

**Industrial  
Hygiene**  
*in the* **Workplace**

# Hearing Conservation & Noise Control in the Workplace

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# Consider This: Choosing the Right Hearing Protection

By: Kari Buchanan, M.P.H., M.A., Industrial Hygienist & National Hearing Conservation Association Expert

Hearing protection devices (HPDs) vary in their ability to attenuate noise. Several factors should be considered when selecting hearing protectors for specific settings and tasks.

- How much protection is needed?
- What is the characterization of the noise exposure?
- Is speech communication or other high-fidelity listening needed?

To select an appropriate HPD, consider the noise spectrum; hearing critical tasks (HCTs) being performed by workers; and HPD noise reduction rating by octave band located on HPD packaging. If you don't have access to all of this information, you can still select an HPD based on what you know about basic noise exposure and any hearing-related work tasks being performed.

HCTs are tasks in which hearing is the only sense that can be used to perform that task (i.e., tuning a musical instrument, talking on the telephone). HCTs can be found in many job settings; for example, they may involve audible alarms, horns, calibration tones or speech-based communication systems. HCTs are categorized as tasks that require sound detection, sound localization or speech communication.

The best way to identify HCTs is to observe and interview supervisors and individual workers. If you observe people shouting to communicate over background noise; removing an earplug to talk with a coworker; turning their heads in the direction of a sound; or delaying response until an approaching object is much closer, these behaviors may indicate the need for an alternative type of HPD (such as a level-dependent, linear earplug). **IHW**

## HPD Selection Considerations

This hearing protection devices needs to...	Check appropriate boxes	Considerations	Answers	Available devices
Provide continuous noise protection		What is the sound pressure level in dBA and dBC? Is the noise intermittent?		
Provide impulsive noise protection		Is the impulsive noise from small arms fire? Is the impulsive noise from artillery, shoulder-mounted weapon systems or explosives?		
Allow me to communicate		Face-to-face? Over a radio? Listen to announcement systems?		
Allow me to localize sounds		Do I need to be able to determine the direction and distance of a sound?		
Other		Does noise vary from continuous to quiet to impulsive noise? Can the impulsive noise be anticipated? What other protective gear is required that may impact my ability to wear hearing protection?		

This chart provides helpful guidance on how to determine if alternative HPDs are needed at a specific worksite. Interacting with and observing workers may also be helpful to increase employee awareness of hearing as a critical sense and to emphasize the importance of hearing loss prevention, on and off the job. Chart source: NHCA (<https://www.hearingconservation.org/>)



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# ACGIH Defining Science for OEHS Experts

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**[Biological Monitoring in Occupational Exposure Assessment](#)** – This is an asynchronous online course on how to use biological monitoring to assess chemical exposures. Biomonitoring can help in exposure assessment of specific chemicals and characterization of exposure pathways.



Biomonitoring is especially useful when chemicals enter the body through inhalation and skin. Recall that traditional industrial hygiene air monitoring can only assess airborne exposures. Biomonitoring may be interpreted at group or individual levels in conjunction with ACGIH Biological Exposure Indices (BEI) values.

**[Computational Fluid Dynamics in Industrial Ventilation](#)** – This on-demand course offers a combination of modules and independent study. Instruction centers on how to interpret the results of a CFD analysis along with understanding how to use subsequent metrics to identify and improve the functionality of ventilation systems.

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# Certificate in *Noise* and Hearing Loss Prevention

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### Computational Fluid Dynamics in Industrial Ventilation

**Earn 23 Education Contact Hours** with this on-demand course that offers a combination of modules and independent study. Instruction centers on how to interpret the results of a CFD analysis along with understanding how to use subsequent metrics to identify and improve the functionality of ventilation systems.



# Age "Correction" in Hearing Conservation Programs

By: Gregory A. Flamme and Kristy K. Deiters, *Contributors*

Employers may elect to adjust observed hearing threshold changes as an attempt to account for typical age-related change. However, there is no guarantee that age "correction" correctly represents the influence of age, and adjusted threshold shifts are not interpretable for individuals or small groups—because age-related changes vary widely across people. Further, age adjustments are only valid if they represent longitudinal trends.

Age-adjustment tables currently included in U.S. regulations are based on differences between small groups of people in the

1970s. Thus, employers choosing to age-adjust audiograms are making an implicit assumption that 1970s cross-sectional trends represent current age-related changes. Employers should carefully consider whether this assumption is reasonable.

We have recently developed age-adjustment tables using nationally representative data and validated them using a large occupational hearing conservation database (Flamme et al., 2019). These tables represent current population trends; account for differences in race/ethnicity; span ages 18 to 85

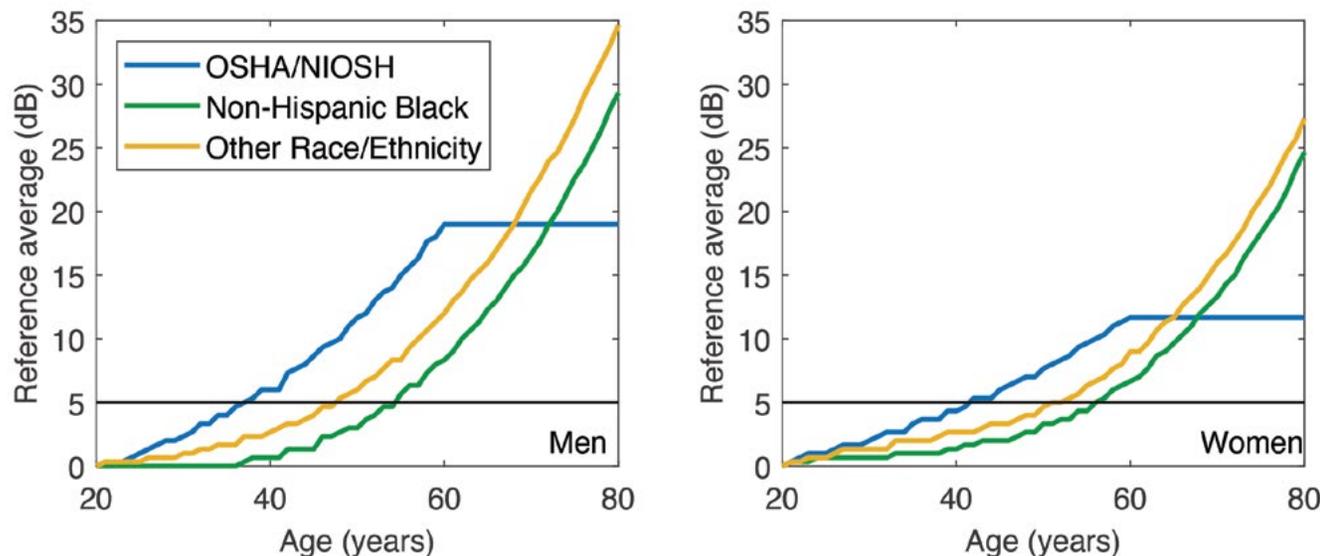
years; and match (within one 5dB audiometric step) median longitudinal changes among male workers through 30 years on the job.

