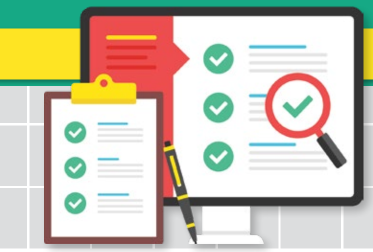
THE 2022 COMPLIANCE ISSUE

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.

Industrial Hygiene in the Workplace



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 Matters

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 OH&S 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 OH&S 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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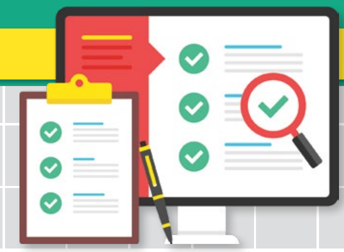

OSHA's National Emphasis Program–Outdoor & Indoor Heat-Related Hazards

"Heat stress related injuries can occur under almost any scenario and can be dependent on many external factors along with the health/fitness of the individual. One important preventive measure often overlooked is proper hydration. Implementing this National Emphasis Program using a healthy hydration approach encourages workers to drink more water and ultimately saves lives." *Janet Baker-Truex, CEO, Nextteq International LLC, info@nextteq.com, www.readygohydration.com*

History/Background

On a warm, summer day in July, a 42-year-old man was on his way to work for his new job as a roofer. When he arrived, there was plenty of water, ice and drinks available at the site for him to hydrate throughout the day. It was only his third day on the job, and he got straight to work. The high temperature was about 86°F and a relative humidity of 57%, for a heat index of 90°F. Later that afternoon, the man told his colleagues he wasn't feeling well. He climbed down from the roof and sat out of the sun. When his co-workers checked on him a few minutes later, he had developed symptoms of heat stroke. He was taken to nearby hospital where he died shortly after. *(See OSHA's case studies link, below.)*

Cases like the one above demonstrate why the new Outdoor and Indoor Heat-Related Hazards standard and the National Emphasis Program (NEP) are so important to keeping workers safe. The NEP protects employees from heat-related hazards and the resulting injuries and illnesses in outdoor and indoor workplaces. The standard expands on the agency's ongoing heat-related illness prevention initiative and campaign by setting forth targeted enforcement components and reiterating its compliance assistance and outreach efforts.

This tactic is intended to urge early interventions by employers to prevent illnesses and deaths among workers during high heat conditions, such as working outdoors in a local area experiencing a heat wave. Early prevention measures include implementing water, rest, shade, training and acclimatization procedures for new/returning employees.

Why the Standard Matters

Millions of American workers are subjected to heat in their work environment and, even though illness from heat exposure is preventable, every year thousands become sick from occupational heat exposure. And, as noted in the above case study, some exposures can be fatal. According to OSHA, "Most outdoor fatalities, 50-70%, occur in the first few days of working in warm or hot environments, because the body needs to build a tolerance to the heat gradually over time." This process is called heat acclimatization, and the lack of acclimatization represents a major risk factor for fatal outcomes.

Occupational risk factors for heat illness include heavy physical activity; warm or hot environmental conditions; lack of acclimatization; and wearing clothing that holds in body heat.

Hazardous heat exposure can occur indoors or outdoors—and during any season, if the conditions are right—not only during heat waves.

Some outdoor industries where workers have suffered heat-related illnesses include:

- Agriculture
- Construction—road, roofing and other outdoor work
- Landscaping
- Mail and package delivery
- Oil and gas well operation

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And, some indoor industries where workers have suffered heat-related illnesses include:

- Bakeries, kitchens and laundries (businesses with heat-generating appliances)
- Electrical utilities (boiler rooms)
- Fire service

- Iron/steel mills and foundries
- Manufacturing with hot local heat sources, like furnaces (i.e., paper products and concrete)
- Warehousing

Key Compliance Requirements:

All industries that could potentially deal with heat-related illnesses and conditions should note the following:

- Compliance safety and health officers (CSHOs), who are investigating for other purposes, shall open or refer a heat-related inspection for any hazardous heat conditions observed, or where an employee brings a heat-related hazard(s) to the attention of the CSHO (such as, employees or temporary workers being exposed to high-temperature conditions without adequate training, acclimatization, or access to water, rest and shade).
- When the weather is hot or a heat alert is issued for an area where the WHD, (Wage and Hour Division) is investigating, the WHD is encouraged to coordinate with OSHA by providing information on heat-related hazards.
- CSHOs should inquire during inspections regarding the existence of any heat-related hazard prevention programs on heat priority days. A heat priority day follows when the heat index for the day is anticipated to be 80°F or more.
- Programmed inspections could occur on any day that the NWS (National Weather Service) has announced a heat warning or advisory for the local area.

