

# HOW STANDARDS ARE DEVELOPED

By David F. Coble

There are tens of thousands of standards, codes, regulations, laws, guidance materials, norms and other terms worldwide that specify a minimum level of attainment. The word *standards* will be used in this article to encompass these types of documents.

**European Telecommunications** Standards Institute (ETSI, 2019) states that standards are intended to provide “rules or guidelines to achieve order.” British Standards Institution (BSI, 2019) states that standards are “an agreed way of doing something.” International Organization for Standardization (ISO, 2019) states that standards provide “requirements, specifications, guidelines and characteristics to ensure that products, services and systems are safe, reliable and fit for purpose.” American National Standards Institute (ANSI, 2019) states that standards are a “recognized unit of comparison by which the correctness of others can be determined.”

Standards are vital to everyday life and most of the time we do not even think about them. Standards are why a light bulb can fit practically every lamp socket, why a toaster can be plugged into the wall receptacle and work, why a file can be sent through the Internet and why professional baseball diamonds are the same size. Manufacturers, sellers, workers, customers, users and regulators need standardization to compete globally, to protect the public, workers and the environment, and to strengthen the global supply chain so that citizens and their governments are confident in the integrity of globally produced goods and services.

Standards developed by nongovernmental organizations (NGOs) can be voluntarily followed such as the more than 9,500 standards developed by ANSI, the more than 20,000 standards developed by ISO or the more than 30,000 standards developed by BSI. Some of these voluntary standards become law through organizations such as OSHA, the state elevator and pressure vessel code agencies, and the U.K.’s Health and Safety Executive. Other standards are developed as law by governmental agencies and legislatures, such as the first hazardous chemical right-to-know laws of the 1980s.

## Standards Are Established for Various Reasons

Some standards establish uniform measurements. For example, a USB plug should fit into the USB port on a device. A VGA or HDMI plug should fit into a projector so that you can show a presentation. The dimensions of these adapters are specified by the EIA/CEA 861 standard so that they are uniform and compatible. (EIA is the Electronics Industries Alliance and CEA is the Consumer Electronics Association, now called the Consumer Technology Association.)

Some standards establish a minimum level of quality. For example, the No Child Left Behind Act of 2001, a reauthorization of the Elementary and

Secondary Education Act of 1965, standardizes the assessments designed to evaluate academic achievement.

Some standards establish a minimum level of reliability, usefulness and convenience. For example, the Global System for Mobile Communications was launched in Finland in 1991 and is the most widely used of the three digital telephone technologies (TechTarget, 2019). Now used in more than 200 countries, this system allows people to use their mobile phones virtually around the world.

But perhaps the most important use of standards is to establish minimum requirements for the protection of people, property and the environment.

## Developing OSH Standards

Regardless of the origin and intended use of a standard, the process for development is generally the same.

### 1) A Need Exists

First, the need for a standard is established. The need can be established by an industry sector, an individual, a government agency or an organization. A series of tragedies, a single event, a developing storm of unwanted consequences or the unknown of what might happen can trigger the development of standards.

- Standards are sometimes triggered by tragedy. The Triangle Shirtwaist Factory fire on March 25, 1911, in New York City caused 146 worker deaths, 62 of which occurred when workers jumped or fell from windows. Exits were blocked, fire escapes collapsed, firefighting equipment consisted of a few buckets of water and fire department ladders could not reach the eighth or ninth floors. This single event triggered the writing of the definitive egress rule in 1913 by the Committee on Safety to Life (the origin of NFPA 101, Life Safety Code).

- Standards can be triggered by a continuing series of events. In the late 1960s, Congress responded to the continuing series of work-related fatalities and catastrophes in the U.S. and promulgated the Williams-Steiger OSH Act of 1970.

- Standards may be triggered by a sudden surge of events. There was a developing storm of concern about keyboards and computer screens in the 1990s when every desk was equipped with these technological wonders and people began complaining of aching hands and strained eyes. The term *carpal tunnel syndrome* became widely known. As a result, standards such as ANSI/HFES 100-2007, Human Factors Engineering of Computer Workstations,

## David F. Coble

David F. Coble, M.S., CSP, is president of Coble, Taylor & Jones Safety Associates in Cary, NC. He has 43 years' safety experience including 12 years with NC OSHA and the past 31 years assisting clients worldwide with identifying and controlling hazards. Coble holds a B.S. from University of North Carolina, Chapel Hill, and an M.S. in Safety Management from University of Arizona. He is content coordinator of ASSP's Manufacturing Practice Specialty and has served on ASSP's and National Safety Council's standards development committees. He is a member of the ANSI B11.19 and ANSI/ASSP Z590.3 committees, and is working on a standard to safeguard employees who work alone.