Shallower cross-sectional trends were observed for people identifying with non-Hispanic Black race/ethnicity, and overall trends imply substantially less age-related change in hearing thresholds than is assumed in current U.S. regulations [see chart]. Employers applying 1970s-based age adjustments will substantially overestimate current age-related effects, and threshold shifts due to other factors (e.g., occupational/non-occupational exposure, disease) would be missed.

Regulations have not been modified to include recent adjustment tables, so employers must either (1) use tables that do not represent current trends; or (2) forego age adjustment. NIOSH has advised against using age "corrections" for decades and recent findings support that advice. **IHW**

[Gregory A. Flamme and Kristy K. Deiters, are with Stephenson & Stephenson Research & Consulting Researchers are also and National Hearing Conservation Association (NHCA) Experts. Visit NHCA at: <https://www.hearingconservation.org/>]

## COMPARISON OF AGE ADJUSTMENT VALUES



The left plot represents data for men; the right plot represents data for women. In each plot, the horizontal axis represents age and the vertical axis represents the mean tabled values across 2k, 3k, and 4k Hz, shifted to be equal at age 20. The blue curves represent the OSHA/NIOSH curves referenced in U.S. regulations. The green curves were derived for people reporting non-Hispanic Black race/ethnicity. The yellow curves were derived for people reporting any other race/ethnicity. The horizontal black lines at 5dB provide a reference comparison for an average of one 5dB audiometric step. Chart reference: Flamme, G. A., Deiters, K. K., Stephenson, M. R., Themann, C. L., Murphy, W. J., Byrne, D. C., Goldfarb, D. G., Zeig-Owens, R., Hall, C. Prezant, D. J., & Cone, J. E. (2019). Population-based age adjustment tables for use in occupational hearing conservation programs. *International Journal of Audiology*, 59(S1), S20-S30.

# An Essential Resource for Hearing Loss Prevention Strategies

AIHA University Bookstore publications set the standard for the occupational and environmental health and safety (OEHS) profession, from continuously updated, peer-reviewed text editions to white papers covering the latest research.

One of the most recent additions to the Bookstore line-up is the **sixth edition of *The Noise Manual***. This leading resource covers the latest hearing-loss prevention strategies to protect your workplace and the community and includes scientific content relevant to diverse disciplines, including students, industrial hygienists, physicists, safety managers, nurses, and more.

Each chapter has been extensively reviewed, updated, and in some cases, completely rewritten by new authors, all long-standing international leaders in the field of hearing conservation. Prior to publication, the new edition was rigorously peer-reviewed by dedicated, qualified volunteers.

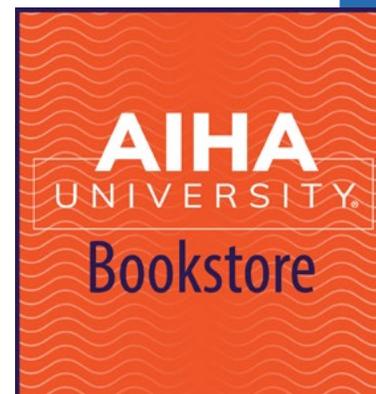
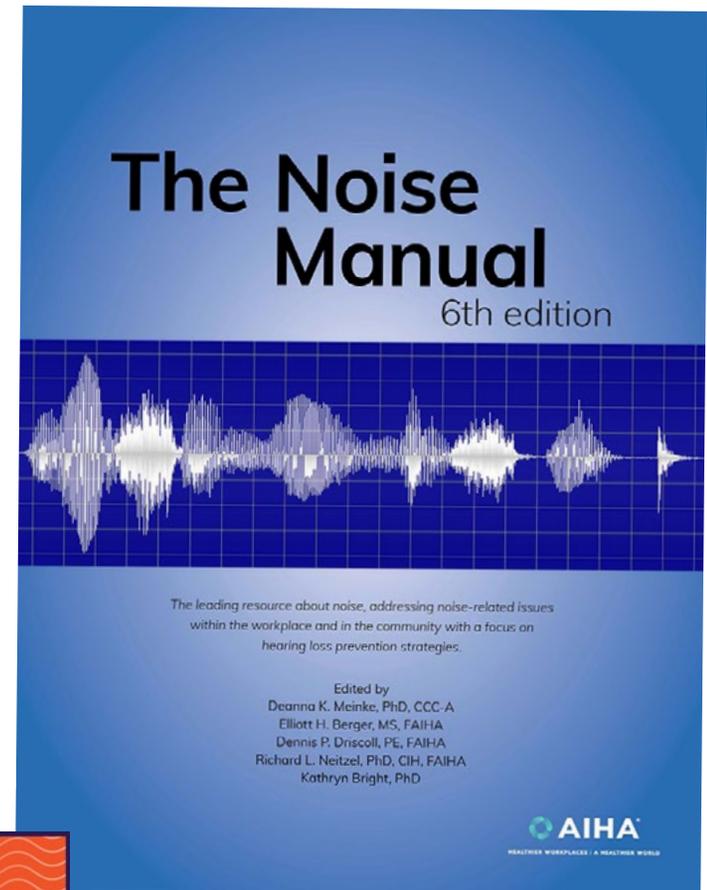
Through AIHA's online marketplace, access to print and digital versions is quick and easy. To make the content

even more accessible, *The Noise Manual*, 6<sup>th</sup> edition can be purchased in topic bundles for as little as \$29. Each bundle includes the front cover, a full chapter, and extras like the front matter, table of contents, symbols and abbreviations, and appendices.

