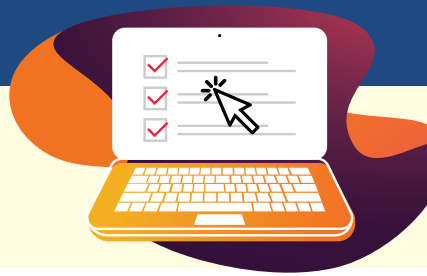
THE 2021 COMPLIANCE EBOOK

On the following pages, find information that helps OHS professionals keep workers safe and companies stay in compliance with standards pertinent to the field of industrial hygiene & safety.



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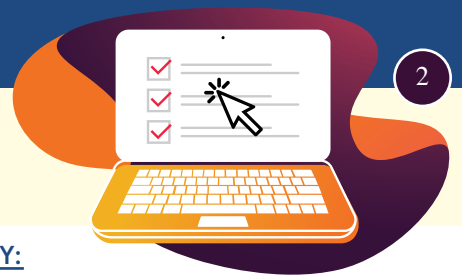
Industrial Hygiene in the Workplace



Combustible Dust Standard: NFPA 652

"The NFPA 652 - 2019 standard provide us with Fundamentals of combustible dust knowledge that we use when recommending solutions to our dust collection customers in the packaging industry. We reference NFPA 652 – 2019 as our starting point when discussing explosion protection strategies and equipment design with our customers. This is one for Camfil APC's most valuable tools in helping customers meet the 'Life Safety Goal'." *Camfilapc.com, 833-322-0820*

History

Combustible dust is any fine material that can catch fire and explode when mixed with air. OSHA defines combustible dust as "…a solid material composed of distinct particles or pieces, regardless of size, shape or chemical composition, which presents a fire or deflagration hazard when suspended in air or some other oxidizing medium over a range of concentrations."

This does not always mean the types of material normally considered either combustible or dangerous. It can include metal dust, wood dust, plastic or rubber dust, coal dust, biosolids, dust from certain textiles—even organic dust, like flour, sugar, paper, soap and dried blood.

Why Standard is Important

If a company has processes that create dust or use powders, then it has a responsibility to determine if a combustible dust hazard exists. NFPA 652: Standard on the Fundamentals of Combustible Dust, 2016 edition, became effective Sept. 2015. This standard was created to promote and define hazard analysis, awareness, management and mitigation. The standard also issues a new term, Dust Hazard Analysis (DHA), to differentiate this analysis from the more complex forms of process hazard analysis methods currently found in industry. NFPA 652 is the starting point for this analysis. It will guide you, step by step, in identifying hazards and what to do next.

The NFPA standards have required a process hazard analysis since 2005. NFPA 652 takes this requirement further by making this requirement retroactive to existing installations, with a deadline. A DHA is now required for new installations and upgrades to existing installations. The standard allows three years to complete this DHA. To illustrate the importance of this hazard analysis, many OSHA citations regarding combustible dust hazards list the lack of a hazard analysis at the top of the citation.

Combustible dusts are created during the transportation, handling, processing, polishing and grinding of the materials. Abrasive blasting, crushing, cutting and screening dry materials can also create dust.

The types of workplaces most at risk of combustible dust include:

- Food production
- Woodworking facilities
- Metal processing
- Recycling facilities
- Chemical manufacturing (rubber, plastics, pharmaceuticals)
- Grain elevators
- Coal-fired power plants

Any workplace that generates dust might be at risk, however. This is why it's essential to conduct a thorough risk assessment.

Key Compliance Requirements

The purpose of a dust-collection system is to remove and isolate dust away from people who can inhale it and process

ADDRESSING DUST CHALLENGES FOR FOOD PACKAGING

Dust can often be created during packaging, as finished products are moved by conveyor or during the box- or bag-filling process. The "puffs" of compressed air used during the bag-filling process can generate little puffs of dust while filling packages. This can cause an accumulation of dust over time, if not addressed properly, which can also create several challenges during the packaging process, including:

- **Cross-contamination:** Packaging lines for multiple products are often located in the same facility, creating a cross-contamination concern if fugitive dust is allowed to escape.
- **Nuisance dust/aesthetics:** Dust that settles on or in packaging is unappealing to consumers of packaged food products.
- **Microbial growth:** Dust that is allowed to settle on surfaces in the packaging facility or in between packaging layers provides a medium for microbial growth.
- **Combustion risk:** Food processing dusts—including flours, powdered milk, corn starch, wheat starch, sugar, tapioca, whey, cocoa powder and many spices—are highly combustible.

To address the challenges, food packaging operations must look at the whole process, including needs analysis, system design and engineering, collector and ductwork installation, filter selection, HVAC system integration, startup and commissioning, and aftercare and service. Calling the experts to help ensure your operations remains NFPA 652-compliant. IHW

–Joan Mantini, Chief Editor, *Packaging Technology Today*

areas where it could accumulate and become a deflagration hazard. The DHA will identify the following conditions that may exist external or internal to the system that contribute to a fire or deflagration hazard:

- **Presence of oxygen:** Air is the oxidant
- **Presence of fuel:** Combustible dust whereever it is found, including floors, elevated surfaces, inside ducts, and inside process enclosures and machines
- **Dispersion of fuel:** includes pulse cleaning inside dust collector; use of compressed air for cleaning; and events that can dislodge dust from elevated surfaces
- **Ignition sources:** Sparks, electrical shorts, hot work, electrostatic discharge, flames, rotating equipment, hot surfaces
- **Containment locations:** inside pipes; inside dust collectors; and inside any process enclosure or machine IHW

Resources:

Because so many different types of workplaces might contain potential combustible dust risks, it's essential to conduct a thorough risk assessment. Failing to comply with this standard can leave you open to serious fines and even more serious injuries, if an incident occurs.

- ➔ OSHA offers a lengthy list of materials that could produce combustible dust: https://bit.ly/1Lni5C7
- ➔ Become familiar with NFPA 652: Standard on the Fundamentals of Combustible Dust. https://bit.ly/2KD03Po. It provides basic principles and requirements for identifying and managing fire and explosion hazards from combustible dust.
- ➔ OSHA looks to this standard for guidance when it comes to best practices for preventing combustible dust fires and explosions. Those who don't take the necessary steps to protect workers can be fined for violations under 18 different standards as part of OSHA's Combustible Dust National Emphasis Program. https://bit.ly/2Rd1Eh8. This includes the General Duty Clause and 29 CFR 1910.22, the main housekeeping standard.
- ➔ For more an in-depth discussion of combustible dust, see the article titled "How to Prevent Combustible Dust Incidents in the Workplace" in *WMHS*'s November 2018 issue: https://bit.ly/2zsbRPM

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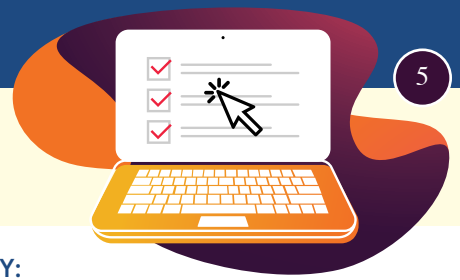

Respirator Fit-Testing Methods (ANSI/AIHA/ASSE Z88.10-2010)

"AccuTec-IHS is pleased to sponsor ANSI/AIHA/ASSE Z88.10-2010 - Respirator Fit Testing Methods. Now more than ever, it's critical to employ standards-compliant Fit Tests to protect workers and your organization from airborne hazards. Many new respirators have been developed during OVID, and our AccuFIT® 9000 PRO tests virtually all models/types." *AccuTec-IHS, Inc., 800-896-6959, www.accutec.com*

History

Developed by ANSI (now known as ASSP), with content provided by the American Society of Safety Engineers (ASSE), guideline Z88.10-2010 provides respiratory protection program managers (RPPM) with clear, consistent guidance on respirator fit-testing and the components required of an effective respiratory protection program. Included in the guide are instructions on how to avoid interference of PPE; it also provides detailed information on face pieces, including their selection, and other considerations for effective fit-testing. Z88.10 was last updated in 2010.

Qualitative fit-testing is a pass/fail test that uses the wearer's sense of taste or smell, or his reaction to an irritant, in order to detect leakage into the respirator facepiece. Whether or not a worker needs a full-face respirator or a half-mask respirator depends on the Assigned Protection Factor (APF). The APF is a number that describes the level of protection that a respirator can be expected to provide—if used properly.

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Yearly fit-testing is now required. According to OSHA, an employer that performed fit-testing every two years reported 7% of their employees switched to different respirator sizes and/or models each time they were tested. OSHA considered this 7% measurement to be unacceptable and adopted the policy to require annual fit-testing and training.

Why Standard is Important

Fit-testing is a protocol used to evaluate sealing surface leakage of a specific, tight-fitting respirator while it is being worn. Individuals do not have to be issued the same respirator that they are fit-tested with, as long as they are issued a respirator that is the same make, model, style, size and material of respirator with which they are fit-tested. There are two categories of respirator fit-testing, which include qualitative and quantitative fit-testing methods.

Standard Z88.10 provides in-depth requirements for training fit-test operators; it also includes a large section entitled "General Considerations," which covers in detail the important considerations for performing all respirator fit-testing protocols.

Clause 6 of the General Considerations section includes medical evaluation and pre-fit test training (such as how to don the respirator without assistance). Z88.10 recommends using a mirror to see how to position and adjust the respirator, for example. Also in this section are guidelines on how to inspect the respirator and how to accomplish user seal checks.

Key Compliance Requirements

There are numerous factors that could potentially diminish the effectiveness and fit of a respirator. These include:

- Weight gain or loss
- Dental work or facial surgery
- Significant scarring in areas where seal meets skin
- Wearer discomfort
- Facial hair or certain hair styles
- Cosmetics or facial jewelry
- Glasses or protective eyewear
- Do not perform fit testing if any foreign material, like gels or creams, are present between the sealing surfaces of the face and the respirator
- PPE must not interfere with respirator sealing surfaces and must be worn during fit testing

In addition, there are some other conditions that can adversely affect fit. These include possible facial feature interference, such as hollow temples, exceedingly protruding cheekbones, deep skin creases, absence of teeth or dentures, or facial injury including mouth or facial swelling.

If dentures are worn during respirator use, dentures should be worn during fit-testing. If dentures are not worn during respirator use, then dentures should not be worn during fit-testing. IHW

Resources:

→ Copies of the standard can be purchased online, at the ANSI Webstore: https://bit.ly/2PKVCqb

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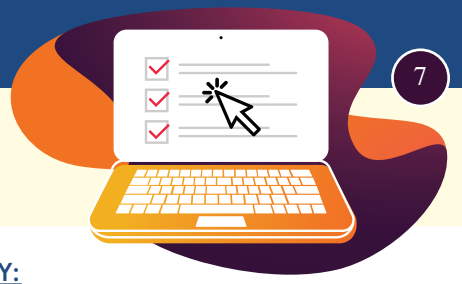
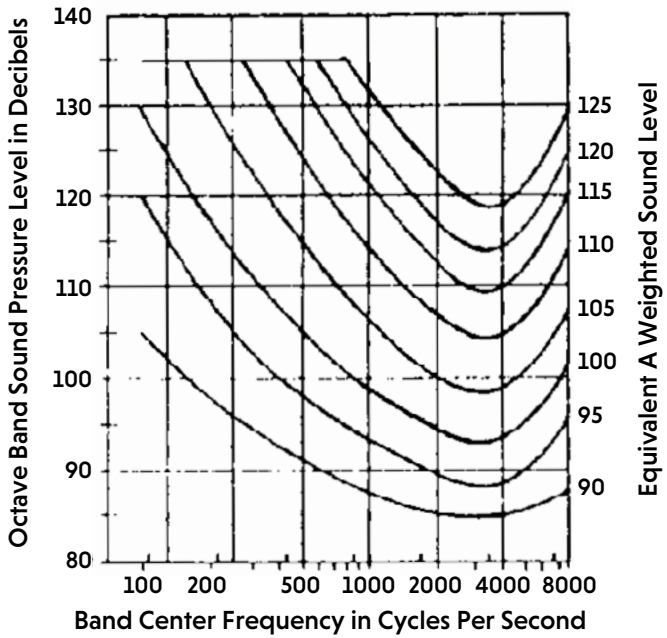


Industrial Noise & Hearing Loss: OSHA 1910.95(a), Part 1

History

The serious consequences of industrial noise have not been lost on OSHA. In March 1983, OSHA incorporated the Hearing Conservation Amendment (HCA) into its existing occupational noise exposure standard that had been enforced since 1974. The occupational noise exposure standard is located in 29 Code of Federal Regulations (CFR) 1910.95.