Resources:

- For more information about how to properly access high temperatures in correlation with safe working practices, visit: https://www.osha.gov/heat-exposure/hazards
- For Employers Administrating Heat Illness Prevention Training, read: https://www.osha.gov/sites/default/files/osha_heattraining_guide_0411.pdf
- For Specifics on planning and supervision, visit: https://www.osha.gov/heat-exposure/planning
- To read up on more case studies, visit: https://www.osha.gov/heat-exposure/case-studies
- For general heat exposure guidelines, visit: https://www.osha.gov/heat-exposure

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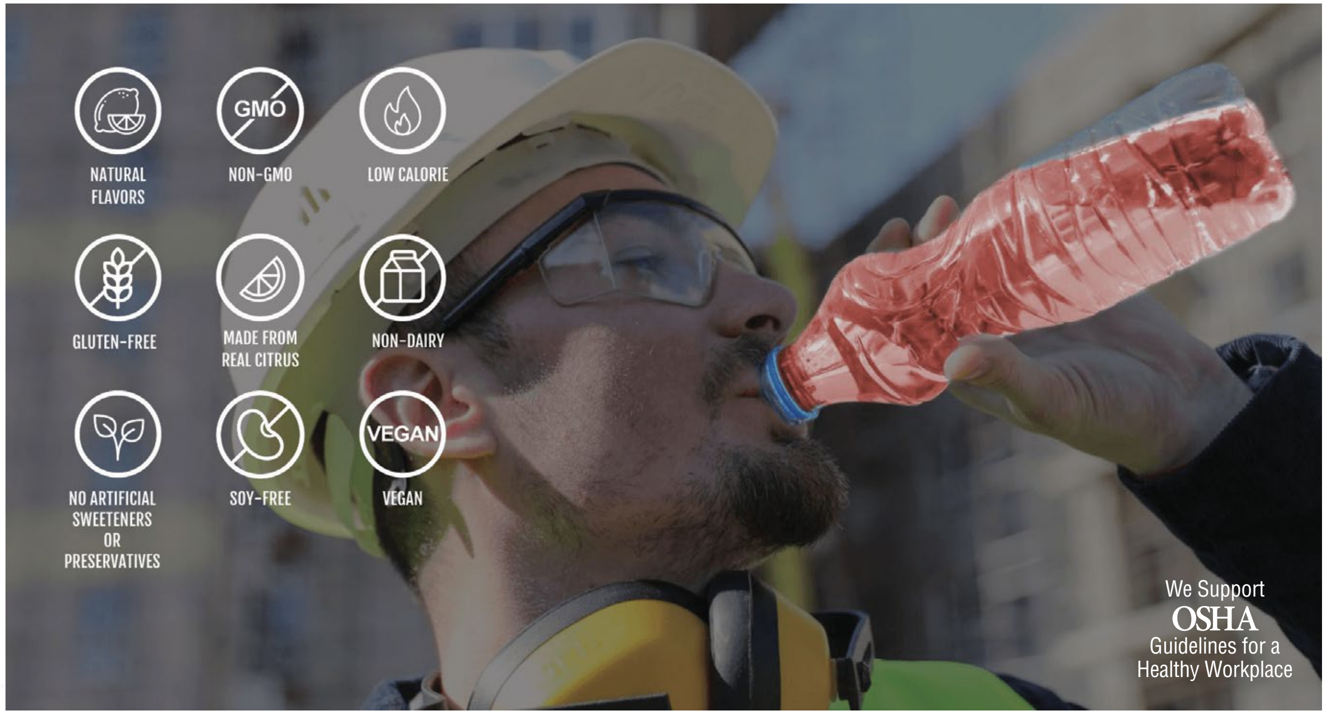

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Heat Stress Guide for Employers

"Heat-related illnesses are preventable with the right tools and controls. At TSI, our QUESTemp° Heat Stress Monitors are designed to quickly and accurately evaluate potential heat stress environments. These instruments deliver high-performance monitoring using Wet Bulb Globe Temperature (WBGT) sensing technology, the standard for heat stress management, and the calculation of a WBGT Index value." *Jason Rutz, Global Product Manager, TSI, Jason.Rutz@tsi.com*

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 Matters

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:

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- 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

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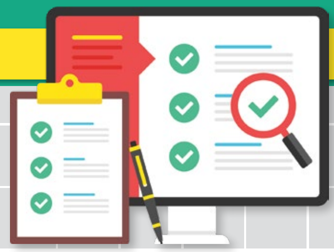

and symptoms of heat-related illness; how to prevent it; and what to do if someone is demonstrating symptoms.
- Track the worksite heat index daily; communicate it and the required precautions to workers. Knowing how hot it will be during scheduled work activities can help to determine which preventive 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's 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:

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

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

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.

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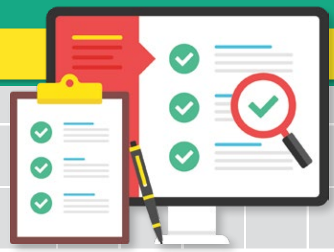

Respirator Fit-Testing Methods (ANSI/AIHA/ASSE Z88.10-2010)

"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 COVID, 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.

