

Hearing Conservation Terminology

Courtesy of Workplace Integra, Inc.

A-Weighting

A filter applied to noise measurements, intended to replicate the frequency sensitivity of the human ear. The A-weighting is the most commonly-used weighting scale in hearing conservation programs, as it predicts quite well the damage risk of the ear. Sound level meters set to the A-weighting scale will filter out much of the low-frequency noise they measure, similar to the response of the human ear. Noise measurements made with the A-weighting scale are designated dBA. If A-weighted measurements are used to determine adequacy of hearing protection, OSHA instructions stipulate that a correction factor of 7 dB should be subtracted from the NRR of the hearing protector [as an error cushion for C-minus-A differences], then subtract the resulting lower NRR from the dBA noise measure to determine the protected noise level for the worker.

Action Level

The noise exposure level at which precautionary actions are required to prevent hearing loss. OSHA defines the Action Level as an 8-hour time-weighted average noise exposure of 85 dBA [or equivalently, a dose of 50%]. According to OSHA regulations, noise exposures at or above this Action Level require follow-up measures that include noise monitoring, annual audiometric testing for exposed employees, hearing protection, training and recordkeeping. Another way to describe these is to consider 85 dBA the required prevention level.

Administrative Controls

OSHA regulations state that when noise exposures exceed mandated levels, engineering and administrative controls are to be the first line of defense in reducing exposures to acceptable levels. Administrative controls include such actions as giving noise-exposed workers breaks in quiet areas, or rotating employees into noisy jobs for short durations so that no single employee is overexposed. If such controls are not feasible or practical, personal protective equipment [earplugs and earmuffs] should be implemented.

Age Correction

When a shift in hearing occurs, it is not immediately known whether that shift is due to noise exposure, normal age-related hearing loss, disease or even wax blockage. In many ways, age-related hearing loss mimics noise-induced hearing loss: it is painless, gradual in progression and affects high frequencies. To help differentiate the effects of aging from noise, OSHA published age correction tables within its Hearing Conservation Amendment. These age correction tables [one for males, one for females] show relative age correction values between two ages. Use of age corrections is optional for Hearing Conservation Program managers, but their use definitely helps differentiate the contributions of aging from noise in a hearing loss.

American National Standards Institute (ANSI)

The agency that promulgates consensus standards used in regulations. In the OSHA Hearing Conservation Amendment, ANSI standards are cited for calibrating audiometers used in annual testing, and for sound level meters used in noise monitoring.

Area Monitoring

A method recommended by OSHA to measure noise exposures. In area monitoring, a sound level meter is used to measure instantaneous noise levels in a given area. This method of noise monitoring is only valid when noise levels are fairly constant in a given area, and where workers remain fairly stationary throughout their work shift; in areas of high worker mobility, or where noise levels fluctuate, personal monitoring is the preferred method.

Attenuation

A reduction in noise level. Hearing protectors are rated for their attenuation; protectors with higher attenuation reduce more noise.

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Audiometric Test

A standardized hearing test. According to OSHA regulations, workers who are routinely exposed to 85 dBA average noise exposure must take an audiometric test at least annually. This annual hearing test is compared to the worker's baseline audiogram to determine if a significant decline in hearing has occurred.

Baseline Audiogram

The hearing test to which all successive hearing tests are compared. A worker's first hearing test is usually his baseline audiogram.

C-Weighting

A filter applied to noise measurements. The the C-weighting is a "flatter" filter, and allows more low frequencies to be measured. Noise measurements made with the C-weighting scale are designated dBC. If C-weighted measurements are used to determine adequacy of hearing protection, OSHA instructions state that the NRR of the hearing protector should be subtracted directly from the dBC noise measure to determine the protected noise level for the worker.

Council for Accreditation in Occupational Hearing Conservation (CAOHC)

The Council for Accreditation in Occupational Hearing Conservation (CAOHC) is a professional organization dedicated to providing consumer safety and protection by offering credentialing to those working to prevent noise-induced hearing loss.

Decibel (dB)

Unit of measurement used for sound levels. The decibel scale is a logarithmic, not a linear scale.

Dose

A measured percent of allowable noise exposure. The dose calculation takes two factors into consideration: the criterion level, and the exchange rate. Under current OSHA regulations, a 100% dose is equivalent to a 90 dBA time-weighted average noise exposure.

Dosimeter

A noise monitoring device that integrates exposures over time. When worn by a noise-exposed worker, a dosimeter measures all continuous as well as intermittent noise exposures, and provides a readout of the worker's average exposure at the end of the monitoring period. Since noise monitoring with a dosimeter is specific to the wearer, dosimetry is also referred to as personal monitoring.

Engineering Controls

According to OSHA regulations, when noise exposures exceed mandated levels, engineering and administrative controls are to be the first line of defense in reducing exposures to acceptable levels. If such controls are not feasible or practical, personal protective equipment [earplugs and earmuffs] should be implemented. Engineering controls include such actions as installing acoustic enclosures, barriers, mufflers, dampers, vibration isolators, or acoustic treatment of walls and ceilings. Varying the feed pressure or drive speed of production machinery can also reduce noise levels.

