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By Geoff Giordano

New maximum permissible exposure limits (MPEs), new definitions and newly rewritten sections are among the main highlights of the just-revised parent standard for laser safety, the ANSI Z136.1-2014.
Updated for the first time in the last seven years, the new *American National Standard for Safe Use of Lasers* will be available through the Laser Institute of America, secretariat of the Accredited Standards Committee (ASC) Z136, which develops the laser safety standards. The ANSI Z136.1 standard guides the safe use of lasers and laser systems by defining control measures for the seven laser hazard classifications.

“There have been extensive changes to the ANSI Z136.1 standard with a focus on increasing usability,” explained Ben Rockwell, chairman of ASC Z136 Standards Subcommittee 1 (SSC-1). “Significant increases in the MPE in the near-infrared will enable a plethora of new laser applications. Several sections were rewritten to reorganize, update and improve technical content to allow for easier access to information necessary for everyday laser safety implementation. For example, a list of acronyms and abbreviations was added at the front of Section 2 (the definitions section) to allow for easy learning of the standard’s vernacular. In addition, much care was put into reviewing the definitions, with many added to allow for clarification of many particulars in the standard.”

Added Wesley Marshall, chair of ASC Z136 Technical Subcommittee 7, Analysis and Applications (TSC-7), the newly revamped ANSI Z136.1 “is probably the most comprehensive revision to date, even more so than the 2000 revision. It has been a monumental task involving thousands of modifications of different sections of the standard and thousands of hours of work by the Z136 accredited committee members. This newest revision, like past standards, covers intrabeam viewing and viewing of diffuse reflections and extended sources, considering photochemical, thermal and skin hazards.”

According to Rockwell, who has chaired LIA’s International Laser Safety Conference (ILSC®) several times, highlights of the standard include:

- 19 new definitions of key terms, including administrative control measure, beam divergence, beam waist, saturable absorption and visible luminous transmission.
- A significant increase in allowed exposure levels for wavelengths between 1.2 µm and 1.4 µm, and a slight decrease in exposure limits for pulses shorter than approximately 10 µs.
- An updated section on “special qualifications” for medical-related exposures to include MPEs expressed in terms of illuminance.
- Rearranged Section 4 (Control Measures) and rewritten Section 7 (Non-beam Hazards) to increase comprehension.
- Examples involving new exposure limits added to Appendix B.
- Vertical standards — Z136.2 through Z136.9 — now take precedence over this document within the scope of those standards. “This makes the Z136.1 officially a horizontal standard.”
- The degradation of optics transmission in the UV and NIR is now included in the analysis of hazard classification of lasers.

**Much Ado About MPEs**

Marshall elaborated on the scope of the MPE revisions. “Maximum permissible exposure to single pulses has been reduced for many lasers that produce a retinal hazard,” he noted. “For most laser systems, calculations of the hazards has been simplified in that the rules for dealing with multiple-pulse lasers has been reduced from three to two. Rule three now only applies to some extended source exposures such as diffuse reflections. Exposure to diffuse reflections may be conservatively treated the same as point source exposure, thereby avoiding the more complicated extended source calculations described in this latest revision.”

Bruce Stuck, chair of the Technical Subcommittee on Laser Bioeffects and Medical Surveillance (TSC-1), stressed that the MPEs are “based upon expert assessment of biological effects or dose-response data.”
Changes in the near-infrared provide dual limits to protect the cornea, iris and lens. Other refinements address dependence of the MPE on the irradiance diameter (spot size), adjustment to the short-pulse MPEs (nanosecond, femtosecond) and treatment of repetitive pulses. “It sounds paradoxical, but although many changes have been made to the MPEs, most hazard assessments of common lasers will not be affected.”

The Gold Standard

The ANSI Z136.1 standard is indispensable in creating a safe working environment where lasers are used. While it is a voluntary standard, it is a laser safety officer’s (LSO’s) best friend — and a vital insurance policy for companies.

“What gives the Z136.1 standard a little bit of teeth is OSHA,” said Bill Ertle, president of Rockwell Laser Industries, during his presentation on Z136.1 updates at ILSC 2013 in Orlando. “OSHA accepts industry practices. If you go to the OSHA website and click on the laser page, it tells you that you should follow safe practices,” referencing the ANSI approved Z136 series.

Ertle, chair of the Technical Subcommittee on Control Measures and Training (TSC-4), emphasizes that the core purposes of the standard include designation of an LSO, confirmation of laser classification, evaluation of hazards and determination of MPEs and nominal hazard zones. “It’s very methodical,” he says. “Many accidents have (involved) untrained or unauthorized personnel, so it’s critical to authorize the (laser) users, train them appropriately and perform periodic audits.”

Having a laser safety program in place is vital. Ertle recalled one report of potential laser irradiation that prompted a visit from OSHA. “People didn’t know who the LSO was; people didn’t know what to do in the event of an injury, and this company got slapped with a nice fine. Not having a program in place was the biggest thing they were hit for.”

That is why “maintaining records is critical — any training, any incidents. Perform periodic audits and surveys. We always, in the Z136 standards, yield to the LSO. We use words like ‘periodic’ so you can determine whether that’s something you have to do annually, every two years or every six months. Many words in the Z136.1 standard are very flexible to let management and the LSO decide what’s appropriate for their facility.”

To obtain the newly revised ANSI Z136.1 standard, visit LIA’s online store at [www.lia.org/store](http://www.lia.org/store). The cost is $173 for LIA members and $193 for non-members.

Tagged as: ANSI Z136.1, ASC Z136, Laser Safety Officer (LSO), OSHA, safe use of lasers, safety standard