Standards are why a light bulb can fit practically every lamp socket, why a toaster can be plugged into the wall receptacle and work, why a file can be sent through the Internet and why professional baseball diamonds are the same size.



DAOLEDU/ISTOCK/GETTY IMAGES PLUS

were developed to help prevent cumulative trauma disorders or repetitive motion injuries and illnesses.

•Guidance can be triggered by the unknown. There still is no consensus on the effects of exposure to nanotechnology, but documents have been developed to help prepare for this unknown (Hull & Bowman, 2018).

## 2) Content Developed

Next, stakeholders develop the content of the standard. What individuals or entities are considered stakeholders depends primarily on the intended use of the standard. For example, if the standard is being developed internally for a specific organization to help control an employee action or behavior such as smoking, employee input, while recommended in a modern safety and health management system, may be of little concern to management. Management may have developed the rule and stipulated that smoking is simply not acceptable on company premises. On the other hand, if the standard is intended to have broad appeal and acceptance through a consensus of those whom the standard will affect, stakeholders would include manufacturers, users, labor organizations, government officials, consultants and the public.

## 3) Approval Process

The standard then goes through an approval process, which can be as simple as the OSH manager writing the policy and the plant manager approving it. However, OSH standards developed by NGOs that are intended for broad use are typically developed through a public review process.

That process includes the stakeholders developing a draft standard based on consensus of the stakeholders (usually called a committee or working group) circulating the draft standard for public comment, rewriting the draft standard to address public comments, and developing the final standard. Standards developed by executive branch government agencies undergo a similar process, but the public input usually includes open hearings where interested parties can testify and present their opinions. Laws developed by the legislative branch of government also accept public input, usually from lobbyists and special interest groups, and, less frequently, constituents.

## 4) Revalidation

Standards developed by NGOs undergo a revalidation process every 5 to 10 years. The committee or working group for that standard updates the standard through a draft revision and goes through the public review process before issuing an updated standard.

Government agencies update their standards whenever they perceive a need and as resources are available, unless the legislative body that authorized the standard requires an update periodically. For example, the OSHA standard regulating guarding of mechanical power transmission apparatus (29 CFR 1910.219) is based on the industry consensus standard ANSI B15.1, Safety Code for Mechanical Power Transmission Apparatus, developed in 1927 as American Standards Association (ASA) B15-1927, revised in 1953 and reaffirmed (a procedure in which the committee or working group votes to continue a standard as is) in 1958. While the ANSI B15 committee updated or reaffirmed that standard routinely until 2010 when ANSI B15.1 was rolled into ANSI B11.19, American National Standard for Machines: Performance Requirements for Safeguarding, OSHA has not made any substantial updates to 1910.219.

## The Framework for Standards Development

Nongovernmental standards are typically overseen by an accrediting standards organization. That organization oversees a fair development process that ensures that a high-quality standard is developed through the consensus of stakeholders, and ensures adequate availability, distribution and maintenance of standards.

An accrediting standards organization is comprised of staff who develop and maintain the policies, practices and procedures to ensure the integrity of the standards development process. Examples of accrediting standards organizations include ANSI and ISO. These organizations oversee the development and use of thousands of standards, technical reports and guidelines by accrediting the procedures of standards developers and approving their documents as ANSI or ISO standards.

The actual development of standards is overseen by a standards development organization (SDO) such as an individual or an industry society, which is also called the secretariat. One example of an SDO is B11 Standards Inc., an ANSI-accredited SDO that develops and administers the ANSI B11 series of American National Standards and technical reports on machine tools and machinery safety. ASSP is another example of an SDO. As secretariat of multiple standards projects, ASSP organizes the committees that develop and maintain the standards, ensures that the process of revision is timely and in accordance with ANSI procedures, and publishes the final product of the consensus process. ASSP is the secretariat for standards such as ANSI/ASSP Z10, Occupational Health and Safety Management Systems, and ANSI/ASSP Z590.3, Prevention Through Design: Guidelines for Address-

ing Occupational Hazards and Risks in Design and Redesign Processes.