EQUIVALENT SOUND LEVEL CONTOURS Octave band sound pressure levels may be converted to the equivalent A-weighted sound level by plotting them on this graph and noting the A-weighted sound level corresponding to the point of highest penetration into the sound level contours. This equivalent A-weighted sound level, which may differ from the actual A-weighted sound level of the noise, is used to determine exposure limits from Table 1.G-16. *(Source: OSHA)*

Luckily, the Occupational Noise Exposure Standard is relatively user-friendly. Its thoroughness eliminates a great deal of "reader interpretation" that many standards require. This leaves it pretty clear-cut and easier to follow.

Implementing a three-pronged approach to address industrial noise exposure, the basic components consist of recognition, evaluation and control. Additionally, training and recordkeeping are used to support each of the standard's basic components. The importance of these support elements are extremely important in order for employers to stay in compliance.

Why Standard is Important

1910.95(a) part of the standard initiates and establishes a hearing conservation program to protect personnel from the effects of occupational noise exposure.

Occupational noise exposure is a significant health hazard and is present in almost all modern industrial workplaces. According to NIOSH, some 22 million workers are exposed to potentially damaging noise each year.

This number impacts both employees—who can potentially suffer permanent hearing loss due to exposure to excessive industrial noise levels—and employers, who can see profits reduced by increased costs of worker claims related to noise-induced hearing loss or injury.

Key Compliance Requirements

According to the OSHA website, "The Hearing Conservation Amendment to the OSHA Occupational noise exposure standard, 29 CFR 1910.95, requires that employers establish a hearing conservation program for employees whose noise exposures equal or exceed an 8-hour, time-weighted average (TWA) of 85 dBA."

Further, protection against the effects of noise exposure "shall be provided when the sound levels exceed those (shown in Table G-16) when measured on the A scale of a standard sound level meter at slow response. When noise levels are determined by octave band analysis, the equivalent A-weighted sound level may be determined in the chart, below.

Resources: (for further reading on standard 1919.95)

- 29 CFR 1910.95, Occupational noise exposure
- 29 CFR 1904.10, Recording criteria for cases involving occupational hearing loss
- 29 CFR 1910.1020, Access to employee exposure and medical records
- OSHA Instruction, PER 04-00-003-PER 8-2.5-CSHO Medical Examinations
- OSHA Instruction, PER 04-00-002-PER 8-2.4-CSHO Pre-Employment Medical Examination
- OSHA Technical Manual TED 01-00-015 [TED 1-0.15A]
- CPL-02-00-135, Recording Policies and Procedures Manual, 12/30/2004 or current update IHW

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More on Hearing Protection Training: A Deeper Dive into Standard 1910.95(a)

The Occupational Noise Exposure mandate (OSHA's 29 CFR 1910.95) requires employees exposed to 85dBA TWA be enrolled in the HCP. Employers are required to ensure employees participate in hearing conservation training for the duration of their employment. This should begin with initial orientation training, followed by annual reinforcement.

Section 1910.95(a) part of the standard initiates and establishes a hearing conservation program to protect personnel from the effects of occupational noise exposure. Here is a short look at the "what," "who," "how" and "when" of hearing conservation implementation.

What Should be Taught

29 CFR 1910.95 includes specific guidance as to what topic areas must be covered annually. The required topics can be broken into three groups of information:

1. The effects of noise on hearing
2. The purpose of hearing protectors; the advantages, disadvantages and attenuation of various types; and instructions on selection, fitting, use and care
3. The purpose of audiometric testing and an explanation of the test procedures

Who Should Be Trained

According to audiologists Dr. Vickie Tuten and Dr. Kathy Gates, all employees exposed to 85 dBA TWA, for even one day, need to be enrolled in the HCP. 85 dBA TWA is referred to as the action level (AL) under OSHA. The program must have at a minimum, annual testing, annual training and available hearing protection to enrolled employees. When employees reach the Permissible Exposure Limit (PEL) of 90dBA TWA, hearing protection is mandated. Annual education and training remain a constant throughout, once the AL is reached.

How to Conduct Training

Industrial hygienists are in a perfect position to provide formal training and impromptu education, when conducting area monitoring or dosimetry. Formal training should always be documented and records maintained, in case of an audit. Informal or impromptu education serves as great reinforcement to remind workers of the importance of adopting good hearing conservation practices, noted Drs. Gates and Tuten.

The training element is flexible and allows for creativity to be incorporated into the process. When you break the topics into the three groups of information listed above, the primary focus of the industrial hygienist would be to provide training on the "effects of noise on hearing" and "all things hearing protection."

The third required topic, "purpose of audiometric testing and explanation of test procedures," should be provided by the hearing technician at the time of the hearing test. The topic "effects of noise on hearing" can be delivered at any time. This could be covered during a formal training session or shared with workers while visiting individual worksites. Informal education sessions are "excellent opportunities to discuss the noise hazards being heard in participants' workplaces; how unprotected exposures to this noise hazard may result in a permanent injury/illness; and how properly worn hearing protection can mitigate the risk of a permanent hearing loss," stated Gates and Tuten.

When Training Should Occur

HCP training must be completed annually, and employers must ensure employee participation. The education and training element allows flexibility for the employer to provide the training at different times throughout the year, by any HCP team member. "There is not a requirement to discuss all mandated education and training topics in a single event; however, the mandatory topics need to be covered and employee attendance rosters maintained," stated Drs. Tuten and Gates. IHW

*[**Editor's note:** Much of the material used in this article first ran in* IHW*'s March/April 2021 issue in an article titled "Now Hear This: Right Steps for Hearing Conservation Training." For the entire article, go to https://industrialhygienepub.com/hearing/now-hear-this-right-steps-for-hearing-conservation-training/ .]*

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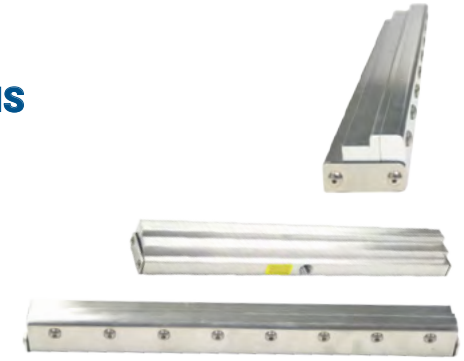

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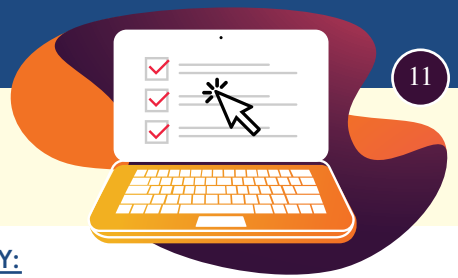

Preventing Fire & Dust Explosions: NFPA 654

"NFPA 654 is a great place to start when taking steps to identify hazards and developing action items designed to reduce risk within a facility handling explosible or combustible materials. There are NFPA codes specific to an industry, but NFPA 654 covers all other processes where combustible material is present." *Fauske & Associates, LLC., 1-877-328-7531, https://www.fauske.com/chemical-industrial/testing/combustible-dust*

History

NFPA 654, the "Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids," is an all-encompassing standard on how to design a safe dust collection system. This standard also points people to more direct standards that deal with different types of dust and explosion protection equipment.

In the U.S., OSHA and the National Fire Protection Association (NFPA) regulate combustible dust issues, each with its own area of responsibility. OSHA, together with local authorities, enforces the NFPA's combustible standards. OSHA's Combustible Dust National Emphasis Program (NEP) outlines policies and procedures for inspecting workplaces that create or handle combustible dusts that have the potential to cause a deflagration, fire or explosion.

The Standards Council of the National Fire Protection Association (NFPA), Quincy, Mass., issued the 2013 revision of the NFPA 654 "Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids." This standard applies to all combustible particulate solids or hybrid mixtures, regardless of concentration or particle size, where the materials present a fire or explosion hazard. The owners or operators of affected facilities are responsible for implementing the requirements.

Some of the changes in the past 15 years include administrative controls, such as safety-management practices; added training requirements for contractors and subcontractors; and incident investigation and reporting requirements. Important sections regarding housekeeping programs and hierarchy of clean-up operations also are included in the 2014 revision.

Incident history and statistics clearly indicate that secondary dust explosions—caused by inadequate housekeeping and excessive dust accumulations—have cause much of the damage and casualties experienced in major industrial dust explosions.

Why Standard is Important

Dust explosions are an ever-present risk faced by process plants that handle combustible powders or other bulk solids. To minimize this risk and provide plant officials with practical requirements to protect against dust explosions, NFPA, in August 2005, first revised NFPA 654 to include Best Engineering Practice designed to protect facilities from combustible dust explosions.

Combustible dust is any finely divided solid—such as flour, wood dust or coal dust—that will burn when dispersed in air and ignited. The standard identifies measures to be taken to avoid dust explosions by designing facilities and work practices that prevent the production and spreading of dust, as well as controlling ignition sources, and provides mitigation recommendations for explosions that cannot be prevented.

NFPA standards are typically adopted by state fire marshals, insurance companies and consultants. The standard applies to "all phases of the manufacturing, processing, blending, pneumatic conveying, repackaging and handling of combustible particulate solids or hybrid mixtures, regardless of concentration or particle size, where the materials present a fire or explosion hazard." (paragraph 1.1.1)

Key Compliance Requirements

The standard contains comprehensive guidance on the control of dusts to prevent explosions. The following are some of its recommendations:

- Minimize the escape of dust from process equipment or ventilation systems
- Use dust collection systems and filters
- Utilize surfaces that minimize dust accumulation and facilitate cleaning
- Provide access to all hidden areas to permit inspection
- Inspect for dust residues in open and hidden areas, at regular intervals
- Clean dust residues at regular intervals
- Use cleaning methods that do not generate dust clouds, if ignition sources are present
- Only use vacuum cleaners approved for dust collection
- Locate relief valves away from dust hazard areas
- Develop and implement a hazardous dust inspection, testing, housekeeping & control program (preferably in writing, with established frequency & methods)

When all of the recommendations of NFPA 654 are met and the potential for dust explosions is still present, an explosion-prevention system should be implemented where needed. IHW

Resources:

➔ To purchase the standard, go to the NFPA catalog online store: https://tinyurl.com/h4eb48n5

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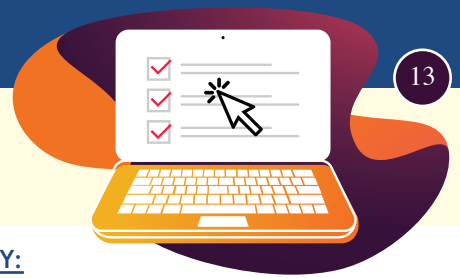

Occupational Health & Safety Management—ISO 45001:2018

"ASSP is the administrator of the technical advisory group (TAG) to ANSI for the ISO TC-283 Committee, the global group responsible for the ISO 45001 OHSMS standard. This role reflects our position as a global champion of these systems and our advocacy for the importance of effective safety management overall." *Tim Fisher, CSP, CHMM, CPEA, CAE, ARM, STS, FASSP Director, Standards Development and Technical Services*

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History

Occupational safety and health (OH&S) management systems help organizations continuously identify and eliminate safety and health risks; reduce incident potential; comply with regulations; and implement risk-reducing interventions.

ISO 45001 is the first standard of its kind, and it includes decades of health and safety regulations and best practices, blending them into the familiar and effective format of the ISO standard for management and improvements.

Adopting a risk-based approach from ISO and drawing requirements from the former benchmark, OHSAS 18001, the program follows previously set benchmarks of the International Labor Organization (ILO). It also helps create an effective path to ongoing safety awareness and improvement.

Not surprisingly, the major focus of 45001 is the necessity of top-down leadership through implementation and continued compliance. This is arguably the most important standard to employ this requirement, which asks executive leadership to commit themselves to employee safety.