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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.

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 Matters

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

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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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Respiratory Protection: OSHA's 1910.134

"A proper respirator fit test is a critical component of employee respiratory protection. At TSI, PortaCount® Respirator Fit Testing equipment measures the fit of the respirator, while the user performs a series of moving, breathing and talking exercises designed to simulate the same movements made in the field. The PortaCount® Respirator Fit Tester can test all types of respirators, including N95s." *Jason Rutz, Global Product Manager, TSI, Jason.Rutz@tsi.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 Matters

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 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 health-care 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.

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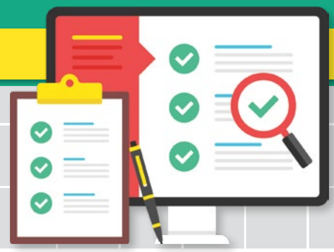

Additional medical evaluations are required under certain circumstances, i.e., if an employee reports medical signs or symptoms related to respirator use; or changes occur in workplace conditions that might substantially increase the physiological burden on an employee.

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.

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

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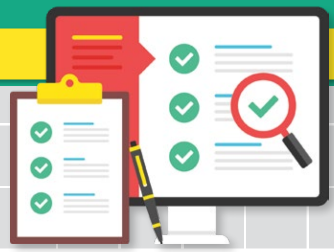

More on Hearing Protection Training: A Deeper Dive into Standard 1910.95(a)

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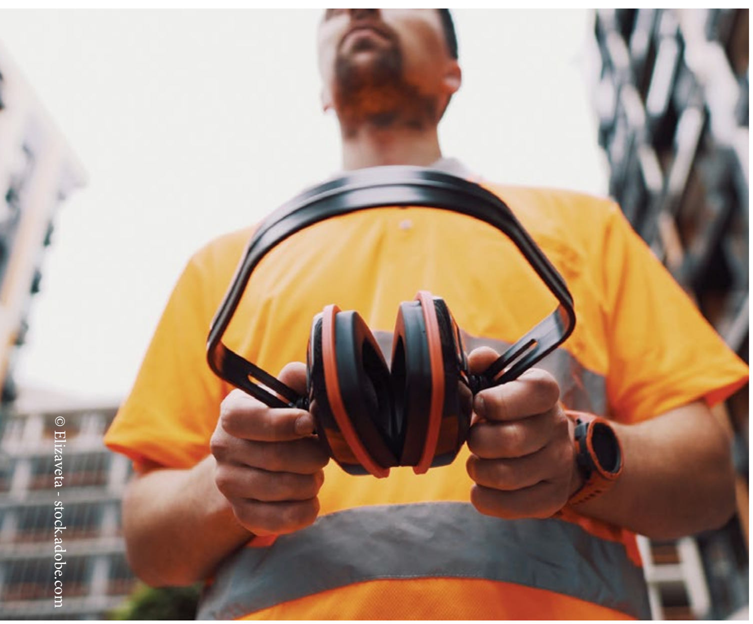
The Occupational Noise Exposure mandate (OSHA's 29 CFR 1910.95) requires employees exposed to 85dBA TWA be enrolled in the HCP. Employers are required to ensure employees participate in hearing conservation training for the duration of their employment. This should begin with initial orientation training,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



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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

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"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," maintained," Drs. Tuten and Gates concluded. 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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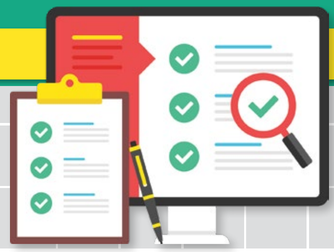

ANSI/ISEA Z89.1-2014: Head Protection Guidelines

"The ANSI/ISEA Z89.1 Standard for Head Protection is vital to Bullard's design and manufacturing process for head protection; it's used to measure and ensure that our products mitigate the impact, penetration, and electrical hazards today's workers face. With market emphasis on enhanced head protection, it's important the standard include these points so manufacturers can produce products customers are confident in." *Matt King, Bullard Global Product Portfolio Manager, Head Face Protection*

History

It should go without saying: Hard hats and head protection must be utilized and maintained properly to ensure safety. Workplaces and their environments can change, with new hazards appearing depending on the place or task. As of June 3, 2014, the American National Standards Institute (ANSI) issued approval for ANSI/ISEA Z89.1-2014, American National Standard for Industrial Head Protection.

The purported goal of ANSI/ISEA Z89.1-2014 was to eliminate ambiguity regarding characteristics and requirements of industrial head protection. This standard, written by members of ISEA's Head Protection Group, is a revised version of the 2009 edition. It was approved by a consensus review panel of tech experts, unions, construction industry, test labs, certification agencies and government agencies.

