apparatus is:

- vii. an optical source, other than a laser product, emitting ultraviolet radiation, infrared or visible light; **or**
- viii. a laser product with an accessible emission level more than the AEL of a class 3R laser product, as set out in AS/NZS IEC 600825.1:2011 *Safety of laser products, Part 1 Equipment classification and requirements*; **or**
- ix. *an optical fibre communication system exceeding Hazard Level 3R, as defined by AS/NZS IEC 60825.2:2011 Safety of laser products, Part 2: Safety of optical fibre communication systems(OFCs)*; **and**

- #### b) It produces non-ionizing radiation that could lead to a person being exposed to radiation levels in excess of the exposure limits mentioned in Schedule 1 [ie the relevant Standard]; **and**

Regulation 4 - continued

- c) the excess levels of radiation mentioned in paragraph (b) are readily accessible to persons:
- i. in the course of intended operations or procedures of the apparatus; or
 - ii. under a reasonably foreseeable abnormal event involving the apparatus; or
 - iii. under a reasonably foreseeable single element failure of the apparatus; or
 - iv. without the use of tools or other specialised equipment required to remove protective barriers or access panels.

Relevant Standards [Schedule 1]

Regulation 4 (2) (a) (vi) [optical source other than laser]

- AS/NZS IEC 62471:2011 *Photobiological safety of lamps and lamp systems*.

Regulation 4, (2) (a) (vii) [laser product]

- AS/NZS IEC 60825.1:2011 *Safety of laser products, Part 1: Equipment classification and requirements*

Regulation 4, (2) (a) (viii) [OFCS]

- Not mentioned in Schedule 1, however intended to be AS/NZS IEC 60825.2:2011 *Safety of laser products, Part 2: Safety of optical fibre communication systems (OFCS)*

Note: May use current version of IEC Standard (with approval)

Maintenance of Embedded Lasers

Undertaking maintenance or repair activities of equipment with embedded lasers requires consideration and may be considered as a dealing under Sec 31 of the *ARPANS Act 1998*.

Regulation 4, (2) (c) (i) – if the intended operations includes the repair or maintenance of apparatus which includes a laser product **and** the laser emission is accessible **and** at a level exceeding the AEL of AS/NZS IEC 60825.1 then this activity could be considered as a dealing covered under Sect 31 of the ARPANS Act 1998.

Regulation 4, (2) (c) (iv) would not apply in this instance, as the undertaking is intended to repair or maintain (ie open panels).

Underwater Autonomous Rover Kit

Details:

- Publicly-available Kit from US
- 2 Embedded Lasers mounted in Unit
- No specifications for laser provided

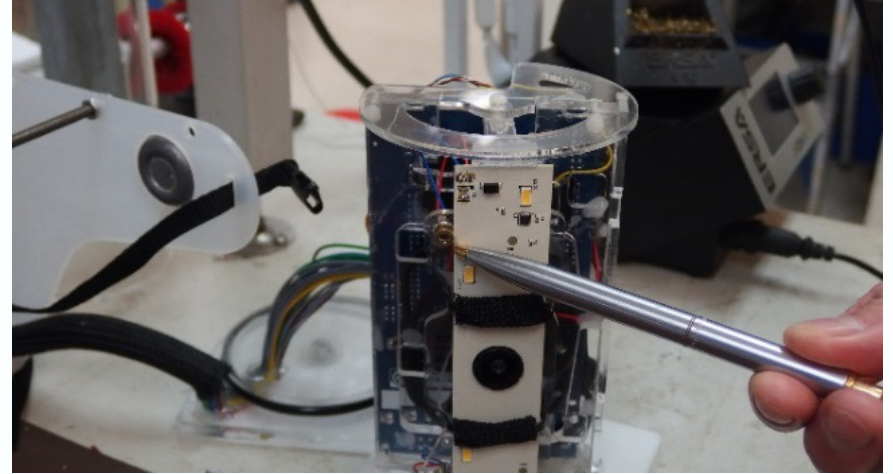
Measured:

6.5mW 'as-is'

15mW as per IEC 60825.1:2011

= **Class 3B**

= **Controlled Apparatus (GP 1 Item 23)**



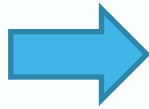
Laser Pointers

A large percentage of laser pointers available on the market do not meet safety standards and emit dangerous levels of visible and non-visible light.

This creates a number of organisational issues

- OH&S requirements to ensure safety of staff, contractors & public
- ARPANSA Licence required for Class 3B and 4 lasers (ie >5mW vis)
- State and Territory Weapons Legislation applies to laser pointers above 1mW (Note: no exemptions in NSW & Vic)
- Customs import Legislation requires import permits and end-use justification for laser pointers measuring >1mW.

An Example



Measurement Results:

Red – 27mW
Green – 67mW
Violet – 100mW

These laser pointers labelled as <1mW were purchased in Australia. The supplier was located in Sydney, and is still advertising today.

All three emit laser radiation well in excess of 1mW and were assessed as Class 3B lasers.

Semi-Scientific Studies

Three Semi-scientific studies highlighted an issue with publicly available laser pointers in Europe and the US.