## Two Standards Development Stories

For many years, I was a member and chair of the ANSI B15.1 committee. Now, I serve on the ANSI B11.19 committee. In addition, I have had a small part in the development of several other standards and laws including:

- North Carolina Hazardous Chemicals Right-to-Know Law of 1985 (North Carolina General Statute Chapter 95, Article 18);

- ANSI/ASSP Z590.3;

- ANSI Z358.1, Emergency Eyewash and Shower Equipment.

How did these two standards, ANSI/ASSP Z590.3 and ANSI Z358.1, become viable?

### ANSI/ASSP Z590.3

ANSI/ASSP Z590.3 is a reality because of the drive and perseverance of Fred Manuele. Safety professionals have long realized that the best approach to controlling hazards is to design structures, buildings, systems, processes and equipment free of unacceptable risks. This philosophy was even being discussed when I became a North Carolina OSHA compliance safety and health officer (CSHO) in 1973, and when I attended my first CSHO course at the OSHA Training Institute in 1974. The OSHA instructors emphasized the importance of design with safety in mind and that is why so many initial OSHA standards specified requirements for design such as ladders, guardrails, machinery, electrical installations, flammable liquid storage cabinets and myriad other pieces of equipment.

But it was several decades before the wheels turned, putting this concept into a practical and useful standard. Let's hear Manuele's story in his own words:

In the early 1990s, several safety professionals recognized that design causal factors were not adequately addressed in incident investigation reports; designing for safety was infrequently addressed in the popular safety literature; and safety management systems that organizations had in place rarely included safety through design provisions.

I chaired a committee at the National Safety Council to study the feasibility of the council promoting safety through design concepts. In 1995, the council established the Institute for Safety Through Design and this definition was approved by the steering committee: "The integration of hazard analysis and risk assessment methods early in the design and engineering stages and taking the actions necessary so that risks of injury or damage are at an acceptable level."

A good deal was accomplished by the institute. Seminars, workshops and symposia were held. Proceedings were issued. And a

book titled *Safety Through Design* was published. In accord with its sunset provision, the institute was dissolved in 1995.

In 2006, several of the participants in the activities of the institute received an e-mail from an executive at NIOSH encouraging that we participate in an initiative to be undertaken by NIOSH for prevention through design. In 2008, NIOSH announced that one of its major initiatives was to "develop and approve a broad, generic voluntary consensus standard on prevention through design that is aligned with international design activities and practice."

I volunteered to lead that endeavor and served as the committee's chair. Support was obtained from the Standards Development Committee at ASSP. It was decided to develop a technical report first for the learning experience that it would provide. So, TR-Z790.001, Prevention Through Design, An ASSP Technical Report, was issued in 2009; it has since been replaced.

I wrote a paper on prevention through design that was published in the October 2008 issue of *Professional Safety*. That paper was put into a draft form for a standard, with valued assistance from Bruce Main, who served as the committee's vice chair. Tim Fisher, who is responsible for standards at ASSP, agreed that we could use the canvass method to obtain criticism of the draft that was sent to about 90 people. A Canvass Resolution Committee was formed to consider and decide on the comments received from those who suggested changes.

On Sept. 1, 2011, ANSI approved the standard ANSI/ASSP Z590.3-2011, Prevention Through Design: Guidelines for Addressing Occupational Hazards and Risks in Design and Redesign Processes. This standard was reaffirmed in 2016. (F.A. Manuele, personal communication, June 2, 2017)

Therefore, ANSI Z590.3 resulted from the leadership of a highly respected safety professional with extensive experience.

### ANSI Z358.1 Emergency Eyewash & Shower Equipment

The first version of ANSI Z358.1 was approved by ANSI in 1981. However, 6 years before that, two North Carolina Department of Labor officials, Raymond Boylston and L. Albert Weaver, envisioned a guidance document on proper installation of emergency eyewashes and showers in industry. It was quite common before 1981 to find any manner of emergency water for flushing of the eyes and body such as garden hoses, drums full of water, spigots with a plastic hose attached, or even a 1.5-in. fire hose.

Boylston is deceased, but Weaver shares the story of the initial development of an emergency eyewash and shower standard in his words:

The document on eyewashes and safety showers started as an assignment from Ray Boylston (North Carolina's first OSHA director with 20 years' safety experience working for DuPont) in 1975 to me to develop guidance on eyewashes and safety showers with the intent that the final product would be a guidance document similar to those we had produced on other subjects at the North Carolina Department of Labor, Occupational Safety and Health Division (NC OSHA). Little did I realize that this document would ultimately be the basis for my master's thesis at North Carolina State University's College of Engineering.