Both fundamental concepts and advanced technical information are included, making this the perfect addition to your IH resource library.

This resource displays just one of the ways AIHA supports IH/OEHS professionals in their pursuit of healthier workplaces and a healthier world. AIHA members can join committees focused on hearing-loss prevention (among other topics) to exchange ideas with like-minded professionals and advocate for public support to help practitioners achieve best-in-class performance.

Their leadership and valuable input put AIHA on the map as the go-to resource for scientific-based education and training. Consider taking your seat at the table by **joining [AIHA](#)**. ■



# The Noise Manual, 6th edition

## The new edition is here!

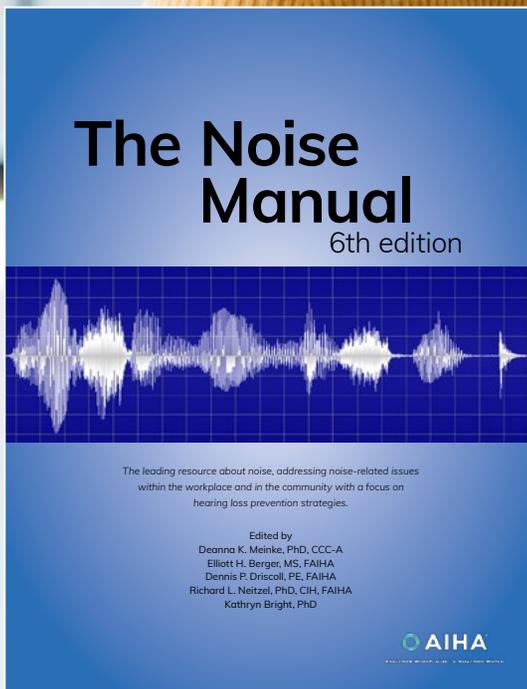
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# Noise Control in the Workplace

By: Phillip Rauscher MPH, CIH, CSP, Contributor

When one thinks of an effective hearing conservation program, there are a few things that often come to mind. The first elements are an in-depth audiogram in which a skilled technician or medical professional provides feedback on results—good or bad—to help the employee make sound decisions when in noisy environments. You may think of a robust noise-sampling program where data is routinely used to make decisions to protect employees. You might even think of a great personal attenuation check to ensure that each employee has a hearing protection device that is well-fitted; gets them the required hearing protection factor; and is well-received. However, there is a time-tested element that is often overlooked in practice in otherwise robust programs: engineering controls.

There are several reasons we need to ensure that noise control is given its due in our hearing conservation programs (HCP). I am a firm believer that, when looking at the hierarchy of control, we all carry the professional pride to heed its warning; elimination, substitution and engineering controls should always reign supreme to ensure that employees are as protected as possible. By this point, we have all been told of the variability and reliability of person protective equipment (PPE), and hearing-protection devices are no exception to the rule. Earmuffs seals will wear out; foam ear plugs may not expand properly; and employees may simply forget to put flanged plugs in when distracted by work. This makes engineering controls the responsible choice.

If the morality of protection is lost on a seasoned employee or a particularly shrewd accountant, there is another undeniable benefit: lower cost. Some of the simplest fixes that will reduce noise also help to prolong the life of equipment or increase its productivity. Unlubricated bearings wear quickly; old belts slip; and improperly mounted equipment vibrates, causing stress. (More on some of these later.)

If this still doesn't convince someone, remember, in the U.S., the OSHA regulation states that engineering controls need to

be utilized when employees are exposed to or above the permissible exposure limit (PEL). Though there is a long-standing compliance memo that states the rule will not be enforced until 100dBA, this could change, given today's tumultuous political landscape. Although it didn't happen, a recent administration considered changing this long-standing memo and could do so with little warning.

## Solving the Problem

In my time in the field, I got over the fear of engineering to help diagnose problem areas and came to realize not all problems need to be solved by a trained noise-control engineer (though if you have one lying in wait, that would be a great resource). The first step to determine the best place for noise-control effort was always to review employee sound exposure.

When looking facility-wide, personal exposure to employees, when measured, allows for the advantage to account for employee movements throughout the day. Though there may be a significant source of noise, sometimes these are naturally segregated from employees. For example, a pump room employees routinely avoid may be a significant source of noise but not a significant source of exposure.

When exposures to higher levels of noise are found in employee exposure, the next step is to do a walk-through of the employee work area. Like other qualitative assessments of the workplace, a noise-exposure assessment can start simply. Using our own hearing, we can likely determine a standout noise source simply by noticing that it is indeed very noisy surrounding that piece of equipment or, at the very least, a general area of concern in which the employee works.

If there are several sources that could be of concern, the next step is to start measuring. With a small amount of background knowledge, we can use a basic sound level meter (or a dosimeter with an instantaneous display, if that's on hand) to help determine the characteristics of a particular problem. When set to



With continued vigilance and sound programs, we can identify noise sources that contribute to the overall noise exposure of employees. (photo courtesy Adobe Stock)

the A-weighted decibel setting, a sound level meter will likely measure the same exposures that were collected by the dosimeter worn by the exposed employee during noise assessments.

The work area can be split into even-sized zones and noise levels; this will allow for a “map” of noise levels throughout the employee work area. Problem areas for noise generation will be of higher concern. Once a general area is identified, we can isolate a component of a complex machine in several ways.