The core performance requirements for head protection remain unchanged. These include the following:

- Resist penetration and deflect blows to the head
- Possess a suspension system that can absorb the force of impact
- Serve as an insulator against electrical shocks (when applicable)
- Material is water-resistant and slow-burning
- Shield the scalp, face, neck and shoulders

Why Standard is Important:

We all know our cranium is hard and has evolved to protect the brain. The natural protection given to the human brain, however, is only suitable for minor hazards. Normal cranial protection is ***not*** enough when an individual is exposed to certain dangers. Therefore, industrial workers must wear hard hats to further protect their heads.

According to the OSHA standard 29 CFR 1910.135, "Employees working in areas where there is a possible danger of head injury from impact, or from falling or flying objects, or from electrical shock and burns, shall be protected by protective helmets." However, the OSHA standard does not specifically cover any criteria for said protective helmets. It ***does*** require compliance with ANSI/ISEA Z89.1-2014. As already noted, industrial hard hats must not only absorb the impact of blows to the head; they also must serve as insulators against electric shocks; shield the scalp, face, neck and shoulders; and be water-resistant and slow to burn. This standard is further designed to prepare hard hats for any of the above anticipated forces—through rigorous testing of the helmets.

Key Compliance Requirements:

There were three important updates in ANSI/ISEA Z89.1-2014, including performance and testing requirements for industrial hard hats. It also highlights the types and classes of protective helmets to provide employers with options, so they can provide appropriate protection for specific hazards present in their workplaces.

ANSI/ISEA Z89.1-2014 addresses the following:

- Specifications for helmets by Type (based on location of impact force) and Class (based on electrical insulation)
- Impact in occupational settings under normal temperature conditions and at high and low temperatures
- Safety recommendations for hard hats worn in the reversed position
- Requirements for high-visibility helmets
- Test methods for evaluating all requirements
- User cautions and recommendations regarding helmet care

Hard hats are categorized by impact type. Top impact (Type I) hard hats are designed to reduce the force of impact on top of the head. Top/lateral impact, or Type II, hard hats reduce the force of an object that may directly impact the top of the head, ***and*** are required to reduce the force from a side blow to other parts of the head.

Hard hats are classified as follows, per ANSI:

- Class G (General) is an all-purpose, general helmet that provides good impact and penetration protection, but it offers limited voltage protection (up to 2,200 volts)
- Class E (Electrical) provides the highest level of protection from high-voltage shock (up to 20,000 volts) and is especially well suited for electrical work
- Class C (Conductive) does not protect against electric conductors

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Some important updates contained in this version include optional testing and marking features for head protection for use in high-temperature environments, as well as editorial revisions to clarify test procedures. In addition to the classification of head protection, as stated above, helmets that comply with the standard's requirements need to be marked with the correct certification. IHW

Resources:

- For more information on the markings, as well as the other aspects of the updated standard, a copy of ANSI/ISEA Z89.1-2014 can be purchased from the International Safety Equipment Association from its web store: https://bit.ly/3OROsvK
- For a blog discussing the standard on ANSI's website, go to: https://blog.ansi.org/2016/06/ansiisea-z891-industrial-head-protection/

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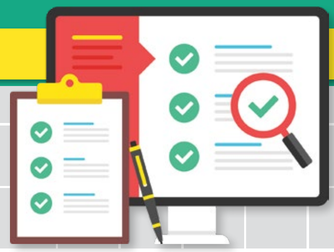

Preventing Fire & Dust Explosions: NFPA 654

"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, 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.

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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 Matters

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

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Resources:

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

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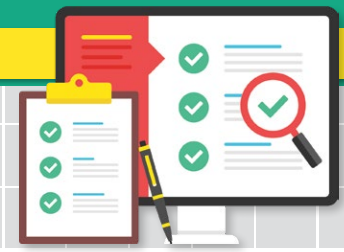


OSHA's General Industry Regulation:

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 has 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*

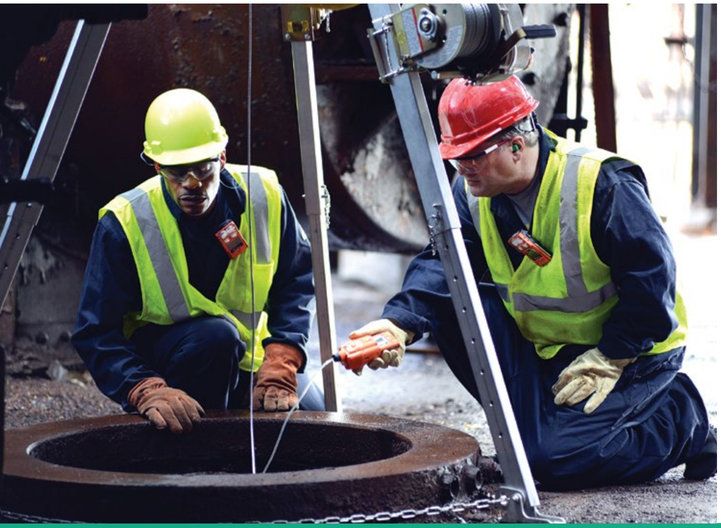
History

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 Matters

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

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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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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 Matters