Why Standard is Important

ANSI/ASSP/ISO 45001 is a global standard for OS&H management systems that provides practical solutions for worker safety. It can help create a global foundation of worker safety standards and inspections that can be used by all global supply chains, for all industries, and covers contractors and subcontractors in every country that supply products into these supply chains.

The standard provides a framework from which occupational safety and health objectives can be effectively managed—thus serving the needs of those who manage, use or benefit from global supply chains. Certifying to ISO 45001 can help drive solutions for improving organizational safety performance, assessing and eliminating risk, and increasing productivity. All organizations, regardless of industry, should prioritize employee health, safety and general well-being.

Through ISO 45001, worker productivity and morale can be improved and enhanced. This happens by focusing industry-best health and safety practices. With the implementation of ISO 45001, companies can be on the forefront of best practices.

Key Compliance Requirements

Increased attention to employee health and safety means increases in regulations and legal compliance. The ISO 45001 certification process provides an avenue for companies not only to understand how regulatory and statutory requirements can impact a business, but also how to create processes and programs to satisfy all of the requirements.

ISO 45001:2018, specifically, is applicable to any organization that wishes to establish, implement and maintain an OH&S management system to improve occupational health and safety; eliminate hazards and minimize OH&S risks (including system deficiencies); take advantage of OHS opportunities; and address OH&S management system non-conformities associated with its activities.

According to iso.org, the 2018 addition to the standard also helps an organization "to achieve the intended outcomes of its OH&S management system."

Consistent with the organization's OH&S policy, the intended outcomes of an OHS management system include:

- Continual improvement of OH&S performance
- Fulfilment of legal requirements and other requirements
- Achievement of OH&S objectives

Further, ISO 45001:2018 is applicable to any organization regardless of its size, type or activities. It is applicable to the OH&S risks under the organization's control, taking into account factors like the context in which the organization operates, and the needs and expectations of its workers and other interested parties.

The 2018 standard does not state specific criteria for OH&S performance, nor is it prescriptive about the design of an OH&S management system. ISO 45001:2018 enables an organization, through its OH&S management system, to integrate other aspects of health and safety, such as worker well-being.

The standard does not address issues such as product safety, property damage or environmental impacts, beyond risks to workers and other relevant interested parties.

In addition, according to the standard, "ISO 45001:2018 can be used in whole or in part to systematically improve occupational health and safety management. However, claims of conformity to this document are not acceptable unless all its requirements are incorporated into an organization's OH&S management system and fulfilled without exclusion." IHW

Resources:

- For purchasable downloads and certification information, visit ASSP's website: https://www.assp.org/standards/standards-topics/osh-management-iso-45001
- For an abstract of the ISO 45001:2018 standard: https://www.iso.org/standard/63787.html

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Occupational Exposure Limit Values

"At ACGIH, we push OEHS professionals to utilize the most up-to-date and scientifically sound information when making decisions. To draw parallels with compliance and the progress toward worker health protection, we offer the Occupational Exposure Values guide: a side-by-side comparison of our industry-leading Threshold Limit Values and those occupational exposure values mandated and recommended by governments around the world." *Phillip Rauscher MPH, CIH, CSP, Senior Director of Science, Education & Publications, ACGIH*

History & Background

An occupational exposure limit (OEL) is an upper limit on the acceptable concentration of a hazardous substance in workplace air for a particular material or class of materials. Therefore, knowing the limits is an important tool in risk assessment and in the management of activities involving handling of dangerous substances. (There are many dangerous substances for which there are no formal occupational exposure limits. In such cases, hazard- or control-banding strategies can be used to ensure safe handling.)

Historically, OELs have been established for airborne workplace chemicals by multiple regulatory and authoritative organizations around the world for more than 60 years. Given the changing regulatory arena; shifting centers of manufacturing growth; and the move towards a more global view on occupational hygiene issues, it is important that occupational/industrial hygienists understand the current and growing issues impacting the continued viability of OELs in professional practice.

OSHA has established three types of permissible/recommended exposure limits:

- Indicative limit value, set by the European Union
- Threshold limit value, set by the American Conference of Governmental Industrial Hygienists
- Occupational exposure banding, a process that can be used when not enough data are available to determine quantitative exposure limits

Key Components of the Guide

The Guide to Occupational Exposure Values is a readily accessible reference for comparison of published values from ACGIH®;(OSHA); the U.S. National Institute for Occupational Safety and Health (NIOSH); Deutsche Forschungsgemeinschaft (DFG), Federal Republic of Germany, Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area; the American Industrial Hygiene Association (AIHA); and Occupational Alliance for Risk Science (OARS). Included in the guide are the sources of the values cited, including publication dates, and the uniform resource locator (URL) if verified online (Reviewed 2019).

The Guide to Occupational Exposure Values also includes those carcinogens found in the occupational environment that are identified by the above organizations and by the U.S. Environmental Protection Agency (EPA), the International Agency for Research on Cancer (IARC) and the U.S. National Toxicology Program (NTP).

The Guide to Occupational Exposure Values is intended as a companion document to the *ACGIH annual Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* (TLVs® and BEIs®) book, specifically the section on "TLVs for Chemical Substances in the Work Environment."

This companion document to the ACGIH TLVs and BEIs book serves as a readily accessible reference for comparison of the most recently published values: 2021 Chemical Substance TLVs from ACGIH; AIHA/OARS Workplace Environmental Exposure Limits (WEELs); the OSHA Final Rule PELs; RELs from NIOSH; MAKs from the German Commission for the Investigation of Health Hazards of Chemical Compounds in the Workplace; and carcinogenicity designations from ACGIH, OSHA, NIOSH, MAK, IARC, U.S. NTP, and U.S. EPA. The book includes a CAS number index. IHW

Resources:

- ACGIH - www.acgih.org (publications store: https://portal.acgih.org/s/store#/store/browse/cat/a0s4W00000g02f3QAA/tiles)

In addition to those sources noted above, the following were also used in preparing the Guide (Reviewed 2021).

- U.S. EPA Integrated Risk Information System (IRIS) database. A–Z List of Substances. Online at: https://cfpub.epa.gov/ncea/iris2/atoz.cfm
- Agents Classified by the IARC Monographs, Volumes 1–124. IARC, Lyon, France (1987–2020). Available online at: http://monographs.iarc.fr/agents-classified-by-the-iarc/ (Reviewed 2020)
- Report on Carcinogens, 14th Ed., U.S. Department of Health and Human Services, Public Health Service, National Toxicology Program, Research Triangle Park, NC (2016). Available online at: http://ntp.niehs.nih.gov/pubhealth/roc/index-1.html (Reviewed 2016).

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2021 TLVs and BEIs

Used worldwide, this year's pocket-sized book introduces the first TLV specifically for a nano-sized particle – included on the NIC for titanium dioxide. This TLV is of vital importance as the use of nano-sized TiO_2 continues to expand within the green energy and consumer product markets.

2021 TLVs and BEIs with 9th Edition Documentation

This digital resource includes scientific data from which particular TLVs or BEIs are derived, along with summaries and evaluations. Knowing the basis of each TLV and BEI, as described in its Documentation, is essential to the application of specific TLVs or BEIs.

2021 Guide to Occupational Exposure Values

An essential companion to the *TLVs and BEIs* book, the Guide includes comparisons of the most recently published values: 2021 Chemical Substance TLVs from ACGIH; AIHA/OARS WEELs; the OSHA Final Rule PELs; RELs from NIOSH; MAKs from the German Commission for the Investigation of Health Hazards of Chemical Compounds in the Workplace; and carcinogenicity designations from ACGIH, OSHA, NIOSH, MAK, IARC, U.S. NTP, and U.S. EPA.

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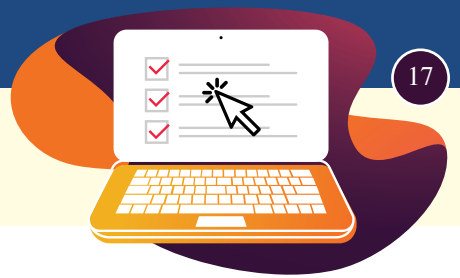

Chemical Protective Gloves

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Background/History

Chemical protective gloves must meet the requirements of European standard EN 374. This standard was modified substantially in 2016. These changes became effective once they were published in the *Official Journal of the European Union*.

EN 374 has several parts. Part one, officially referred to as EN ISO 374-1:2016, states: "Protective gloves against dangerous chemicals and microorganisms—Part 1: Terminology and performance requirements for chemical risks."

Updates to Standard (2016)

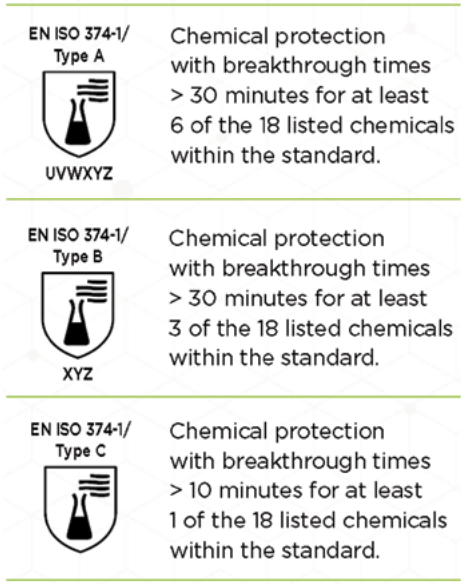
The changes that have occurred can be summarized by comparison, below.

Previous standard language (EN 374-1:2003):

- "Protective gloves against chemicals and micro-organisms"
- Assumption of protection against micro-organisms
- 12 test chemicals
- Beaker for "waterproof protective gloves with limited protection against chemical dangers"
- Labeling on product should be a pictogram of conical flask with a minimum of 3 letters for test chemicals

The new standard, as of 2016, on the other hand, changes some of the language and also adds more specificity:

- "Protective gloves against dangerous chemicals and micro-organisms"
- Removal of reference to micro-organisms in the text (now part of part 5)
- Number of test chemicals increased from 12 to 18
- Beaker no longer used
- Gloves are classified as types A, B or C



Graphic courtesy Chem Rest (Showa)

- Change of labelling on the product now should depict a pictogram of conical flask with differing number of letters for test chemicals per type

The test chemicals have also increased in number. The test catalogue was extended as per the new 2016 standard. The chemicals with code letters from M to T are new, and now include nitric acid (65%), acetic acid (99%), ammonium hydroxide (25%), hydrogen peroxide (30%), hydrofluoric acid (40%) and formaldehyde (37%).

Marked for Protection

You can identify a glove's chemical protection performance by looking at the Type at the top of the pictogram and the letters underneath it. The Type will tell you how many of the 18 chemicals listed in the table were tested with the glove to check its performance, as well as the expected minimal length of the protection against these chemicals. The Letter code denotes the tested chemicals within the EN 374 standard.

The markings for protective gloves was also updated, as follows:

- **Type A:** Protective glove with permeation resistance of at least 30 minutes each for at least six test chemicals.
- **Type B:** Protective glove with permeation resistance of at least 30 minutes each for at least three test chemicals.
- **Type C:** Protective glove with permeation resistance of at least 10 minutes for at least one test chemical.

Most chemical protective gloves can be assigned to type class A; only thin, disposable protective gloves will be assigned to types B and C.

Why 2016 Changes are Important

The 2016 EN ISO 374 standard ensures consistency in testing and helps users and safety professionals determine their chemical protection needs. The revised requirements are reflected in pictograms that appear on gloves and on glove dispenser boxes certified for chemical and micro-organism exposure. IHW

Resources:

According to the ISO website, "ISO 374-1:2016 specifies the requirements for protective gloves intended to protect the user against dangerous chemicals and defines terms to be used. If other protection features have to be covered, e.g., mechanical risks, thermal risks, electrostatic dissipation etc., the appropriate specific performance standard is to be used in addition. Further information on protective gloves standards can be found in the EN 420."