The easiest way to determine which component of a machine is causing the concern is to turn systems on and off while other confounding noise sources are turned off. This could be after a shift or during lunch; a maintenance employee can help to turn on and off systems to help determine the source. This can isolate compressed air, gears, fans, bearings or belts causing noise.

If turning systems on and off isn't an option, another option that requires more specialized equipment is utilization of an octave band analyzer. This could be integrated with a sound level meter or could be a “filter” that is attached to help separate the entirety of noise measurement into narrower “bands.” This can isolate high- and low-pitch noise.

Understanding the characteristic of the noise exposure can help to determine which component is likely the problem. If

there is one octave that is particularly high, the sound level meter can be utilized to isolate this component. As we head into the future—smaller equipment can do more on a smaller platform—some personal noise dosimeters now have the option to measure octave bands, while simultaneously measuring A-weighted exposures required for compliance. This has the advantage of, rather than speculating the frequency of reoccurring noise exposures from throughout the shift, we can *see* these exposures all day. Once identified, there are several control measures that can be employed to lower overall exposure to employees.

### Possible Solutions to Common Noise Sources

#### Compressed Air

Often, one of the great drivers of any shop is compressed air. However, this is also a common source of noise. This is a case where more definitely isn't better. I suggest examining the amount of air use for all functions in a facility. Reduced air usage comes at a reduced cost (compressor runs less often in addition to a lower noise-generation rate). If there are part ejection sites that use air, a modified nozzle or even just a lower flow rate that still does the job can help to reduce noise.

When purchasing nozzles, manufacturers can often tell you how much noise will be generated at the air flow rate you need



Once a general problem area is identified, it's possible to isolate a component of a complex machine in several ways. (photo courtesy Adobe Stock)

to get the job done. Nozzles that reduce turbulence in air will also reduce the noise generated. When air flow is not needed, and instead is an exhaust from the process, exhaust silencers can be used that will greatly reduce noise generation.

#### Machine Guarding

Another common problem in the field is vibration of guarding: Every solution has a problem, right? Fortunately, there are several things that can help to alleviate some of the noise that is generated from guarding panels. If vibration is the major cause of noise from the panel, expanded metal can help to reduce the amount of noise generated by the panel.

If this is not possible, or if it does not reduce the noise level to the amount desired, we can reduce the amount of vibration in the panel with vibration-suppressing mounts. If a solid panel is utilized, adding mass to the panel in the form of stick-on rubber pads can help. Which side of the panel is treated will not matter in this case, as it will have equal effect no matter where applied. If the panel is part of a total enclosure of equipment, this could also double as a sound-attenuation device. Be sure gaps are closed and felt or rubber are used to minimize vibration between panels.

#### Gear Noise

Every time a gear strikes another, it will cause an impact noise—increasing the number of teeth will reduce the force applied by each tooth and will reduce noise. Better yet, use a belt that has no impact noise from contact. Just keep the belts properly maintained, or else you will get slippage that will become a problem all by itself.

#### Fans

A minimal amount of math can be used to determine the frequency of noise generated by an axial fan. If we multiply the number of blades by the fan's rotations per second, we will result in the frequency in hertz. If this is the predominant source of noise in the analysis, the simplest solution is to change out the fan. A new fan with different blade can change the frequency and noise generated, while still moving enough air to keep components cooled.



If a fan is determined to be a source of noise, a new fan with different blade can change the frequency and noise generated, while still moving enough air to keep components cooled. (photo courtesy Adobe Stock)

Centrifugal fans used in ventilation can also cause a problem. The amount of energy required to change the direction of air flow is one of the greatest challenges ventilation system fans are required to overcome. Every inefficiency in a ventilation system will create some kind of noise, but this is especially true when a duct turns too closely to the fan. In this case, proper use of a smooth duct with no turns at the inlet and exhaust of the fan will greatly reduce fan inefficiencies and noise.

With continued vigilance and sound programs, we can identify noise sources that contribute to the overall noise exposure of employees. Small measures taken daily by those in the field can help to eliminate noise-induced hearing loss as one of today's most common occupational health conditions. These small measures do not require massive overhaul of facilities in most cases and, with a bit of thought and intention, can reduce equipment wear; reduce employee exposure; and become a vital component of a top-tier hearing conservation program. **IHW**

[Phillip Rauscher, MPH, CIH, CSP, is Senior Director-Science, Education & Publications, at ACGIH®.]

## Cirrus Research

Noise changes lives. For more than 50 years, Cirrus Research has worked tirelessly to prevent and eradicate noise-induced hearing loss. Cirrus Research helps organizations worldwide protect their employees from the devastating effects of excessive noise exposure by developing easy-to-use, highly accurate and reliable noise measurement instruments.

Noise-induced hearing loss continues to be one of the most common yet preventable health conditions caused in the workplace. Despite how easy it is to avoid, experts estimate that around 250 million workers worldwide are affected by the condition. Noise-induced hearing loss doesn't just affect people's ability to hear. Research has shown a direct link between hearing loss and other health problems such as stroke, cardiovascular disease and mental health conditions including Alzheimer's disease.

Cirrus Research is committed to reducing and eradicating the risk to people's health caused by noise. We design, manufacture, and supply noise measurement instruments worldwide. In doing so, we help protect hundreds of thousands of people from the impact of excessive noise exposure.

### Making noise measurement work for you

The OSHA standards for occupational noise measurement indicate the type of sound level meter or noise dosimeter that you should use. The noise meters and noise dosimeters we manufacture meet these requirements and those of other occupational noise regulations throughout the world, including NIOSH, MSHA, ACGIH, Canada and the European noise at work regulations.

We offer a full range of noise measurement solutions to meet any need in any industry and application, including:

- **Noise level meters** for the measurement of machinery, tools and ambient noise levels
- **Noise dosimeters** to measure individual noise exposure for the duration of a working day
- **Cloud-connected remote noise monitors** to provide instant access to live noise, air quality and ground-vibration data, whenever and wherever it's needed
- **Noise-activated warning signs** to provide a visual alert to employees when noise levels have reached potentially dangerous levels, prompting them to wear their hearing protection
- **Acoustic calibrators** ideal for field calibration of your noise meters and dosimeters
- **Neighbor Noise monitors** to measure neighbor noise for resolving noise complaints.