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
- → See *IHW*'s article introducing the new standard: https://industrialhygienepub.com/respiratory/employer-responsibilities-under-oshas-new-crystalline-silica-rules-2/

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NFPA 350 Guide for Safe Confined Space Entry & Work

“Confined spaces are challenging working environments. Identifying the hazards involved then taking proactive steps to prevent them and minimize risks is paramount. Minimizing risks starts with knowing who’s inside a confined space, for how long, and monitoring the atmospheric conditions within it. This guide outlines many of the best practices we recommend with our own connected safety solution for gas detection and emergency response.” *www.blacklinesafety.com, 877-869-7212*

Background Information

NFPA 350 is a guide that was developed for workers who enter confined spaces for inspection, testing or associated work and to protect them from death, injuries or illnesses. The NFPA 350 Guide for Safe Confined Space Entry & Work provides information to protect workers from confined space hazards. This guide supplements existing confined space regulations, standards and work practices by providing additional guidance for safe confined space entry and work. References are provided throughout the guide, as well as annexes to direct the reader to other regulations and standards or other applicable content.

Also provided in the guide is information to identify, evaluate, assess; and then eliminate, mitigate or control hazards that are present or that may occur during entry into or work in and around confined spaces. It provides information on how to understand confined space safety and safeguard personnel from fire, explosion and other health hazards that are uniquely associated with confined spaces, as well as the training, qualifications and competencies required for personnel responsible for confined space hazard identification, hazard evaluation and hazard control.

Reducing Terminology Overload

One often confusing aspect of confined space safety is the terminology used by safety professionals and regulators to describe confined spaces. The terms "confined space" and "non-permit confined space" are too often used interchangeably to describe a confined space where no hazards are present. However, this same space might become a "permit-required confined space" if used by an employee welding or painting within it.

The guide states:

“It is well-recognized that changes that occur during confined space work can negatively affect confined space entry and work safety. NFPA 350 outlines the types of changes that can occur during confined space work and provides a method for reporting and managing those changes through a management-of-change system.”

Therefore, because the type of space can change daily, depending on what type of work is being done inside the space, NFPA 350 uses the term “confined space” throughout the document, instead of renaming a space based on the presence or absence of a hazard. All spaces that meet the OSHA definition of a confined space are referred to simply as "confined spaces" in NFPA 350.

Another issue that causes confusion is that OSHA allows for three types of permit-required confined space entries, depending on the hazards:

1. Alternate procedures entry
2. Reclassification to non-permit confined space
3. Full permit entry

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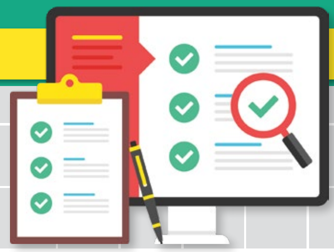
The procedures and requirements are different for each of these three different entries. NFPA 350 attempts to clarify this confusion by stating that three things should be present for all confined spaces:

Because the type of space can change daily, depending on what type of work is being done inside the space, NFPA 350 uses the term “confined space,” instead of renaming a space based on the presence or absence of a hazard. *(photo courtesy Adobe Stock)*



- Pre-entry evaluation for all confined spaces
- Use one form: Pre-entry Evaluation/Permit
- All entries undergo the same evaluation

The reclassification of alternate procedures is important, because it calls all confined spaces by the same term, and it requires a pre-entry evaluation for all spaces. This means the hazard (if present) can be identified and controls required can be addressed—without worrying about terminology. A signed form that is required for alternate procedures and reclassification is essentially now the pre-entry evaluation permit form.

> ***"All spaces that meet the OSHA definition of a confined space are referred to simply as 'confined spaces' in NFPA 350."***

Why Standard Matters

Documentation of confined space fatalities, while not complete, has estimated approximately 90-100 worker deaths, per year, from the mid-1990s through about 2010—despite regulations. However, the numbers are increasing. The most recent *Census of Fatal Occupational Injuries* published by the Bureau of Labor Statistics showed that 148 workers were killed in incidents associated with confined spaces in 2018. This is an alarming statistic, as it has increased steadily since 2011, when there were 120 fatalities in this area.

Communication & Monitoring

Confined space communication begins well before anyone actually enters the space itself. It starts with proper understanding of the hazards and risks that someone might encounter when working inside the space.