To purchase the standard, go to https://www.iso.org/standard/66421.html

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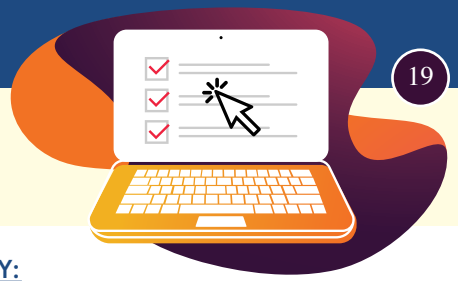

OSHA's General Industry Regulation:
29 CFR 1910.146, Permit-Required Confined Spaces

"You can't overstate the impact the confined space legislation has had on the safety of workers. Before the standard was implemented, there was no guidance on gas detection. Few workers carried gas monitors, and there was little concern over entering a confined space. Today, everything is different. This standard gives greater visibility into gas hazards and initiated a focus on safety that has paved the way for similar legislation around the world." -*Dave Wagner, Director of Applications Engineering and Product Knowledge, Industrial Scientific, www.indsci.com*

History

OSHA issued a general industry standard (29 CFR 1910.146) on January 14, 1993, to require protection for employees who enter permit-required confined spaces. The permit space standard, which provides a comprehensive regulatory framework for the safe performance of entry operations in general industry workplaces, became effective April 15, 1993.

Why Standard is Important

OSHA's *Permit-Required Confined Spaces* manual overviews this standard, stating: "Many workplaces contain spaces that are considered to be 'confined,' because their configurations hinder the activities of employees who must enter into, work in or exit from them. Due to the work environment, employees who perform tasks in confined spaces also face increased risk of exposure to serious physical injury from hazards, such as entrapment, engulfment and hazardous atmospheric conditions."

Confinement itself may pose entrapment hazards, and work in confined spaces may keep employees closer to hazards, such as machinery components, than they would be otherwise. The terms "permit-required confined space" and "permit space" refer to spaces that meet OSHA's definition of a "confined space" and contain health or safety hazards. For this reason, OSHA requires workers to have a permit to enter these spaces.

Key Compliance Requirements

According to osha.gov, OSHA's standard for confined spaces (29 CFR 1910.146) contains the requirements for practices and procedures to protect employees in general industry from the hazards of entering permit spaces. Employers in general industry must evaluate their workplaces to determine if spaces are permit spaces. If a workplace contains permit spaces, the employer must inform exposed employees of their existence, location and the hazards they pose. This can be done by posting danger signs, such as "DANGER—PERMIT-REQUIRED CONFINED SPACE—AUTHORIZED ENTRANTS ONLY" or using an equally effective means.

"This standard gives greater visibility into gas hazards and initiated a focus on safety that has paved the way for similar legislation around the world."

If employees are not to enter and work in permit spaces, employers must take effective measures to prevent them from entering these spaces. If employees are expected to enter permit spaces, the employer must develop a written permit space program and make it available to employees or their representatives.

As an alternative to a full permit entry under certain conditions described in the standard, the employer may use alternate procedures for worker entry into a permit space. For example, if an employer can demonstrate with monitoring and inspection data that the only hazard is an actual or potential hazardous atmosphere that can be made safe for entry using continuous forced-air ventilation, the employer may be exempted from some requirements, such as permits and attendants. However, even in these circumstances, the employer must test the internal atmosphere of the space for oxygen content; flammable gases and vapors; and the potential for toxic air contaminants—before any employee enters it. The employer must also provide continuous ventilation and verify that the required measurements are performed before entry. IHW

Resources:

- OSHA offers help and training through several programs, including technical assistance about effective safety and health programs, state plans, workplace consultations, voluntary protection programs, strategic partnerships, training and education.
- For a complete detailed on this standard, go to https://bit.ly/2re6oei.
- For an article on gas detection in confined spaces, see "Gas Detection and Monitoring in Confined Spaces," *Workplace Material Handling & Safety*, March 2018. Go to workplacepub.com for more on this and many other safety topics.

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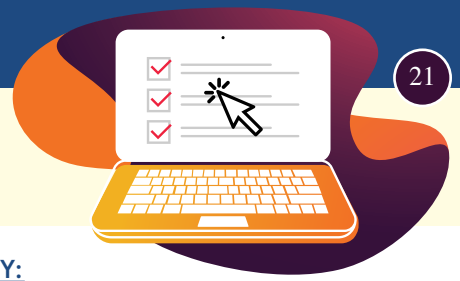

ANSI/ASSP EHS Training Standard Z490

"Vector Solutions sees the ANSI/ASSP Z940 standards on EHS training as incredibly valuable resources for everyone involved in EHS training—training producers like ourselves, EHS managers, people vetting EHS training before licensing it, training deliverers with deep content expertise but less training expertise, and more." *Vector Solutions, 866-733-0790, www.vectorsolutions.com*

History

ANSI stands for the American National Standards Institute, which helps to create national standards for many different safety issues. ASSP (American Society of Safety Professionals) works with ANSI to create national standards related to safety and health, including the Z490 EHS Training.

There are two Z490 EHS Training standards. Z490.1 addresses all EHS training, no matter the delivery method (instructor-led, online, etc.), while Z490.2 addresses online EHS training. Z490.2 supplements/complements Z490.1; it is not meant as a replacement.

Why Standard is Important

The OSHA standard establishes the requirement for workplace health and safety training, as safety training helps build a positive safety culture and is an important, integral part of an effective safety management system. ANSI/ASSP Z 490.1 provides the best training practices for effective training programs. The trainings listed in the OSHA standards are mandatory. However, although following ANSI/ASSP Z490.1 is not mandatory, it is an excellent guide to the effective implementation of an EHS training program.

The ANSI/ASSP Z490.2-2019 "Accepted Practices for E-Learning in Safety, Health and Environmental Training" standard's purpose is to provide accepted practices for e-learning in safety, health and environmental training programs.

This standard establishes criteria for e-learning as part of safety, health and environmental training programs, including program management, development, delivery, evaluation and documentation. This standard is intended to complement ANSI/ASSP Z490.1, "Criteria for Accepted Practices in Safety, Health and Environmental Training." As such, all criteria in ANSI/ASSP Z490.1 apply. Only criteria unique to or particularly relevant to e-learning are presented in this standard. As stated above, it is important to note that Z490.2 isn't meant to replace Z490.1. Instead, it's meant to supplement Z490.1 on issues related to online training. All that is stated in in Z490.1 is still true for online EHS training.

Key Compliance Requirements

The "meat" of Z490.1 is a commonly used training design and development methodology known as ADDIE. Each of the five letters stands for a step in the process: A = Analysis; D = Design; D = Development; I = Implementation; and E = Evaluation.

Analysis—Analysis begins with identifying the problem and its cause. This includes analysis of the organization, to understand its goals and align training with those goals; analysis of the learners, to identify their prior knowledge and skills, job roles, learning preferences, schedules and other factors

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(language fluency, physical disabilities, learning disabilities, etc.) that would influence their success in training; and analysis of the job task(s), to design training appropriate to the job workers perform in the field.

Design—Design includes creating performance-based learning objectives; determining the criteria for successful completion of the training; creating the assessments workers must complete after the training; determining appropriate content and instructional activities to help workers satisfy the learning objectives; choosing the appropriate training delivery methods/media; determining the proper sequence of training; and breaking the training experience, content and activities down to easily learned "chunks."

Development—Development includes the creation of the training materials (i.e., workbooks or any other materials needed during the training), reference materials for workers to take with them after training and job aids for workers to use in the field at the moment of need. Development also includes a small beta test of the training materials to a learner population that's similar to the larger learner population that will have to complete the training (and then any necessary revisions).

Implementation—Implementation involves scheduling the training; notifying workers and their managers of the training; and explaining to managers how they can support workers in their efforts to apply the training later on the job. Implementation also includes delivering the training to the learners.

Evaluation—Evaluation determines if training was effective. There are multiple training evaluation models, including the Kirkpatrick, Brinkerhoff, Kaufman and Phillips models (as well as the newer Thalheimer/LTEM model). The Kirkpatrick four-level training evaluation model is the basis of the evaluation method explained in Z490.1. IHW

Resources:

- Vector Solutions offers a useful guide: Effective EHS Training: A Step-by-Step Guide Effective: https://bit.ly/3wVJOnF
- ANSI STORE: https://bit.ly/3qsldEz
- Visit ASSP's website for the standard and training tips:
  - Standard: https://www.assp.org/standards/standards-topics/osh-training-z490
  - Training Tips: https://bit.ly/3gT6wap

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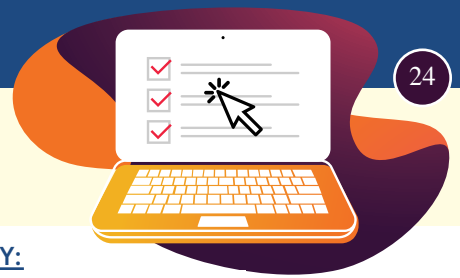

Heat Stress Guide for Employers

"Heat-related illnesses are preventable with the right tools and controls. At TSI, our mission is to provide trusted measurement, application guidance and data analysis analytics that enable our customers to make informed decisions. QUESTemp° Heat Stress Monitors deliver high-performance monitoring of heat stress factors using Wet Bulb Globe Temperature sensing technology." *Steve Graf, Quest Global Product Manager, TSI, steve.graf@tsi.com, 651-703-5848*

History

OSHA does not have a specific standard that covers working in hot environments. Nonetheless, under the OSH Act, employers have a duty to protect workers from recognized serious hazards in the workplace, including heat-related hazards. *The Heat Index: A Guide for Employers* was created to help employers and worksite supervisors prepare and implement hot weather plans. This guide explains how to use the heat index to determine when extra precautions are needed at a worksite, with the goal to protect workers from environmental contributions to heat-related illness.

Why Standard is Important

Outdoor workers exposed to hot and humid conditions can be at risk of heat-related illness. The risk of heat-related illness becomes greater as the weather gets hotter and more humid. The combination of both air temperature and humidity affect how hot outdoor workers feel in hot-weather conditions.

Employers need to take into consideration the "heat index," which is a single value that takes both temperature and humidity into account. The higher the heat index, the hotter the weather feels. The heat index is considered a better measure than air temperature alone for estimating the risk to workers from environmental heat sources.

- NOAA issues extreme-heat advisories to indicate when excessive, extended heat will occur. The advisories are based mainly on predicted heat index values:
- Excessive Heat Outlook: issued when the potential exists for extended excessive heat (heat index of 105-110°F) over the next 3-7 days. This is a good time to check on supplies, such as extra water coolers, and refresh worker training.
- Excessive Heat Watch: issued when excessive heat could occur within the next 24-72 hours, but the timing is uncertain.
- Excessive Heat Warning: issued when the heat index will be high enough to be life-threatening in the next 24 hours. This warning indicates that the excessive heat is imminent or has a very high probability of occurring.
- Excessive Heat Advisory: similar to an Excessive Heat Warning, but less serious. This is issued when the heat index could be uncomfortable or inconvenient but is not life-threatening if precautions are taken.

Key Compliance Requirements

Extra measures, including implementing precautions at the appropriate risk level, are necessary for reducing the risk of heat stress for employees working outdoors in extreme heat. The employer's response at the four risk levels is the subject of the remainder of OSHA's guidelines. The steps employers should take in response to an elevated heat index are the same type of steps that they would follow to address other hazards in the workplace:

- Develop an illness-prevention plan for outdoor work based on the heat index.
- Train your workers how to recognize and prevent heat-related illness. Train workers about safe work practices before heat index levels go up. Workers should be prepared, so they recognize the signs and symptoms of heat-related illness; how to prevent it; and what to do if someone is demonstrating symptoms.
- Track the worksite heat index daily; communicate it and the required precautions to workers. Knowing how hot it will be during scheduled work activities can help to determine which preventive measures should be taken in preparation.
- Implement your plan; review and revise it throughout the summer.

It is suggested that workers are trained before hot outdoor work begins, and training can be more effective if it is matched to job tasks and conditions and is reviewed and reinforced throughout hot weather conditions. The following OSHA-suggested training topics might be addressed in one session or in a series of shorter sessions:

- Risk factors for heat-related illness
- Different types of heat-related illness, including how to recognize common signs and symptoms
- Heat-related illness prevention procedures
- Importance of drinking small quantities of water often
- Importance of acclimatization; how it is developed; and how your worksite procedures address it
- Importance of immediately reporting signs or symptoms of heat-related illness to the supervisor
- Procedures for responding to possible heat-related illness
- Procedures to follow when contacting emergency medical services
- Procedures to ensure that clear and precise directions to the worksite will be provided to emergency medical services IHW

Resources:

➔ You can find more about information about heat stress at *Using the Heat Index: A Guide for Employers* https://bit.ly/34v0nYJ or, for training documents, you can visit https://bit.ly/2M6Eto9.