All our instruments are backed by our industry-leading 15-year warranty, covering all accidental damage and providing peace of mind for our customers.

### New US-based calibration and service center

Whatever your brand of noise level meter or noise dosimeter, you can now calibrate them to the standards



you need at a new US-based instrument calibration center run jointly by Cirrus Research and our US partners NoiseMeters Inc.

The center covers the whole of the American continent. It offers a fast turnaround on factory-calibration, and meets the highest quality assurance levels needed for both occupational safety and environmental noise measurement.

### Why choose Cirrus Research

Not only can you benefit from the accuracy, reliability, and ease of use of our instruments, but also the added value that comes as standard with a purchase from Cirrus Research:

- Peace of mind knowing that your investment is protected with our **industry-leading worry-free 15-year warranty**

- The ability to analyze your data and create detailed reports for your organization, with our **licence-free data analysis software**, NoiseTools, that is supplied with each product as standard
- Confidence in the accuracy and reliability of your instruments, with our **US-based calibration laboratory**
- Trust in our technical excellence and expertise, as we've been a **market leader** for more than 50 years
- Certainty that you'll always have access to the answers you need, with our **in-house technical support team**
- Reassurance that you're playing your part to help the environment, as we ensure we build all our products with **sustainability** in mind

### Expert training, support and advice

We want you to get the best results from your investment, which is why we offer the following options to support you:

- Noise Awareness and Product Training courses delivered through our online Noise Academy. We've designed these to help you get the best from your equipment and to help you understand the

theory and practice of noise measurement and control, and

- Ongoing support and advice from our in-house team of experts.
- Whether you have a question about a product, or if you need advice on choosing the best one for your needs, our friendly team are always happy to help. Contact us today to find out how we can help you.

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# Hearing Protection: Critical, but Often Unused



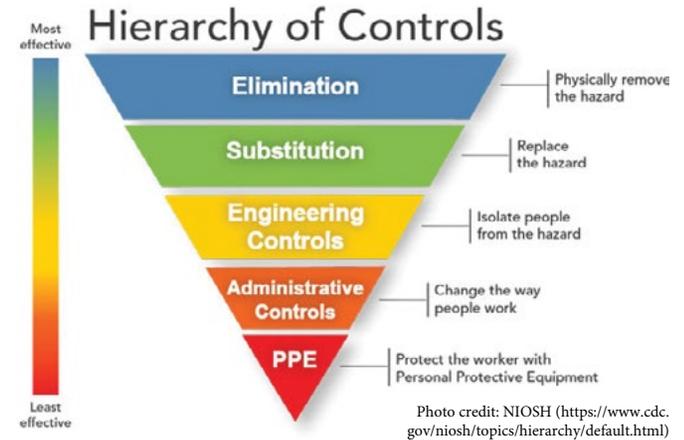
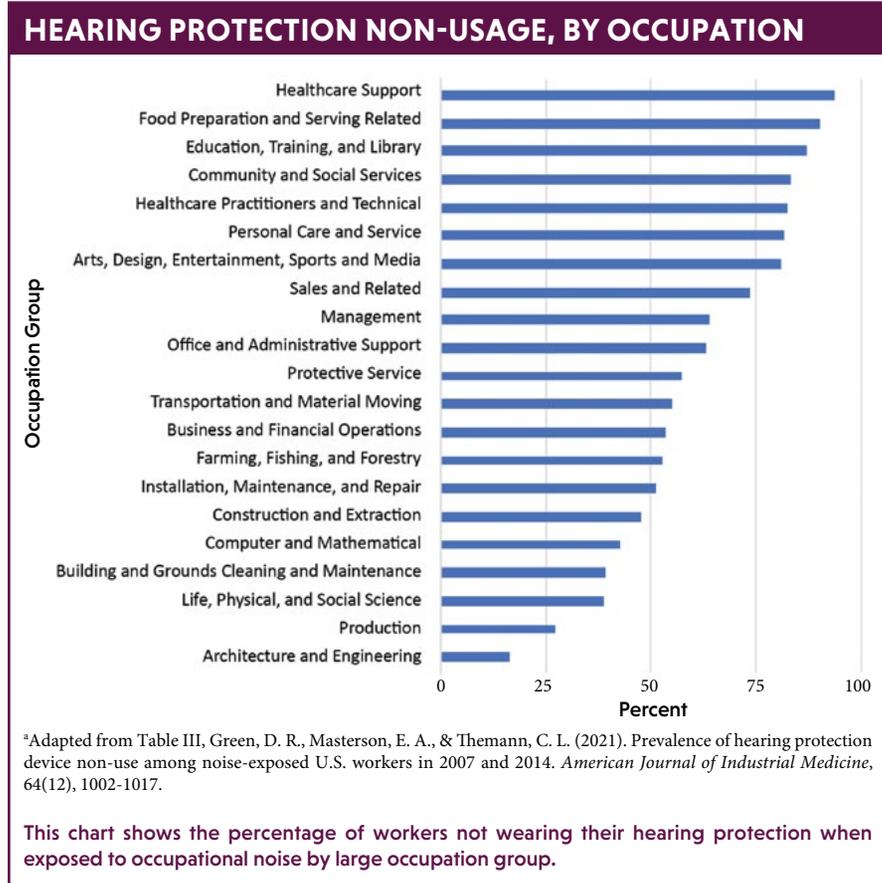
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About 14% of U.S. workers are exposed to hazardous occupational noise each year. The best way to reduce worker noise exposure is to follow the Hierarchy of Controls, beginning with eliminating the noise hazard; replacing the loud equipment or process; and using engineering controls to reduce noise levels at the source. These are considered the most effective methods, because they remove or reduce the hazard for all

affected workers. However, when these options are insufficient to reduce noise to safe levels, hearing protection is necessary.