The NFPA 350 Guide to Safe Confined Space Entry and Work says that communication is a "vital, reiterative part of reducing hazards" in confined space entry operations. Hazards are identified and communicated during job hazard assessments and can also be communicated through other resources, such as Safety Data Sheets (SDS) that identify substances that might be found inside a space; blueprints and schematics that communicate information about the construction and equipment that may be in the space; and posted placards and markings that provide entrants with specific warnings about the space. NFPA 350, Sec. 7.13.1 states that "the atmosphere within and outside the confined space should be monitored continuously to ensure continued safe working conditions."

Resources:

- NFPA 350, Guide for Safe Confined Space Entry and Work can be viewed on the document information page at www.nfpa.org/350. This page includes a free, downloadable fact sheet and five-minute video, as well as an online training series and information about on-site training.
- All NFPA documents are available for viewing, free of charge, by going to NFPA's website at www.nfpa.org/[document number]. All guides are also available to purchase on the website.
- Go to https://www.bls.gov/iif/oshwc/cfoi/confined-spaces-2011-18.htm for the most recent *Census of Fatal Occupational Injuries* Fact Sheet published by the Bureau of Labor Statistics regarding confined space injuries and fatalities. IHW

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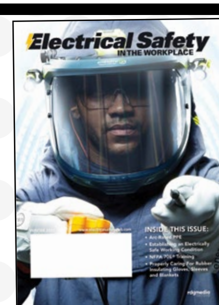

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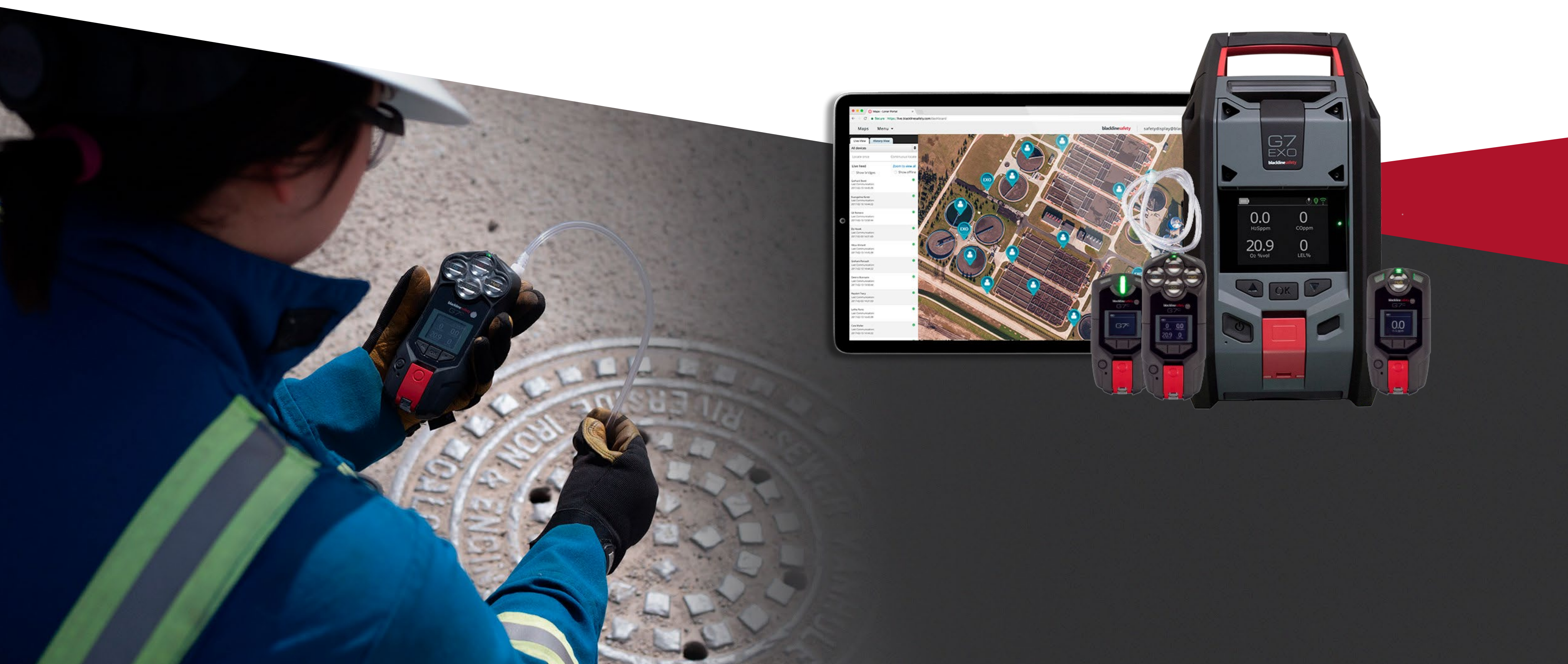

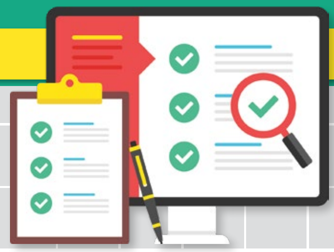

Chemical Protective Gloves

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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 micro-organisms—Part 1: Terminology and performance requirements for chemical risks."