- Product Safety Enforcement Forum of Europe (PROSAFE)
 - 88 pointers measured - 100% of green and violet pointers and 59% of red pointers non-compliant.
- Amazon.com
 - Tested 24 pointers available on their website – despite being labelled as <5mW all of them exceeded 5mW, 16 exceeded 20mW and 9 exceeded 50mW.
- Lucidos (UK)
 - Tested 20 pointers – only 1 was IEC compliant, 16 exceeded 5mW and half of them (which were all green) exceeded 50mW.

International Laser Safety Conference 2013

Four Papers were presented on overpowered laser pointers:

- **UK's Health Protection Agency** [J. O'Hagen et al, HPA, Oxfordshire, UK]
 - 219 samples measured - 96% were above 1mW and 80% were above 5mW.
- **National Institute of Standards and Technology (NIST)** [J. Hadler et al, NIST, US]
 - 122 pointers measured - 90% of green pointers and about 44% of red pointers were >5mW (ie potentially Class 3B or higher).
- **University of NSW (ADFA)** [T. Wheatley, UNSW, Canberra, Australia]
 - 41 pointers measured – 95% were above 1mW and 56% were measured >5mW (ie Class 3B). Of the 23 green or violet samples, 86% measured as Class3B
 -
- **US Federal Drug Agency (FDA)** **Not included in Analysis

Weapons Licencing in NSW & Victoria

Government Agencies requiring to possess, use, manufacture or modify 'laser pointers' >1mW in NSW and Victoria are not exempt from Weapons Legislation.

Even when licenced with ARPANSA, Agencies must obtain an Organisational Weapons Licence from NSW or Vic Police.

Requirements:

- The responsible person and each operator registered with Police
 - All persons must meet 'fit & proper person' checks with Police.
- Every device registered and secured in lockable cabinet
- Fee for the licence and per person registered

Optic Fibre Communication Systems (OFCS)

The organization installing these systems is responsible for ensuring they are classified in accordance with the standard (AS/NZS IEC 60825.2:2011)

Many higher power OFCS utilize Automatic Power Reduction (APR) systems in order to lower the classification of the system allowing them to be installed in non-controlled environments.

Caution: where staff have access to control the system's APR function in maintenance modes. By deactivating APR, they may be increasing the effective classification of the system above Class 3R.

- Equivalent to defeating an interlock

IEC 60825.1:2014

Class 1	Intrinsically safe by either low emission levels or good engineering design.
Class 1C	This only applies to any device whose laser radiation is intended to be in contact with its intended target and radiation in the excess of Class 1 AEL cannot escape by virtue of good design and safeguards.
Class 1M	Lasers emitting from 302.5nm to 4000nm that are safe but could be hazardous if optical aids are employed within the beam path.
Class 2	Low power CW or pulsed devices emitting in the visible spectrum. Not intrinsically safe but protection is afforded by the blink reflex. Output power must be limited to 1mW for CW or 1mW peak power for pulsed systems.
Class 2M	As Class 2 but may be hazardous if optical aids are used within the beam.
Class 3R	Devices emitting from 302.5 to 4000nm which are potentially hazardous. CW or pulsed visible devices can have an output of up to 5mW.
Class 3B	Medium power CW or pulsed devices up to 500mW output. Direct intra-beam viewing of the beam is HAZARDOUS.
Class 4	High power devices, mostly above 0.5 Watt output power. EXTREMELY HAZARDOUS! Use with great caution.

Other 'new' laser sources

Laser Illuminated Projectors

Pico projectors

High-intensity LED's

Laser Illuminated Projectors

Lasers are being used in projectors as an alternative to conventional lamps.

Whilst these LIPs emit laser light from extended sources and their uncollimated beams do not present the same hazards as other lasers, they are still laser products that present risks.

Therefore they must undergo classification in accordance with a relevant standard.

However which standard?

AS/NZS IEC 60825.1:2011, or AS/NZS IEC 62471:2011

IEC 62471-5:2015 Photobiological safety of lamps and lamp systems
- Part 5: Image projectors

US CDRH Guidance on LIP's

Classification and requirements for Laser Illuminated Projectors - issued 18 Feb 2015

IEC 60825-1:2014 “Safety of laser products – Part 1: Equipment classification and requirements” (IEC 60825-1:2014) allows alternative classification procedures for certain laser products that produce extended source light emissions, such as LIPs.

Under this alternative classification procedure, LIPs are categorized by optical safety “Risk Groups” specified in standard IEC 62471:2006 “Photobiological Safety of Lamps and Lamp Systems” (IEC 62471:2006).

Classification Guidance

The CDRH considers LIPs that are in Risk Group 3 to be equivalent to demonstration laser products in Laser Classes IIIb or IV (IEC Class 3B or 4).

Which, would make these projectors a controlled apparatus under Regulation 4 (2)(A)vii or viii.

Light Emitting Diodes (LED's)

From September 2011, the IEC 60825.1 standard excluded LED's.

LED's are now covered under AS/NZS IEC 62471:2011
(Photobiological safety of lamps and lamp systems)

High-intensity LED's can exceed irradiance limits of the AS/NZS IEC 62471:2011 standard, and therefore could be considered as controlled apparatus under Regulation 4.

AS/NZS IEC 62471:2011

Provides guidance for the evaluation of the photobiological safety of non-laser sources of optical radiation

- electrically-powered
- emitting in the spectral range of 200 to 3000 nm,
- **whether or not the emission of light is the primary purpose of the product.**

We love Challenges



Thank you

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