Hearing protection is only effective when worn consistently and correctly. Unfortunately, many workers report not wearing their hearing protection when they are exposed to noise on the job. A recent study indicates that across all occupations, more than half of noise-exposed workers don't wear their hearing protection (53%). The three occupation groups with the most workers not wearing their hearing protection during noise exposure were healthcare support occupations (94%), food preparation and serving-related occupations (90%), and education, training and library occupations (87%). [See chart, below]

protection; and providing management support for compliance. **IHW**



*Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention.*

Elizabeth A. Masterson, is a National Institute for Occupational Safety and Health (NIOSH) Research Epidemiologist and National Hearing Conservation Association (NHCA) Expert. Visit NHCA at: <https://www.hearingconservation.org/>.

To reduce these percentages, the five critical barriers to wearing hearing protection must be addressed, including communication with others, comfort, convenience, climate (safety culture) and cost. Interventions include increasing awareness in industries and occupations with smaller proportions of noise-exposed workers; performing repeated trainings on the risks of noise and proper use of hearing protection; providing a variety of hearing protection device choices for workers; fit-testing to ensure proper fit and to increase self-efficacy in using hearing

# Advances in Sound Measurement Technology for the Industrial Hygiene Professional

Excessive noise in the workplace can present a real danger to employee health and well-being. Industrial Hygienists can use two tools to help understand whether workplace noise exceeds safe levels – sound level meters and noise dosimeters.

## How are Noise Levels Measured in a Facility?

Typically, the Occupational Safety Professional should start their investigation with a site sound survey. This involves measuring with a handheld sound level meter for a specific time period at various locations. Often, these measurements are plotted on a map to create a sound map of the site.

If the sound level in this survey exceeds a pre-determined level anywhere in the facility, the next step is to determine individual worker noise dose, either with the same meter or with a personal noise dosimeter. Larson Davis offers the



Spartan™ Series - a complete line of noise measurement solutions.

There are many options to choose from when selecting noise measurement equipment. At Larson Davis, noise is our focus. Our long track-record in noise, plus our commitment to investing in new technology allows us to provide IH professionals with the tools and support they need to get the job done. Our Spartan Series offers a single platform for Occupational Noise Assessment and advances in noise measurement technology that matter to the IH professional.

## Octave Band Analysis

Spartan Sound Level Meters and Noise Dosimeters offer optional Octave Band Analysis to help the user understand the frequency composition of the sound. Octave Band Analysis filters sound into discrete frequency bands and reports the sound level for each band. Why is this useful? Personal hearing protection devices such as ear muffs or earplugs are not equally effective across all frequencies. PPE manufacturers test their devices at various frequencies, allowing IH professionals to ensure their chosen and appropriately worn PPE adequately protects the wearer at the frequencies needed for their specific situation.

## Motion Detection

Spartan Noise Dosimeters with built-in bump and motion detection automatically excludes sounds that come from bumping the microphone. Results are graphically represented to indicate periods of time in which the device was stationary, helping detect tampering.

## Wireless Charging

Spartan Series meters save setup and teardown time through charging on a wireless charging pad, causing less wear and tear than traditional plug-in chargers. Not only can this

extend the life of your equipment, it is a more cost effective solution than docking stations.

## Wireless Setup, Remote Live View, and Data Download

Spartan Meters are able to communicate over Bluetooth and allow the entire measurement process to be managed from a mobile device. Built-in preprogrammed noise dose standards plus wireless connectivity make it easy to see noise dose in real time, with programmable exceedance alerts and alarms. As soon as the measurement is complete, data is automatically download to nearby connected devices. Reporting is quick and easy right from the job site, even when using multiple meters to simultaneously measure noise dose for many employees. Spartan Sound Level Meters have a large, intuitive touch display, streamlining meter setup. Both Spartan Meters and Dosimeters are compatible with the app and included G4 LD Utility software.

## Our Commitment to Support

Workplace noise assessment doesn't have to be hard. At Larson Davis, we are here to support the Industrial Hygiene professional so that understanding workplace noise can be as easy as understanding any other potential hazard. Contact us today to learn more about our solutions and our commitment to Total Customer Satisfaction. ■

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# What's a Problem Audiogram?

By: Theresa H. Small, Contributor

In hearing conservation programs, Occupational Hearing Conservationists often are tasked in selecting problem audiograms to send to a Professional Supervisor (PS). One might ask, what is a problem audiogram, and which audiograms need to be selected for further review?

Problem audiograms are often interpreted as those with a standard threshold shift (STS). The STS is calculated by finding an average change of 10dB or more at 2, 3 and 4kHz from the baseline hearing test. Depending on the regulation, there are specific steps that must be taken when this change occurs, and there is a point when a regulatory agency must be notified of that change. However, STS is not the only test that should be selected and evaluated further by the PS.

Problem audiograms should also include invalid, inconsistent and questionable hearing tests, as well as hearing loss that has not been previously evaluated and/or that meets referral criteria. An OSHA letter of interpretation dated December 19, 2017, states that “problem audiograms may include invalid audiograms; audiograms manifesting ear pathologies; audiograms that show large differences in hearing thresholds between the two ears; and audiograms that show unusual hearing loss configurations that are atypical of noise-induced hearing loss. If a technician’s preliminary review of an audiogram indicates a problem audiogram or an audiogram of questionable validity, the technician must refer the employee to the audiologist, otolaryngologist or physician for further evaluation.”