Updates to Standard (2016)

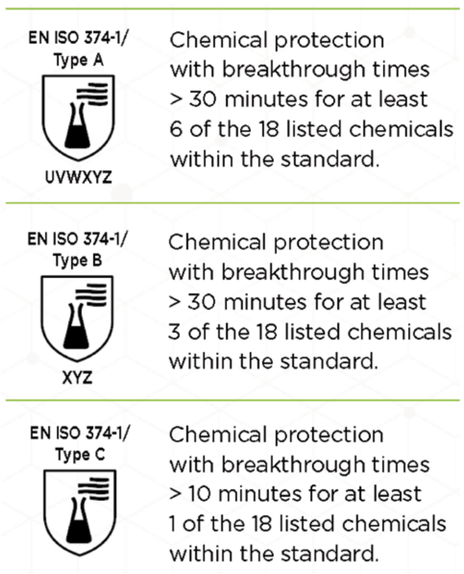
The changes that have occurred can be summarized by comparison, below.

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



Graphic courtesy Chem Rest (Showa)

- Gloves are classified as Types A, B or C
- Change of labeling 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.

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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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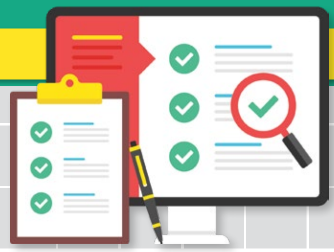

By: **Bob Henderson**, *Contributor*

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).

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.

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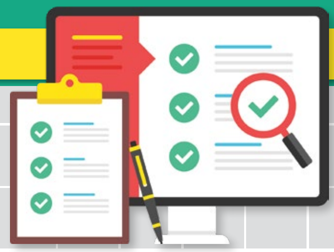
How you set the alarms in your gas detectors is a critical part of keeping workers safe. OSHA has annotated the Air Contaminant Z-Tables to clarify the differences between exposure limit guidelines and to help instrument users understand what is needed. *(photo courtesy Adobe Stock.)*



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 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

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

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).

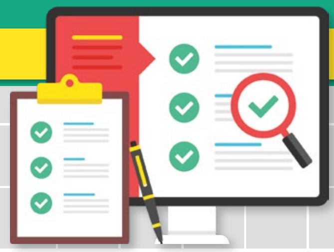
Individual employers are in much the same position as states when it comes to workplace exposure limits. Employers can either follow the official limits; or follow their own more conservative guidelines. Given the potential for lawsuits, many employers have made the strategic decision to base their corporate 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 push-back 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.

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,

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

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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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.

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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

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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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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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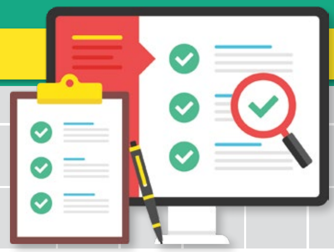

Emergency Eyewash & Shower Equipment: ANSI/ISEA Z358.1-2014

"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 Matters

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.

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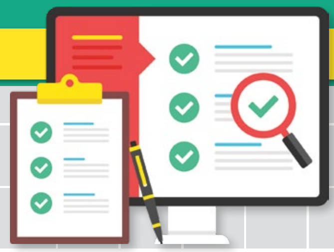
Safety Shower Test Cart

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

Keeping you dry for weekly eyewash and shower testing!

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When you have only a few showers to activate weekly

- Funnel collects the water
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- Clear, rigid tube is easy to hold
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T-Bowl

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- Included water gauge to help measure water flow

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- Includes all SSTC-5 features
- Included water gauge to help measure water flow

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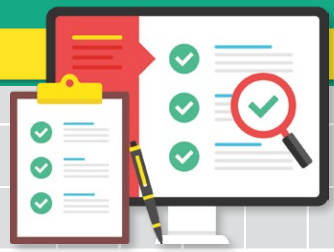

Navigating Combustible Dust

"Proper housekeeping is a powerful and essential line of defense against many types of workplace hazards, and combustible dust is no exception. NFPA 652 recommends cleaning methods, such as vacuuming, but also outlines specific design requirements to ensure the equipment can meet the demands of collecting combustible dust. In the absence of a formal OSHA rule, NFPA 652 is vital to guiding our manufacturing customers on how to identify, measure and, most importantly, choose the proper industrial vacuum to safely mitigate their combustible dust risk." *Nilfisk, 800-989-2235, www.nilfisk.us*

Why Standard was Created

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. If a company has processes that create dust or use powders, then it has a responsibility to determine if a combustible dust hazard exists.

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.

Background

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."

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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.