OSHA' Critical Actions for Heat Risk

According to OSHA*, the most critical actions employers should take to help prevent heat-related illness at each risk level:

Heat Index: <91°F
Risk Level: Lower-Caution
Suggested Measures:

- Provide drinking water
- Ensure that adequate medical services are available
- Plan ahead for times when heat index is higher, including worker heat-safety training
- Encourage workers to wear sunscreen
- Acclimatize workers

If workers must wear heavy protective clothing, perform strenuous activity or work in the direct sun, additional precautions are recommended to protect workers from heat-related illness.

Heat Index: 91°-103°F
Risk Level: Moderate
Suggested Measures:
In addition to the steps listed above:

- Remind workers to drink water often (about four cups/hour)
- Review heat-related illness topics with workers: how to recognize heat-related illness; how to prevent it; and what to do if someone gets sick
- Schedule frequent breaks in a cool, shaded area
- Acclimatize workers
- Set up buddy system/instruct supervisors to watch workers for signs of heat-related illness

If workers must wear heavy protective clothing, perform strenuous activity or work in the direct sun, additional precautions are recommended to protect workers from heat-related illness.

- Schedule activities at a time when the heat index is lower
- Develop work/rest schedules

Monitor workers closely

Heat Index: 103°-115°F
Risk Level: High
Suggested Measures:
In addition to the steps listed above:

- Alert workers of high-risk conditions
- Actively encourage workers to drink plenty of water (about four cups/hour)
- Limit physical exertion (e.g., use mechanical lifts)
- Have a knowledgeable person at the worksite who is well-informed about heat-related illness and able to determine appropriate work/rest schedules
- Establish and enforce work/rest schedules
- Adjust work activities (e.g., reschedule work, pace/rotate jobs)
- Use cooling techniques
- Watch/communicate with workers at all times

When possible, reschedule activities to a time when heat index is lower

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Heat Index: >115°F
Risk Level: Very High-Extreme
Suggested Measures:
Reschedule non-essential activity for days with a reduced heat index or to a time when the heat index is lower

Move essential work tasks to the coolest part of the work shift; consider earlier start times, split shifts, or evening and night shifts.

Strenuous work tasks and those requiring the use of heavy or non-breathable clothing or impermeable chemical protective clothing should not be conducted when the heat index is at or above 115°F.

If essential work must be done, in addition to the steps listed above:

- Alert workers of extreme heat hazards
- Establish water drinking schedule (about four cups/hour)
- Develop and enforce protective work/rest schedules
- Conduct physiological monitoring (e.g., pulse, temperature, etc.)

Stop work if essential control methods are inadequate or unavailable.

*This chart is available online at http://www.osha.gov/SLTC/heatillness/heat_index/.

DATA DOESN'T WAIT FOR SYMPTOMS

When it comes to worker exposure to heat, don't wait for symptoms to drive your decisions. TSI QUESTemp° Heat Stress Monitors put information in your hands to keep heat stress events from occurring.

Our instruments provide intuitive monitoring using WBGT sensing technology, giving you the knowledge to help you properly rest, hydrate and acclimate your workers.

That means understanding dangerous environments and protecting your workers before symptoms arise.

Visit tsi.com/heat-stress to learn more about the risks of workplace heat exposure.

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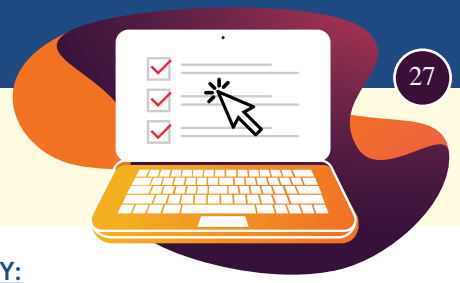

Crystalline Silica General Industry and Maritime Standard

History

Dust control efforts can include HEPA-filtered vacuuming; wet methods that apply water at the point where silica dust is made; local exhaust ventilation that removes silica dust at or near the point where it is made; and enclosures that isolate the work process or the worker.

Workers must not allow dry sweeping or dry brushing where they could contribute to employee exposure to respirable crystalline silica, unless methods like the ones mentioned above are not feasible. In addition, employers must not allow compressed air to be used to clean clothing or surfaces unless (1) the compressed air is used in conjunction with a ventilation system that effectively captures the dust cloud created by the compressed air; or (2) no alternative method is feasible.

Why Standard is Important

Crystalline silica is all around us: in sand, stone, concrete and mortar. This common mineral found in the earth's crust is also used to make products such as glass, pottery, ceramics, bricks and artificial stone.

However, when it's turned into tiny particles by workplace activities like cutting, sawing, grinding, drilling and crushing stone, rock, concrete, brick and mortar, crystalline silica becomes respirable—and dangerous to human health.

Approximately 2.3 million people in the U.S. are exposed to respirable crystalline silica at work. Exposure can occur during the manufacture of glass, pottery, ceramic, brick, concrete, asphalt roofing, jewelry, artificial stone, dental, porcelain or structural clay products; the use of industrial sand in operations such as foundry work and hydraulic fracturing; and the use of sand for abrasive blasting (e.g., maritime operations).

Breathing in very small crystalline silica particles can cause a number of life-altering and life-threatening diseases. Silicosis, which results in scar tissue forming on the lungs, is incurable and can be fatal. It typically occurs after 15–20 years of occupational exposure to respirable crystalline silica. Because silicosis affects the immune system, it increases the risk of lung infections, such as tuberculosis. Exposure to respirable crystalline silica increases the risk of developing lung cancer, in which abnormal cells grow uncontrollably into tumors, interfering with lung function and often metastasizing to other parts of the body. Chronic obstructive pulmonary disease (COPD) causes shortness of breath due to difficulty breathing air into the lungs. It is usually irreversible. Exposure to respirable crystalline silica is also related to kidney failure, the development of autoimmune disorders and cardiovascular impairment.

Key Compliance Requirements

1910.1053 requires employers to:

- Determine the amount of silica that workers are exposed to if it is, or may reasonably be expected to be, at or above the action level of 25 µg/m3 (micrograms of silica per cubic meter of air), averaged over an 8-hour day.
- Protect workers from respirable crystalline silica exposures above the permissible exposure limit (PEL) of 50 µg/m3, averaged over an 8-hour day.
- Limit access to areas where workers could be exposed above the PEL.
- Use dust controls and safer work methods to protect workers from silica exposures above the PEL.
- Provide respirators to workers when dust controls and safer work methods cannot limit exposures to the PEL.
- Establish and implement a written exposure control plan that identifies tasks that involve exposure and methods used to protect workers.
- Restrict housekeeping practices that expose workers to silica, such as use of compressed air without a ventilation system to capture the dust and dry sweeping, where effective, safe alternatives are available.
- Offer medical exams—including chest X-rays and lung function tests—every three years to workers exposed at or above the action level for 30 or more days per year.
- Train workers on the health effects of silica exposure, workplace tasks that can expose them to silica and ways to limit exposure.
- Keep records of workers' silica exposure and medical exams. IHW

Resources:

- Details of the standard's requirements can be found at: https://tinyurl.com/yxu49g8l and FAQs about it at: www.osha.gov/silica-crystalline/general-industry-info.
- For specifics on the construction aspect of this standard, go to: https://www.osha.gov/silica-crystalline/construction

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Respiratory Protection: OSHA's 1910.134

"The purpose of the OSHA Respiratory Protection Standard 29 CFR 1910.134 is to provide a guideline in establishing an effective, written respiratory program. Where engineering controls are not feasible or are not sufficient to maintain compliance, respirators are an effective method of protection when properly selected and worn. Currently listed as #3 on OSHA's Top 10 most frequently cited violations, over 2,629 businesses were cited for respiratory protection violations in 2020. Providing a clean and compliant workplace doesn't need to be complicated. Following OSHA's standard allows you to establish and implement an effective respiratory program. Miller offers respiratory and weld fume solutions when exploring considerations within the OSHA Hierarchy of Controls, helping to ensure that your workplace safety is maximized and compliance is maintained." – *Kathi Abshire, Welding Safety Solutions Manager, Miller Welding, www.millerwelds.com*

History/Background

OSHA's Respiratory Protection Standard 29 CFR 1910.134 applies to general industry, construction, shipyards, marine terminals and longshoring. In keeping with many of OSHA's other standards, 1910.134 identifies engineering controls as the primary means of limiting employees' exposure to a workplace hazard—in this case, airborne contaminants.

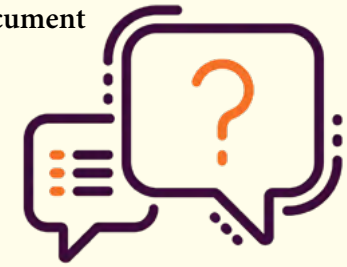
When engineering controls aren't feasible, respirators must be provided to employees, free of charge. A respirator is a protective facepiece, hood or helmet that is designed to protect the wearer against a variety of harmful airborne agents. Respirator selection depends upon the hazards to which the worker is exposed (i.e., insufficient oxygen environments, harmful dusts, fogs, smokes, mists, gases, vapors and sprays). These hazards may cause cancer, lung impairment, diseases or death.

Why Standard is Important

Respirators protect the user in two basic ways: by removing contaminants from the air or by supplying clean, respirable air from another source. The first category includes particulate respirators that filter out airborne particles and air-purifying respirators with cartridges/canisters, which filter out chemicals and gases. In the second category are airline respirators, which use compressed air from a remote source, and self-contained

FAQS

Here are some of the frequently asked questions OSHA addresses on a document available on its website (https://tinyurl.com/y9bn4zbc).



Q Why is a formal respirator program needed?
A respirator program increases the chances of using a respirator correctly. A respirator will only protect if it is used correctly.

Q What can be done if an employee has an unusual face size and has trouble being fit-tested for a respirator?
Manufacturers make several different sizes. Respirators may also vary in size from manufacturer to manufacturer. Users may be able to get a better fit by trying a respirator made by another manufacturer. In some cases, the use of powered air-purifying respirators may be appropriate. Employers must help employees find a suitable respirator.

Q Can a respirator be used by more than one person? How often should it be cleaned and disinfected?
Disposable respirators cannot be disinfected and are therefore assigned to only one person. Disposable respirators must be discarded if they are soiled, physically damaged or reach the end of their service life. Replaceable filter respirators may be shared, but must be thoroughly cleaned and disinfected after each use, before being worn by a different person. IHW

breathing apparatus (SCBA), which include their own air supply.

OSHA estimates that compliance with its respiratory standard could avert hundreds of deaths and thousands of illnesses annually.

Key Compliance Requirements

OSHA requires employers to implement and maintain a respiratory protection program that will be overseen by a qualified program administrator. In addition to respirators, the program must also provide employees with training on how to use the respirators and medical evaluations. Respirators used must be certified by the National Institute for Occupational Safety and Health (NIOSH). OSHA specifies the types of respirators approved for "immediately dangerous to life or health" (IDLH) atmospheres and for non-IDLH atmospheres.

Employers must identify and evaluate the respiratory hazards in the workplace, including a reasonable estimate of employee exposures and identification of the contaminant's chemical state and physical form. Where exposure cannot be identified or reasonably estimated, the atmosphere shall be considered immediately dangerous to life or health (IDLH).

A medical evaluation must be conducted by a physician or other licensed healthcare professional (PLHCP) in order to determine an employee's ability to use a respirator. The employer must obtain a written recommendation regarding the employee's ability to use the respirator from the PLHCP.

Additional medical evaluations are required under certain circumstances, i.e., if an employee reports medical signs or symptoms related to respirator use; or changes occur in workplace conditions that might substantially increase the physiological burden on an employee.