After the eyewash and safety shower guidance document was prepared, it ended up being used for other purposes as well. These other purposes included the development of an NC OSHA Standards Notice (Directive) and the Eyewash and Safety Shower Criteria Document entitled Eyewash and Safety Shower Criteria Document, Division of Occupational Safety and Health, NC Department of Labor, Raleigh, NC, 1976.

The NC OSHA Eyewash and Safety Shower Criteria Document was quite progressive in that it used anthropometric data to establish eyewash and shower dimensions to protect the 5th percentile woman and the 95th percentile man. Such dimensions include the shower pull ring to be within 67 in. of the floor, the height of the eyewash fountain to be at 34 to 39 in. from the floor, the distance between the eyewash jets to be 4 in. and other dimensions that were eventually incorporated into ANSI Z358.1-1981.

The criteria document included recommended travel distance to an eyewash or shower (25 ft or 15 seconds), markings, testing and maintenance, and training for potential users, all criteria that was eventually included in ANSI Z358.1. The NC OSHA Eyewash and Safety Shower Criteria Document also led to a companion document entitled Absorption Type Chemical Burns Evaluation and Recommended Controls, also published by the NC Department of Labor.

The criteria document also became the basis for a work product by Karen Britt, now Peeler, who was working as an intern from Meredith College for NC OSHA, and me, and submitted to ASSP for publication in *Professional Safety*. That article was published in June 1977 as "Criteria for Effective Eyewashes and Safety Showers."

As word spread in the manufacturing sector about the need for suitable eyewash and safety shower equipment,

NC OSHA was invited to participate in the development of a standard, since a standard did not exist at that time. This process first began with Industrial Safety Equipment Association. That group (an SDO) was able to work with ANSI and have it produced as an ANSI standard. (L.A. Weaver, personal communication, June 3, 2017)

Therefore, ANSI Z358.1 resulted from a farsighted state OSHA plan that included an OSHA director (Boylston) and his colleague (Weaver) working on a master's degree.

## Conclusion

Many believe that there are already too many standards to comply with and that U.S. competition, innovation and the ability to react quickly are compromised. On Jan. 30, 2017, President Trump signed Executive Order 13,771 (2017), titled Reducing Regulation and Controlling Regulatory Costs. It is known as the "one in, two out" rule: For every new regulation issued, at least two prior regulations must be identified for elimination.

On the other hand, there are many safety and health risks for which there is no standard yet. For example, in the U.S., it is estimated that 3 million people work alone for at least part of the day. There is no U.S. standard intended to safeguard an employee who works alone (i.e., working solo with no readily available assistance in an emergency). Several Canadian provinces, the U.K., Australia, New Zealand, Germany and other countries have such regulations.

Like Manuele and Weaver, we each have opportunities to make a difference for worker safety and health. If you have a chance to join a standards development committee, do so. If you see a need for a standard that can save a hand, an eye or even a life, bring it to ASSP's attention. **PSJ**

## References

- ANSI. (2019). Standard (Glossary entry). Retrieved from [www.standardsportal.org/usa\\_en/resources/glossary.aspx](http://www.standardsportal.org/usa_en/resources/glossary.aspx)
- British Standards Institution (BSI). (2019). What is a standard and what does it do? Retrieved from [www.bsi-group.com/en-GB/standards/Information-about-standards/what-is-a-standard](http://www.bsi-group.com/en-GB/standards/Information-about-standards/what-is-a-standard)
- European Telecommunications Standards Institute (ETSI). (2019). What are standards? Retrieved from [www.etsi.org/standards/what-are-standards?](http://www.etsi.org/standards/what-are-standards?)
- Exec. Order No. 13,771, 82 FR 9339 (2017).
- Hull, M. & Bowman, D. (Eds.) (2018). *Nanotechnology environmental health and safety risk regulation and management* (3rd ed.). Amsterdam, Netherlands: Elsevier.
- International Organization for Standardization (ISO). (2019). We're ISO: We develop and publish international standards. Retrieved from [www.iso.org/standards.html](http://www.iso.org/standards.html)
- No Child Left Behind Act of 2001, Pub. L. No. 107-110, 115 Stat. 1425 (2001). Retrieved from [www2.ed.gov/nclb/overview/intro/execsumm.pdf](http://www2.ed.gov/nclb/overview/intro/execsumm.pdf)
- TechTarget (2019). GSM (Global system for mobile communication). Retrieved from <https://searchmobilecomputing.techtarget.com/definition/GSM>