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 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

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. *–Packaging Technology Today*

- **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

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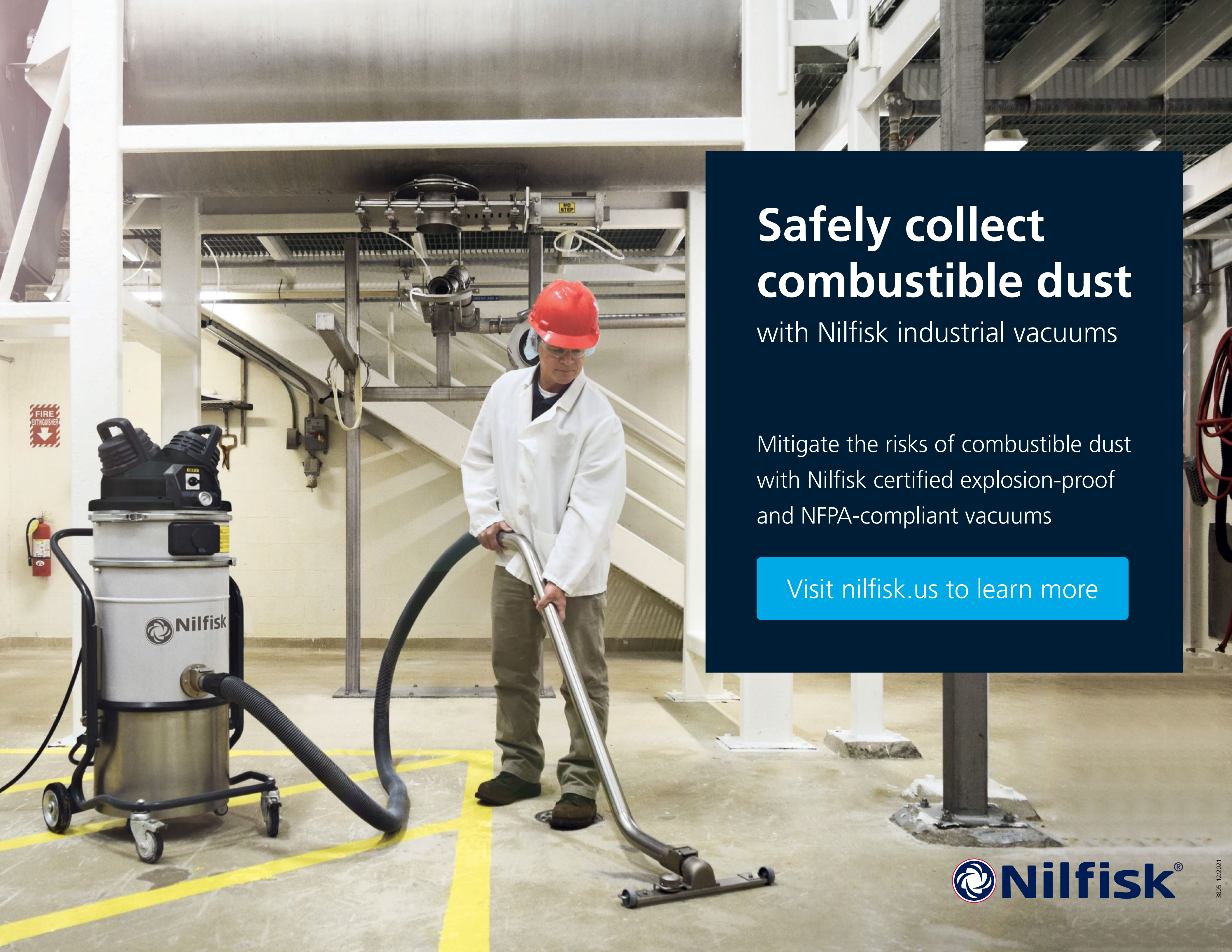
Resources:

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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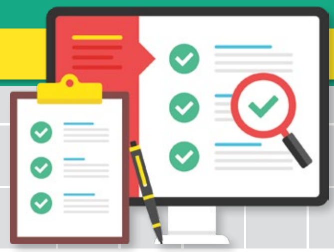

Combustible Dust Standard: NFPA 652

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 Matters

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.

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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 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:

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- → OSHA offers a lengthy list of materials that could produce combustible dust: https://bit.ly/1Lni5C7
- → For an in-depth article on this topic, see the article titled "Maximize Safety When Working With Combustible Dust" in the May-June 2022 issue of *IHW*.

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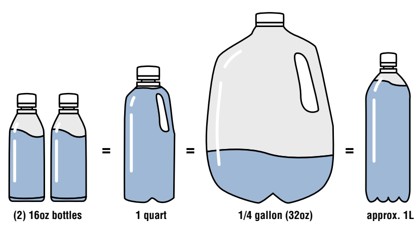

Per OSHA guidelines -
What does hydration look like for one hour?

According to OSHA, at least one cup (8oz) of water every 20 minutes while working in the heat is a good preventive measure, along with rest and shade.

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