All employees using a tight-fitting, facepiece respirator must pass a fit test prior to initial use and at least annually thereafter. The employer must provide for the cleaning and disinfecting, storage, inspection and repair of respirators used by employees. The cleaning and disinfecting must be done before being worn by different individuals (if a respirator is issued to more than one employee) and after each use for emergency use respirators and those used in fit-testing and training. IHW

Resources:

- To view the complete standard, go to www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.134
- For many articles on this topic, go to *IHW*'s website (https://industrialhygienepub.com/) and type "respiratory protection" into the search box.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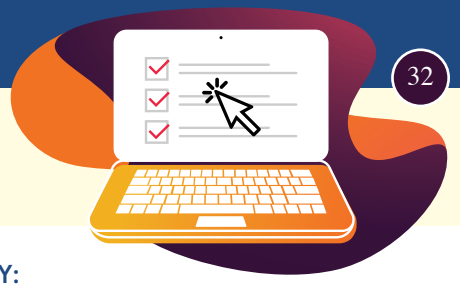

Emergency Eyewash & Shower Equipment: ANSI/ISEA Z358.1-2014

"Standards provide guidance so various groups understand both expectations and their purpose. ANSI Z358.1 explains what is needed to provide a safe environment and the minimum [required] to maintain that safety. Green Gobbler Safety is grateful to play a small part in making the work environment a safe environment." *Green Gobbler Safety, greengobblersafety.com*

History

Emergency eyewash stations, as well as shower equipment, are addressed by ANSI/ISEA Z358.1-2014: American National Standard for Emergency Eyewash and Shower Equipment. This standard, written and published by the International Safety Equipment Association (ISEA), an ANSI-accredited standards developing organization, establishes minimum performance and use guidelines for eyewash and shower equipment for the emergency treatment of the eyes or body of someone who has been exposed to hazardous materials.

Regarding personnel safety, there are multiple factors to take into account when handling hazardous materials in factories, laboratories or other workplaces. Emergency showers and eyewash stations need to remain visible, easily accessible and reliable. They are a final level of protection, in many cases, as they can sufficiently combat any chemicals or other hazardous materials that may make contact with one's eyes or body.

OSHA regulations address emergency eyewash and shower equipment in 29 CFR 1910.151. Specifically, 1910.151(c) states: "Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use." However, this is the only federal requirement for emergency eyewash and shower equipment. OSHA has often referred employers to ANSI Z358.1 as a recognized source of guidance for protecting employees who are exposed to injurious corrosive materials. The standard has also been adopted by many governmental organizations and the International Plumbing Code.

Why Standard is Important

The first 10-15 seconds after exposure to a hazardous substance, especially a corrosive substance, are critical. Delaying treatment, even for a few seconds, may cause serious injury.

This ANSI standard establishes minimum performance and use requirements for eyewash and shower equipment for the emergency treatment of the eyes or body of a person who has been exposed to hazardous materials. It covers the following types of equipment: emergency showers, eyewashes, eye/face washes and combination units.

Key Compliance Requirements

The standard contains specific language for both showers and eyewashes, including performance, installation, maintenance and training components.

Emergency Showers

Performance: A means shall be provided to ensure that a controlled flow of flushing fluid is provided at a velocity low enough to be non-injurious to the user.

- Emergency showers shall be capable of delivering flushing fluid at a minimum of 75.7 liters/minute (20gpm) for a minimum of 15 minutes. If shut-off valves are installed in the supply line for maintenance purposes, provisions shall be made to prevent unauthorized shut off.
- Emergency showers shall provide a flushing fluid column that is at least 208.3cm (82in) and not more than 243.8cm (96in) in height from the surface on which the user stands.
- The spray pattern shall have a minimum diameter of 50.8cm (20in) at 152.4cm (60in) above the surface on which the user stands. The center of the spray pattern shall be located at least 40.6cm (16in) from any obstruction. The flushing fluid shall be substantially dispersed throughout the pattern.
- Emergency showers shall be designed, manufactured and installed in such a manner that, once activated, they can be used without requiring the use of the operator's hands.

- Emergency showers shall be constructed of materials that will not corrode in the presence of the flushing fluid. Stored flushing fluid shall be protected against airborne contaminants.

Installation: When the self-contained emergency shower is installed, its installation shall be verified in accordance with manufacturer's instructions. It is the installer's responsibility to ensure that emergency showers shall:

- Be assembled and installed in accordance with the manufacturer's instructions, including flushing fluid delivery requirements.
- Be in accessible locations that require no more than 10 seconds to reach. The emergency shower shall be located on the same level as the hazard; the path of travel shall be free of obstructions that may inhibit its immediate use.
- Be located in an area identified with a highly visible sign, positioned so the sign shall be visible within the area served by the emergency shower. The area around the emergency shower shall be well-lit.
- Be positioned so that the shower pattern is dispersed such that the top of the flushing fluid column is at least 208.3cm (82in) and not more than 243.8cm (96in) from the surface on which the user stands. The center of the spray shall be at least 40.6cm (16in) from any obstruction.
- Be connected to a supply of flushing fluid per the manufacturer's installation instructions to produce the required spray pattern for a minimum period of 15 minutes. Where the possibility of freezing conditions exists, the emergency shower shall be protected from freezing or freeze-protected equipment shall be installed. If shut-off valves are installed in the shower line for maintenance purposes, provisions shall be made to prevent unauthorized shut off.

- Deliver tepid flushing fluid. In circumstances where chemical reaction is accelerated by flushing fluid temperature, a facilities safety/health advisor should be consulted for the optimum temperature for each application.
- When the plumbed emergency shower is installed, its performance shall be verified in accordance with the following procedures:
  1. With the unit correctly connected to the flushing fluid source and the valve(s) closed, visually check the piping connections for leaks.
  2. Open the valve to the full-open position. The valve shall remain open without requiring further use of the operator's hands.
  3. With the valve in the fully opened position, measure the diameter of the spray pattern. It shall be a minimum of 50.8cm (20in) at 152.4cm (60in) above the standing surface. The flushing fluid shall be substantially dispersed throughout the pattern.
  4. Using the flowmeter or other means, determine that the rate of flow is at least 75.7 liters/minute (20gpm).
  5. Using a temperature gauge or other means, determine that the flushing fluid is tepid.

Maintenance and Training: Manufacturers shall provide operation, inspection and maintenance instructions with emergency shower equipment. Instructions shall be readily accessible to maintenance and training personnel.

- Plumbed emergency showers shall be activated weekly for a period long enough to verify operation and ensure that flushing fluid is available.
- Self-contained emergency showers shall be visually checked weekly to determine if flushing fluid needs to be changed or supplemented. Such inspection shall be conducted in accordance with manufacturer's instructions.
- Employees who may be exposed to hazardous materials shall be instructed in the location and proper use of emergency showers.
- All emergency showers shall be inspected annually to assure conformance with this standard.

Eyewash Equipment

Performance: A means shall be provided to ensure that a controlled flow of flushing fluid is provided to both eyes simultaneously at a velocity low enough to be non-injurious to the user.

- The eyewash shall be designed and positioned in such a way as to pose no hazard to the user.
- Nozzles and flushing fluid units shall be protected from airborne contaminants. Whatever means is used to afford such protection, its removal shall not require a separate motion by the operator when activating the unit.
- Eyewashes shall be designed, manufactured and installed in such a manner that, once activated, they can be used without requiring the use of the operator's hands.
- Eyewashes shall be constructed of materials that will not corrode in the presence of the flushing fluid.
- Eyewashes shall be capable of delivering flushing fluid to the eyes not less than 1.5 liters/minute (0.4gpm) for 15 minutes. If shut-off valves are installed in the supply line for maintenance purposes, provisions shall be made to prevent unauthorized shut off.
- Eyewashes shall be designed to provide enough room to allow the eyelids to be held open with the hands while the eyes are in the flushing fluid stream.
- Eyewashes shall provide flushing fluid to both eyes simultaneously. A test gauge for making determination of a suitable eyewash pattern shall be a minimum 10.16cm (4in) in length with two sets of parallel lines equidistant from the center. The interior set of lines shall be 3.18cm (1.25in) apart and the exterior lines shall be 8.26cm (3.25in) apart. Place the gauge in the stream of the eyewash. The flushing fluid shall cover the areas between the interior and exterior lines of the gauge at some point less than 20.3cm (8in) above the eyewash nozzle(s).

Maintenance and Training: Manufacturers shall provide operation, inspection and maintenance instructions with eyewashes. Instructions shall be readily accessible to maintenance and inspection personnel.

- Plumbed eyewashes shall be activated weekly for a period long enough to verify operation and ensure that flushing fluid is available.
- Self-contained eyewashes shall be visually checked weekly to determine if flushing fluid needs to be changed or supplemented. Such inspection shall be conducted in accordance with manufacturer's instructions.
- Employees who may be exposed to hazardous materials shall be instructed in the location and proper use of emergency eyewashes.
- All eyewashes shall be inspected annually to assure conformance with this standard. IHW

Resources:

- The standard is available at the ANSI Webstore, along with information, specifications, performance guidelines, and illustrations for emergency shower and eyewash stations: https://bit.ly/2Rj5JjY
- Read more at the ANSI Blog: Standard for Emergency Eyewash and Shower Stations: https://bit.ly/2Rj17KP

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By: **Bob Henderson**, *Contributor*

Limits for Air Contaminants: 1910 Subpart Z

"Federal and state regulations define the PEL for toxic contaminants, but do not specify how to set the alarms. Gas detection customers depend on manufacturers for guidance. The annotated Z-1 tables provide a side-by-side comparison that allows GfG to provide advice based on best practice as well as minimum requirements specified by OSHA." *GfG Instrumentation, Inc, 800-959-0329, www.goodforgas.com*

Setting Alarms & Conforming with Exposure Limit Requirements

OSHA recognizes that many of the permissible exposure limits (PELs) in Table Z-1 "Limits for Air Contaminants" are outdated and inadequate for ensuring protection of worker health. To provide employers, worker and other interested parties with a list of alternate occupational exposure limits that may serve to better protect workers, OSHA has annotated the existing Z-Tables with other selected occupational exposure limits (https://www.osha.gov/annotated-pels/table-z-1).

How you set the alarms in your gas detectors is a critical part of keeping workers safe. OSHA has annotated the Air Contaminant Z-Tables to clarify the differences between exposure limit guidelines and to help instrument users understand what is needed. *(photo courtesy Adobe Stock.)*

The annotated tables provide a side-by-side comparison with the California Cal/OSHA PELs, NIOSH Recommended Exposure Limits (RELs) and the ACGIH TLVs®. While the tables explain the statutory exposure limits, they do not directly provide advice as to how users of direct reading instruments should set the alarms. Fortunately, the ACGIH "Guide to Occupational Exposure Values" provides additional guidance.

History

The Occupational Safety and Health Act was enacted by Congress in 1970. Most American workers nowadays were not even born when the OSH Act was signed into law! The Act created the Occupational Safety and Health Administration (OSHA) and the National Institute of Occupational Safety and Health. NIOSH was established to provide research and recommendations in the field of occupational safety and health which would later be incorporated into the rules and standards enforced by OSHA. The goal then and now is to ensure that employers provide employees with a workplace free from recognized hazards such as toxic chemicals, noise, heat stress, mechanical hazards and unsanitary conditions.

OSHA regulations use the term Permissible Exposure Limit (PEL) to define the maximum concentration of a listed contaminant to which an unprotected worker may be exposed during his workplace duties. PELs are usually expressed as an eight-hour, time weighted average (TWA) exposure limit. Exposure limits for gases and vapors are usually given in units of parts-per-million (ppm). Limits for mists, fume and particulate solids are expressed in units of mg/m3.

The TWA concept is based on the average exposure over an eight-hour day. Short excursions above the TWA are permitted as long as they do not exceed the short-term exposure limit (STEL) or Ceiling (C), and are compensated by equivalent excursions below the limit. The regulatory TWA calculation is projected over a full eight hours. The OSHA TWA for extended shifts is based on the most recently completed eight hours. Thus, for a worker exposed to 100ppm of contaminant for four hours, the projected eight-hour TWA would be equal to only 50ppm at that time. The TWA for a worker exposed to 100 ppm for a full eight hours is 100ppm. The TWA for a worker exposed to 100ppm of contaminant for 12 hours would still be 100ppm.