See the three figures for example problem audiograms. There are several sources for referral criteria, such as the American Academy of Otolaryngology-Head and Neck Surgery and the Council for Accreditation in Occupational Hearing Conservation, which provide details on when a hearing loss meets the point of referral. Problem audiograms are more than STS, so connect with the PS to further clarify, define and identify problem audiograms. **IHW**

Theresa H. Small, Associates in Audiology, is an Audiologist and National Hearing Conservation Association (NHCA) Expert. Visit NHCA at: <https://www.hearingconservation.org/>

Figure 1: New Hearing Loss

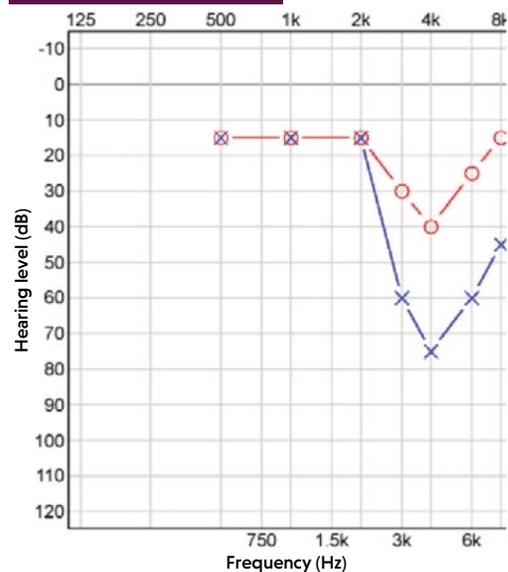


Figure 2: Invalid Erratic Pattern

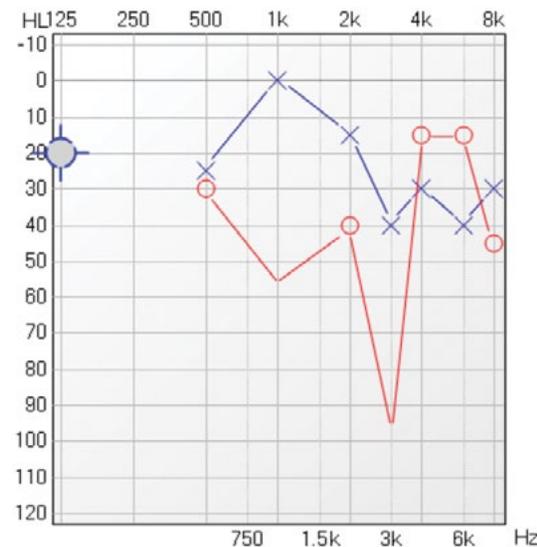
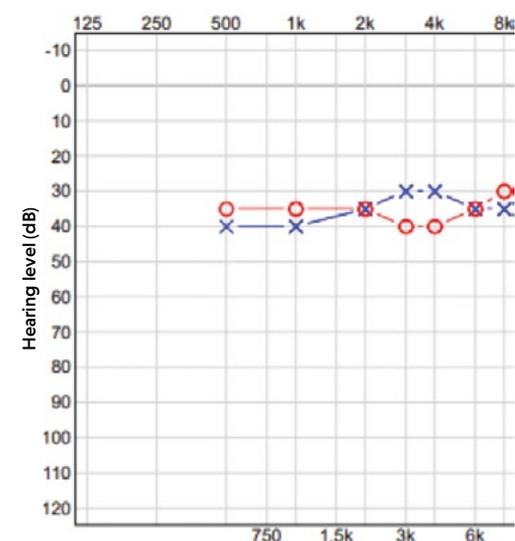


Figure 3: Asymmetrical 4k Hz Notch



# Advancements in Personal Noise Dosimeter Design: Making Noise Surveys Easier for the OEHS Professional

With all the responsibilities that fall on the OEHS professional's plate, noise monitoring is likely to be a part of it at some point due to the ubiquitous nature of the hazard. Many industrial hygienists and safety professionals monitor noise daily or weekly, but some are only called to measure exposures monthly, yearly, or when a complaint arises. Having a personal noise dosimeter that you can pick up, set up, and use without complex decision-making is essential to efficiency and results.

## A quick look at how personal noise dosimeters evolved

Taking a high-level look at the evolution of personal noise dosimeters<sup>1</sup>, one finds that early conventional noise surveys to determine compliance were performed with sound level meters (SLMs). SLMs were accurate and results somewhat representative but the instruments were not small enough to clip on a worker. This required the presence of another person to run the survey. Inherent complications with this process included possible variations in the sound field, problems taking measurements, and introduction of human error. Personal noise dosimetry came about as a solution and as a complement to the data SLMs provide. However, it was not until introduction of micro-electronic technology that the practical small, cable-free instruments we use now began to take shape.

Fast-forward to today. Among the many dosimeter options available, only one personal noise dosimeter truly stands out for its extreme ease of use.

A dosimeter designed with OEHS professionals in mind



**Introducing the NoiseCHEK Personal Dosimeter!** SKC's Team of Certified Occupational Hearing Conservationists, with its decades of combined experience in noise instrumentation, compiled a noise dosimeter wish list. The Team's goal--to create the easiest-to-use noise dosimeter available.

## What was on the noise dosimeter wish list?

OEHS professionals said they wanted:

- **Very simple, intuitive operation.** You can't get any easier than a bright green checkmark button for yes/go and red X button for no/stop! Screen language is simple and navigation easy.
- **Multiple programmable virtual dosimeters.** NoiseCHEK features 4 virtual dosimeters for simultaneous compliance monitoring.
- **A large easy-to-read screen, viewable in all light conditions.** NoiseCHEK features the largest display on a cable-free dosimeter and is front-lit for challenging viewing environments.
- **A secure windscreen!** NoiseCHEK has a locking windscreen. Say goodbye to compromised study results due to lost windscreens.
- **The ability to see status from a distance.** NoiseCHEK's bright multi-color LED collar indicates mode, status, and connection that you understand at a glance.
- **Automatic calibration.** No calibration adapter is needed. Place the SKC AcoustiCHEK Calibrator on the



NoiseCHEK microphone...NoiseCHEK's screen displays PASS or FAIL. No more guessing!