Short Term Exposure Limits (STELs) are based on the average exposure over a shorter period. Most STELs are calculated on a 15-minute basis. Ceiling (C) limits are based on a concentration that may not be exceeded for any length of time. The PEL for many contaminants includes both a TWA and a STEL, or a TWA and a Ceiling. Some include only a STEL, or only a Ceiling. When the PEL includes more than type of limit, no part of the exposure limit can be exceeded.

OSHA PELs are listed in Subpart Z (Section 1910.1000) of the Code of Federal Regulations. Subpart Z contains three tables (Z-1, Z-2 and Z-3) which list the contaminants which are specifically regulated by this standard. The PELs were originally issued shortly after adoption of the OSH Act in 1970. The Federal PELs set the highest allowable unprotected workplace exposure limits for these substances. Individual states either follow the Federal regulations, or follow their own, state-specific permissible exposure limits. States may not publish or follow exposure limits that are more permissive than Federal OSHA limits.

The Recommended Exposure Limit (REL) is the name used by NIOSH for the occupational exposure limits (OELs) it

OSHA Annotated Table Z-1 source: OSHA

Substance	CAS No.	Regulatory Limits			Recommended Limits	
		OSHA PEL (8-hour TWA unless otherwise indicated)		Cal/OSHA PEL (as of 10/2/2019)	NIOSH REL (as of 10/18/2019)	ACGIH® 2019 TLV®
		ppm	mg/m³	8-hour TWA (ST) STEL (C) Ceiling	Up to 10-hour TWA (ST) STEL (C) Ceiling	8-hour TWA (ST) STEL (C) Ceiling
Nitrogen dioxide	10102-44-0	(C) 5	(C) 9	(ST) 1 ppm	(ST) 1 ppm	0.2 ppm
Sulfur dioxide	9/5/46	5	13	2 ppm (ST) 5 ppm	2 ppm (ST) 5 ppm	(ST) 0.25 ppm

recommends to protect workers. NIOSH over the years has been active in the study of chemical hazards and has updated the REL for many airborne toxic contaminants, sometimes more than once, since 1970. Until adopted by OSHA, NIOSH recommendations are not automatically enforceable. However, states are free to incorporate NIOSH recommendations as enforceable under their own state specific laws.

On January 19, 1989, OSHA updated the exposure limits in 29 CFR 1910.1000. OSHA reduced the exposure limits for 212 substances, created new PELs for 164 substances that were not previously regulated, and raised the exposure limit for one chemical. The PELs of 223 other contaminants were either left unchanged or not considered in the rule-making process. The changes were largely based on the NIOSH RELs that were current at that time.

The updated OSHA rule was the subject of several legal challenges, and on July 7, 1992, the U.S. Court of Appeals, Eleventh Circuit, vacated the 1989 PELs. The current versions of the OSHA Z-1000 Tables reflect the Court's decision. It also explains why there is such a large difference between the OSHA PEL and the NIOSH REL for many toxic contaminants.

State Plans are OSHA-approved workplace safety and health programs operated by individual states or U.S. territories. There are currently 22 State Plans covering both private sector and state and local government workers, and six State Plans covering only state and local government workers. In most of these states, when there is a difference between the OSHA PEL and the NIOSH REL, the enforceable exposure limit in the state is tied to the more conservative of the two limits. In some states the limits are based on the (usually) even more conservative American Conference of Governmental Hygienists (ACGIH) Threshold Limit Value (TLV®). Sometimes states modify their exposure limits based on their own findings. California has taken this approach with several state specific PELs.

The ACGIH TLVs are among the world's most widely used and respected guidelines for workplace exposure to toxic substances. TLVs are developed and designed to function as recommendations for the control of health hazards, and to provide guidance intended for use in the practice of industrial hygiene. Although ACGIH TLVs are not expressly developed for use as legal standards, they are frequently incorporated by reference into state, federal, and many international regulations governing workplace exposure. They may also be cited or incorporated by reference in consensus standards of associations such as the National Fire Protection Association (NFPA), or American National Standards Institute (ANSI).

Individual employers are in much the same position as states when it comes to workplace exposure limits. Employers can either follow the official limits; or follow their own more conservative guidelines. Given the potential for lawsuits, many employers have made the strategic decision to base their corporate health and safety programs on the most conservative applicable recognized standards. Since ACGIH recommendations are frequently more conservative than OSHA PELs and NIOSH RELs, many programs, especially the programs of prominent multinational corporations, use the ACGIH TLVs. Some of the most conservative corporations limit exposure to one-half of the of the published REL or TLV.

Strategies for Setting the Alarms in Real-time Atmospheric Monitors

Even when it is clear which exposure limits apply, deciding how to set the alarms can be a difficult decision. The OSHA PEL, NIOSH REL and ACGIH TLV specify exposure limits for unprotected workers, but do not tell instrument users how to set the alarms in their real-time instruments. The alarms have two purposes: to ensure that the exposure limits are not exceeded and to alert workers if conditions begin to become unsafe. Alarms need to be activated under conditions that allow workers to self-rescue.

Most OSHA PELs have never been updated since the passage of the Occupational Safety and Health Act back in 1970. NIOSH RELs and ACGIH TLVs are regularly updated, and increasingly more conservative than the PELs. Some would say too conservative. One of the reasons that there has been so much pushback against the newer, more conservative exposure limits is worry about how to set the alarms. Instrument users (and sometimes regulators) often believe they need to set the instantaneous "low" alarm at the TWA limit. Fortunately, this is not the case.

Real-time atmospheric monitors have multiple alarms tied to the concentration of the gas being measured. Some alarms can set by users, while others are set by the manufacturer, or required by the certifications carried by the instrument. Most real-time toxic gas instruments have at least four user settable alarms; a "low" instantaneous (peak) alarm, a "high" alarm (also based on the peak reading), a STEL alarm based on the most recent 15 minutes of exposure, and a TWA alarm based on the average exposure projected over a full 8-hour shift. For extended shifts, most instruments calculate the TWA alarm according to OSHA and ignore exposure prior to the most recent eight hours.

OSHA Annotated Z-2 Table source: OSHA

Regulatory Limits						Recommended Limits	
OSHA PELs					Cal/OSHA PEL (as of 10/2/2019)	NIOSH REL (as of 10/18/2019)	ACGIH® 2019 TLV®
Substance	8-hour Time Weighted Average (TWA)	Acceptable Ceiling Concentration	Acceptable maximum peak above the acceptable ceiling concentration for an 8-hr shift				
			Concentration	Maximum Duration	8-hour TWA (ST) STEL (C) Ceiling	Up to 10-hour TWA (ST) STEL (C) Ceiling	8-hour TWA (ST) STEL (C) Ceiling
Hydrogen sulfide (Z37.2-1966)	-	20 ppm	50 ppm	10 min once only if no other measurable exposure occurs.	10 ppm (ST) 15 ppm (C) 50 ppm	(C) 10 ppm [10-min]	1 ppm (ST) 5 ppm

When the exposure limits are high compared to the range and resolution of the instrument, an easy approach is to set the instantaneous low and high alarms at the TWA and/or STEL limit values. Setting the instantaneous low alarm at the TWA is extremely conservative. Taking this approach was easier in the past when exposure limits were higher. It is much more difficult to take this approach with the latest REL and TLV exposure limits for several important contaminants, including H2S, SO2 and NO2. It is not always feasible to set the instantaneous alarm at the latest TLV-TWA limit.

The annotated OSHA Z-Tables (https://www.osha.gov/annotated-pels/table-z-1) make it easier to understand the differences between the major exposure limit guidelines; and decide on the optimal approach to setting alarms. Consider the H2S exposure limits listed in the Z-2 Table: OSHA Annotated Table Z-2.

The most common alarm settings used by instrument manufacturers and users follow the reasoning behind the Cal/OSHA PEL, (as well as guidance contained in OSHA 1910.146 "Permit Confined Spaces"). The instantaneous (peak) low alarm is typically set at 10ppm, the high alarm is set at 15 ppm, the STEL alarm is set at 15 ppm, and the TWA alarm is set at 10ppm.

It is a little tougher for instrument users who are required to follow the TLV. The 2012 H2S TLV consists of a TWA limit of 1.0 ppm, and a STEL limit of 5.0 ppm. Setting the instantaneous "low" alarm at 1.0ppm can lead to frequent nuisance alarms due to short term transients above 1.0ppm. Also, setting the low alarm at 1.0 may not even be possible for many instrument designs.

The ACGIH provides some useful guidance for setting alarms in the 2021 "Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs)" handbook. The handbook notes that for many substances with a TLV–TWA, there is no TLV–STEL or Ceiling. Nevertheless, short-term peak exposures above the TLV–TWA should still be controlled. According to the guidance, transient exposure levels may exceed up to 3 times the value of the TLV–TWA level for up to 15 minutes at a time, on up to four occasions spaced at least one hour apart during a workday. Under no circumstances should transient exposure levels exceed 5 times the value of the TLV–TWA level when measured as a 15-min TWA.

In other words, a valid alarm strategy would be to set the "low" alarm at 3X the TWA and the "high" alarm at 5X the TWA, while setting the TWA alarm at the actual TLV-TWA limit value. So, for employers and instrument users who follow TLV exposure limits, the instantaneous (peak) low alarm is set at 3.0ppm, the high alarm is set at 5.0ppm, the STEL alarm is set at 5.0ppm, and the TWA alarm is set at 1.0ppm. Because the TWA is calculated on an 8-hour basis, short term transients and/or fluctuations in the readings have little effect on causing false alarms. Most real-time H2S instruments can be used with the TWA alarm set to 1.0ppm.

The same issues apply to other contaminants like NO2 and SO2. Having the exposure limits side-by-side in the annotated tables makes it much easier to develop a prudent alarm setting strategy.

Conclusions and Advice

- Make sure to define the objectives behind the use of your real time instruments. It is critical that the instruments you use are "fit for purpose." The instrument capabilities need to match your requirements, and the instrument settings need to match your objectives.
- Make sure you have sufficient resolution and accuracy. If you need to set the alarms in your NO2 instrument at 0.2ppm, you better not be using an instrument that limits the resolution to 0.1ppm.
- Make sure you understand the effects of ambient conditions on readings. Temperature, pressure, and humidity can have an effect on readings. Make sure you are aware of the effects of interfering contaminants as well. For instance, the presence of NO2 can cause SO2 sensors to read negative, while the reverse is true as well.
- If one of your requirements is to log your results and generate reports, make sure the datalogging capabilities of the instrument meet your objectives.
- Make sure you and your instrument users are well trained. Make sure to read the Owner's Manual.
- Fresh air adjust your instrument before each day's use; test and calibrate according to statutory and manufacturer requirements; make sure that you follow proper procedures; and document what you are doing. IHW

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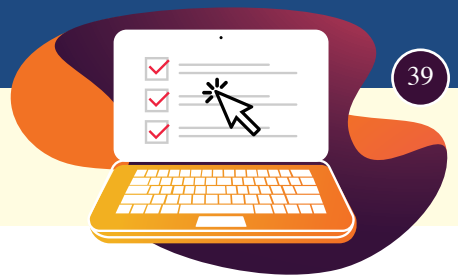

By: **David Withee**, *Contributor*

Testing of Showers & Eyewashes

Test showers and eyewashes how often? Short answer: weekly. Middle answer: testing annually, activating weekly. Long answer: as often as needed to meet OSHA requirements and expectations for your circumstances.

OSHA Standard 29 CFR 1910.151 (C) words it simply: "Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use."

A University of Colorado employee uses a Green Gobbler Safety testing cart to test an emergency shower for water flow, clarity, temperature and spread, while collecting the water for later disposal elsewhere. *(photo courtesy Green Gobbler Safety)*

The key word there is "suitable." This leaves OSHA with plenty of leeway to take circumstances into account. This doesn't give you the clearest direction, though.

For instance, showers and eyewashes are typically located at plumbing deadlegs with non-moving water, unless the equipment is activated. Since the water is also normally tepid (more on that later), this is likely to create a corrosive environment for the plumbing and could even create an environment conducive to bacteria and biofilm growth.