- **More data in the palm.** One screen contains all the information you need.
- **Bluetooth connectivity!** NoiseCHEK is available with or without Bluetooth to meet your needs.
- **Software and mobile app convenience.** **DataTrac dB Software for PC** provides for easy setup, scheduling, downloading, device lockout, exclusion and offset zone creation, file sharing, compliance report generation with graphs, and more. The **SmartWave dB mobile app** for Apple and Android communicates with NoiseCHEK via Bluetooth for operation, history, field notes, and compliance report generation that you can email or text on the go.
- **Secure charging.** The NoiseCHEK's magnetic charging docks securely hold one or five units securely in place.
- **Intrinsic safety.** NoiseCHEK is available with or without intrinsic safety to meet your applications.

## It's all about what you need... SKC NoiseCHEK is the solution.

NoiseCHEK makes noise surveys easier and is attuned to your specific needs. In addition, NoiseCHEK is your direct line to the SKC quality, service, and expertise that you have trusted for 60 years. Our Team is always here to help. Contact us today to learn more about what NoiseCHEK can do for you or simply visit [www.skcinc.com/noisechekis](http://www.skcinc.com/noisechekis) ■



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<sup>1</sup> Informational Report 1049 (MSHA)

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# Effective Hearing Loss Prevention Programs must Consider both Occupational and Non-occupational Noise

Hearing loss prevention programs (HLPPs) are essential to prevent occupational noise-induced hearing loss (NIHL). At a minimum, these programs must include noise measurements, noise controls and worker training; as well as use of hearing protection devices where exposures cannot be reduced through noise controls; and audiometric testing.

One vital but often overlooked topic for effective hearing loss prevention is non-occupational noise. HLPP training that focuses only on occupational noise misses an important opportunity to educate workers on the potential hazards of exposures outside the workplace. While non-occupational noise does not contribute much to NIHL risk among workers with very high occupational exposures (i.e., 8-hour average exposures >90 A-weighted decibels, or dBA), it can contribute substantially to NIHL risk among workers with lower workplace exposures.

One way to assess this potential risk is to consider not just 8-hour occupational noise exposures, but also 24-hour (daily)

noise exposures. As part of our Apple Hearing Study (AHS, [sph.umich.edu/applehearingstudy/](http://sph.umich.edu/applehearingstudy/)), a study of noise exposures and hearing impacts across America, we have evaluated 24-hour noise exposures among more than 100,000 volunteer participants.

Approximately 25% of more than 29 million measured person-days exceeded the 70dBA 24-hour limit for environmental noise recommended by the Environmental Protection Agency (see chart). Additionally, across more than 16 million person-days of measured headphone sound exposures among AHS participants, about 18% of person-days exceeded the 8-hour (daily) average limit of 75 dBA for headphone exposure recommended by the World Health Organization.

Incorporating non-occupational noise exposures into workplace HLPP training can help workers understand why it is important to limit non-occupational noise exposures in order to reduce the risk of NIHL. By addressing this issue, employers

can better prevent NIHL in their workforce and help improve the overall hearing health of Americans. **IHW**

## About the Authors

*Richard L. Neitzel, Abas Shkembi, Lauren M. Smith, Xin Zhang and Linyan Wang are Researchers and National Hearing Conservation Association (NHCA) Experts. Visit NHCA at: <https://www.hearingconservation.org/>*

## Noise Exposures Among Apple Hearing Study Participants

Type of noise	Number of person-days measured	Percent of person-days exceeding the recommended limit
Environmental (24-hour daily average)	29,090,556	About 25% over the Environmental Protection Agency limit of 70 dBA
Headphone (8-hour daily average)	16,773,264	About 18% over the World Health Organization limit of 75 dBA



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## Casella

Casella's dBadge2 noise dosimeters capture every possible noise exposure-related parameter in a single measurement run and make it available for subsequent download and analysis. dBadge2 Personal Noise Dosimeter Kits allow remote start, stop, or pause of a measurement run without interrupting the user—ideal for hazardous locations, positions, and filed data capture.

Transmit sound level measurements through Bluetooth® 4.0 wireless connectivity to increase productivity—no need to stop working to download readings! Dose, status, level alerts and more can be accessed through the free Airwave™ app and sent directly to your Apple or Android enabled device. Casella's dBadge2 noise dosimeters capture every possible noise exposure-related parameter in a single measurement run, and make it available for subsequent download and analysis. Email summary data, photographs, and even notes for review or inclusion in reports.

Ensure the correct hearing protection is chosen for each application and location. The measurements taken are in accordance with CFR 1910.95, ISO 9612:2009, and UK Guidance document L108. The LCD displays current noise levels in color-coded format for easy interpretation of alarm conditions at a glance. Use the preset alarm limits to adhere to OSHA, ISO, MSHA, and ACGIH guidelines, or set your own.

Each personal noise dosimeter comes with two mounting clips, one at the top and one at the bottom, for secure shoulder attachment and features a reliable and robust 1/2" diameter microphone with windscreen.

The dBadge2 downloads to the latest software package, Noisesafe. Casella's

NoiseSafe software saves the user time with its instantaneous reporting on an employee's noise exposure levels. Linked to the dBadge2, the software downloads a typical eight-hour workplace recording in just a few seconds. Audio and motion can be analysed to determine if any of the data is erroneous, which can be quickly and easily removed from exposure data, giving confidence in the results.

Designed to simplify downloading, reporting and analysing the data from Casella's dBadge2, our NoiseSafe software is free and available with each purchase any of our noise dosimeters. Support your noise exposure compliance and hearing conservation program with the easy generation of professional reports using Casella's NoiseSafe software. Easy analysis of the results from tests allow for compliance to legislation saving yourself time. Should you have any spurious noise readings; these can easily be selected and excluded from exposure results.

Tim Turney, Global marketing Manager at Casella explains, "The software is designed to make noise assessments easier for managers concerned with the health of their employees. The graphs and data produced can easily be customised depending on the user's requirements, making reporting pain-free and quick."

Casella's NoiseSafe software is available Free with any purchase of the dBadge2.

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Casella is dedicated to reducing occupational health and environmental risks and supporting businesses with their monitoring and analysis needs. For more information about Casella's advanced dBadge2 and NoiseSafe software visit, [www.casellasolutions.com](http://www.casellasolutions.com).

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