If someone needs to use an eyewash, do you really want rust to flow into their eyes—or, if using a shower, to have black gunk land on them? Activating showers and eyewashes weekly, long enough to ensure the water is clear, helps ensure your employees will be able to use the equipment safely and completely (and you will hopefully be in the good graces of OSHA).

What if the water isn't tempered and is just cold? You want a victim to stay in the water for at least 15 minutes to wash away corrosive materials, not jump back due to the shock of cold water. If you have tempered the water, weekly activation ensures it is still tempered as soon as someone needs to use the shower or eyewash. The ANSI standard, Z358.1, requires "tepid" water, which is defined as above 60°F (160°C) and below 100°F (38°C).

Why Test?

"But," I can hear you ask, "what if we haven't had a single need to use an emergency shower

Duke University Facilities Management staff preparing to test some of their 1,000 emergency showers and 2,000 eyewashes using Green Gobbler Safety testing carts. *(photo courtesy Green Gobbler Safety)*

or an eyewash in 20 years?!" Well, you know how the saying goes: "It only takes once."

Do you want to explain to OSHA why you didn't do the weekly activation? They will likely wonder what else you haven't done to keep your employees safe. Do you really want them to wonder about that? Even if your emergency showers and eyewashes were installed before the latest—or any—edition of ANSI Z358.1, you don't get a pass on safety issues. Equipment which doesn't meet standards and a lack of annual testing and/or weekly activation are two strikes, where a single strike can be costly.

Let's get back to the question of how often to test. OSHA will often refer people to ANSI/ISEA Z358.1 for guidance as to an industry consensus of what is needed in general. OSHA, though, may or may not accept meeting that standard when taking into account particular circumstances and incidents. The key is what have you done to make "suitable facilities." Following the requirements of ANSI Z358.1 should at least show a good faith effort. ANSI requires weekly activation, so. . .

Besides, especially if you have an educational institution or healthcare facility, commissioning bodies are increasingly requiring ANSI Z358.1 be followed. Is losing your accreditation a risk you really want to take?

Now, the issue is often a matter of being able to activate showers and eyewashes easily and quickly, without making a mess. The mess is the challenge; no one wants to end up with water all over the floor. Laboratories are often built without drains to ensure chemicals don't mix with community water systems. Water all over the floor really puts a crimp on their lab work. Healthcare facilities can't afford to create circumstances which may create or exacerbate potential safety hazards and definitely don't want to encourage the growth of biofilms, bacteria, mold, etc.

Industrial facilities don't want to create safety hazards they are trying to avoid in the first place. Fortunately, several companies have developed products to help make weekly activation less of a challenge. You can minimize, and possibly eliminate altogether, the potential mess.

How often should you activate eyewashes and showers? The answer is as often as needed to meet what OSHA would require in your circumstances. Following ANSI Z358.1 guidelines and activating weekly is a good place to start. IHW

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By: **Edward Stern**, *Contributor*

The Osha Recordkeeping Advisor

OSHA has a powerful, free tool to help employers (and employees) understand the Recordkeeping Rules. It is the OSHA Recordkeeping Advisor, available at https://webapps.dol.gov/elaws/osharecordkeeping.htm.

Why is it needed? A good clue is the text of the first page of the Advisor. It says, "… The OSHA Recordkeeping Advisor is intended to help determine:

- Whether an injury or illness (or related event) is work-related
- Whether an event or exposure at home or on travel is work-related
- Whether an exception applies to the injury or illness
- Whether a work-related injury or illness needs to be recorded
- Which provisions of the regulations apply when recording a work-related case"

If one of your employees got injured or sick while on travel for work, the Advisor system would need more information to understand what happened. *(photo courtesy Adobe Stock)*

To my mind, the OSHA Recordkeeping Rules are well-written, and they are understandable to people who take the time to read them carefully. So far, so good. However, the rules cover a wide range of issues and circumstances—as indicated by the list above of things to be determined.

OSHA provided help on these rules, because there are so many things that might affect the answers to some of the following questions: Is it work-related? Does an exception apply? Does it need to be recorded? And, if so, which provisions apply? Those are key issues, but there are many other situations that need to be analyzed which are not on the list above. This article will touch on a few of these other issues.

Injuries and illnesses at work can occur in all manner of circumstances. That is what makes the determinations complicated. Unless you know the rules down pat, it is possible to overlook some provision when you deal with anything out of the ordinary.

Why is the Advisor an Expert?

It is an "expert" advisor interview, because OSHA's experts on the rules and the attorneys in the Occupational Safety and Health (OSH) Division of the Office of the Solicitor of Labor went over the questions, answers, notes and decision logic behind the Advisor with a fine-tooth comb. Then they signed off. So, you get the official guidance from OSHA and the Solicitor's Office. (These were excellent people; I enjoyed working with them on this Advisor.)

Suppose you have a contract or temp employee who gets sick or injured. Before you even consider whether the event is OSHA recordable, you would have to figure out whether your company or the person's employer is responsible for record-keeping. The Advisor analyzes that. How?

The OSHA Recordkeeping Advisor determines its guidance to users by asking necessary questions and by following up with further questions prompted by your answers. Its online, interactive expert interview finds the guidance appropriate to your responses. As it goes along, it recaps what you told the system and what your answers mean in terms of the rules. If you see that what you told the system is not correct, then you can back up to give a different response.

Some Issues to be Analyzed

One early question is: "Did an event or exposure occurring in the work environment cause or contribute to the resulting injury or illness, or significantly aggravate a pre-existing injury or illness?" This is not a simple question. You may wonder about it. If you answer that you do not know whether an event "significantly aggravated" a pre-existing injury or illness, the system will ask further questions, beginning with:

"Did an event or exposure in the workplace result in the affected employee:

- Missing one or more days away from work?
- Having one or more days of restricted work?
- Having one or more days of job transfer?
- Getting medical treatment beyond first aid?
- Losing consciousness?
- Dying?
- Having Standard Threshold Shift in hearing?
- None of the above.

The Advisor may ask follow-up questions based on your answers to this question. It will determine the issue of "significantly aggravated" and proceed to the next issue.

What About Working at Home?

When we developed the Recordkeeping Advisor, relatively few people were working at home compared to 2020 and 2021. Still, it was an issue to be considered. If you said the person was working from home, you would get this message:

"You indicated that the event or exposure that caused the injury or illness occurred while the affected employee was working from home. Was the injury or illness a direct result of the performance of work, or was the injury or illness directly related to an aspect of the home environment or setting?" Choices include:

- The injury or illness was a result of the performance of work.
- The injury or illness was related to the home environment.

For example, if an employee is working at home and drops a box of work documents and injures his/her foot, the injury would be considered work-related. If an employee is working at home and is electrocuted because of faulty home wiring, the injury would NOT appear to be work-related.

One of the attorneys added notes under that question. These came right from the rules. There are helpful, illustrative notes on some other questions.

What if the Worker was Traveling?

If one of your employees got injured or sick while on travel for work, the system would need more information to understand what happened. Let us say the employee had already signed into a hotel. The Advisor recaps what you told it and says:

"You indicated that the affected employee had checked into a hotel or other temporary residence.

During which activity did the event or exposure occur?

- Work-related activity (business meals, setting up for a conference, etc.)
- Personal activity (eating, dressing, walking, etc.)
- Commuting to the work location"

The circumstances make a difference as to whether an injury or illness is work-related. Once the Advisor understands the circumstances, it will cite the relevant section of the rules—and give you a link to it.

Please Note: Some users may never see the questions (and choices of answers) that I show here. The Advisor has questions, choices of answers and decision logic to examine everything the rules cover. But, any one incident cannot possibly involve all of the issues. A person cannot be hurt at work, at home and on travel in one incident.

Exceptions

To know whether an exception applies, the Advisor needs to ask about each of the exceptions. You can get through these questions by clicking on the "No" for every question. That is quick, but do not click "No" without reading the questions.

As you might expect, even the "exceptions" have follow-up questions to determine their applicability. Accidents in the company parking lot and mental illness are not simple matters. If you run into these, think carefully about the questions.

Conclusion

The Advisor is a powerful, analytical tool. It will be a huge help to someone new at this, and it will support your most experienced person on a tricky case. In all fairness, I should add that we looked into developing Expert Advisors, because senior attorneys in the Office of the Chief Counsel for Advocacy at SBA, especially Kevin Bromberg, pushed us to do more to help small business understand the rules. Kevin was annoying, but he was right. See similar tools at www.dol.gov/elaws. IHW

*[**Editor's Note:** This article first appeared in the June 2020 issue of* Workplace Material Handling & Safety.*]*

By: **Barbara Nessinger**, *Editor-in-Chief, Industrial Hygiene in the Workplace*

Mitigating Risks, Preventing the Spread of COVID-19

OSHA recently published guidance intended for employers and workers, in workplace settings outside of healthcare, to help identify risks of being exposed to and/or contracting COVID-19. Also designed to help employers determine appropriate control measures to implement, here is an overview of OSHA's detailed guidance.

This OSHA guide contains recommendations, as well as descriptions of mandatory safety and health standards. The recommendations are, according to OSHA, "advisory in nature; informational in content; and are intended to assist employers in providing a safe and healthful workplace."

Covered in the guidance are what employees need to know about COVID-19; a detailed discussion of face coverings; and the roles of both employers and employees in responding to COVID-19.

Not all face coverings are the same; the CDC recommends face coverings be made of at least two layers of a tightly woven, breathable fabric, such as cotton, and should not have exhalation valves or vents. *(photo courtesy Adobe Stock)*

What Employees Need to Know about COVID-19

- The best way to protect yourself is to **stay far enough away from other people** so that you are not breathing in particles produced by an infected person—at least 6ft (about 2 arm lengths)—however, this is not a guarantee, especially in enclosed spaces or those with poor ventilation.
- **Practice good personal hygiene** and wash your hands often. Always cover your mouth and nose with a tissue when you cough or sneeze, or use the inside of your elbow and do not spit. Monitor your health daily and be alert for COVID-19 symptoms.
- **Face coverings** are simple barriers to help prevent your respiratory droplets or aerosols from reaching others. Not all face coverings are the same; the CDC recommends face coverings be made of at least two layers of a tightly woven breathable fabric, such as cotton, and should not have exhalation valves or vents. The main function of wearing a face covering is to protect those around you, in case you are infected but not showing symptoms. Studies show that face coverings reduce the spray of droplets when worn over the nose and mouth. Although not their primary value, studies also show that face coverings can reduce wearers' risk of infection in certain circumstances, depending upon the face covering. This means wear a face covering even when there are no symptoms present. Asymptomatic workers can spread the virus to others.

It is especially important to wear a face covering when you are unable to stay at least 6ft apart from others, since COVID-19 spreads mainly among people who are in close contact with one another. But wearing a face covering does not eliminate the need for physical distancing or other control measures (e.g., handwashing). It is also vital to wear a face covering and remain physically distant from co-workers and customers, even if you have been vaccinated, because it is not known at this time how vaccination affects transmissibility.

In addition, there are many employer prevention programs that include important steps to keep workers safe—from telework to flexible schedules to PPE and face coverings. All workers should be aware of such prevention options.

The Roles of Employers & Workers

Under the OSH Act, employers are responsible for providing a safe and healthy workplace, free from recognized hazards likely to cause death or serious physical harm. Implementing a workplace COVID-19 prevention program is the most effective way to mitigate the spread of COVID-19 at work, according to the OSHA guidance.

This includes a 16-step guideline for minimizing risk, including education and training; establishment of an effective communication system; and consideration of employees who might be at higher risk of contracting COVID-19, through established policies and practices.

The new guidance also contains multiple links for in-depth reference for both employers and employees. See the "Additional Resources" section, below, for more. IHW

Additional Resources:

- "Protecting Workers: Guidance on Mitigating and Preventing the Spread of COVID-19 in the Workplace," https://www.osha.gov/coronavirus/safework
- "Scientific Brief: Community Use of Cloth Masks to Control the Spread of SARS-CoV-2," https://www.cdc.gov/coronavirus/2019-ncov/more/masking-science-sars-cov2.html
- CDC's "People at Increased Risk and Other People Who Need to Take Extra Precautions," https://tinyurl.com/jwveuss8
- "Implement Physical Distancing in All Communal Work Areas," https://www.osha.gov/coronavirus/safework#implement-physical-distancing

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