Effective Protection Level (EPL)

The level of noise in which the employee is working. $TWA-PAR = EPL$

Exchange Rate

The increase [or decrease] in noise level in decibels which warrants a doubling [or halving] of the noise dose. For example, an increase in noise level from 90 to 95 dB warrants a decrease in allowable exposure time from 8 to 4 hours, according to the 5 dB exchange rate accepted by OSHA. Exchange rates are somewhat arbitrary: different regulatory bodies choose different exchange rates. The most common exchange rates in use are 5 dB [used by OSHA] and 3 dB [recommended by NIOSH, and used in European regulations, as well as US Army and Air Force measurements].

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Field Attenuation Estimation System (FAES)

Commonly known as Fit-Testing Systems for Hearing Protection Devices.

Frequency

The physical measurement of the oscillations in a sound wave [measured in units called Hertz]. Subjectively, we hear frequency as “pitch” of a sound. The frequency range that can be perceived by human hearing generally extends from 20 - 20,000 Hertz, but the sounds that are most useful to us [in the speech and conversation range] are in the narrower range from 300 - 3,000 Hertz. Audiometric tests administered in industry generally test hearing at six or seven different standardized frequencies: 500, 1000, 2000, 3000, 4000, 6000 and sometimes 8000 Hertz. In noise monitoring and audiometric testing, frequency is often measured in thousands of Hertz, or kilohertz [kHz].

Hearing Conservation Amendment (CFR1910:95)

The 1983 amendment to OSHA’s basic noise regulation, defining the components of an effective hearing conservation program. The Hearing Conservation Amendment is the regulation that details noise monitoring, annual audiometric testing, provision and evaluation of hearing protectors, employee training and recordkeeping.

Hearing Protection Device (HPD)

A generic term for earplugs, earmuffs, and banded protectors.

Hertz (Hz)

Unit of measurement for frequency, equal to the number of oscillations [or cycles] per second of a sound wave.

Impulse Noise - Impact Noise

Defined as noise bursts with peaks more than one second apart [as opposed to continuous noise with peaks less than one second apart]. If the noise bursts occur very rapidly [noise from a running jackhammer, for example], the noise would not be considered impulse noise.

Microphone-In-Real-Ear (MIRE)

An objective method using a dual-element microphone probe to measure noise reduction by quickly sampling the difference in noise levels outside and under an earplug, with appropriate adjustments to predict real-ear attenuation at threshold (REAT).

Mine Safety and Health Administration (MSHA)

The Administration that protects Miners’ safety and health since 1978. Congress passed the Federal Mine Safety and Health Act of 1977 (Mine Act), the legislation which currently governs MSHA’s activities.

National Hearing Conservation Association (NHCA)

The Association was created to provide a forum where others of similar persuasion could share information and gain increased insights regarding occupational hearing conservation. The mission of the NHCA is to prevent hearing loss due to noise and other environmental factors in all sectors of society.

National Institute for Occupational Safety & Health (NIOSH)

NIOSH is a U.S. government agency, charged with providing research and recommendations in support of U.S. health and safety policies and regulations. In one of its roles, NIOSH is the research arm of OSHA. NIOSH has no authority to make regulations, only recommendations.

Noise-Induced Hearing Loss (NIHL)

Permanent loss of hearing due to overexposure to noise. NIHL is marked by a decline in high-frequency hearing sensitivity [often beginning around 3000-4000 Hz] regardless of the noise source, usually affecting both ears, and usually slow in progression - NIHL often takes years to develop. NIHL is often accompanied by tinnitus [ringing in the ears], but is not typically accompanied by other symptoms such as pain, fullness, or drainage from the ears. NIHL is permanent, painless, progressive, but also very preventable when hearing protectors are properly used 100% of the exposure time.

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Noise Reduction Rating (NRR)

The hearing protector rating method used in the U.S. The current range of NRRs available in the U.S. market extends from 0 to 33 decibels. The NRR is derived from an involved calculation that begins with attenuation test results from at least ten laboratory subjects across a range of frequencies. While it is not a perfect real-world measure of attenuation, the NRR is the most standardized method currently in use for describing a hearing protector's attenuation in a single number.

Occlusion Effect

The amplification of body-borne sounds caused when you occlude [close off] the ear canal. With hearing protectors, the Occlusion Effect is reduced by inserting the earplug deeper into the ear canal, or by stiffening the soft portion of the ear canal by using an earplug with more surface contact in the ear canal.

Occupational Safety & Health Administration (OSHA)

The U.S. government agency, organized in 1970 as part of the Department of Labor, charged with overseeing safety and health issues in the workplace. OSHA is a regulatory body, with the authority to enact standards and rules. The most significant OSHA standard affecting workplace noise exposures is its Hearing Conservation Amendment CFR 1910.95, enacted in 1983.

Octave Band Analysis

An analysis of noise levels broken down by component bands one octave apart in center frequency [e.g. 125, 250, 500, 1000, 2000, 4000, 8000 Hz]. Such noise measurements offer more precise information about the spectrum of the noise, but are more time-consuming.

Personal Attenuation Rating (PAR)

The amount of hearing protection achieved by the earplug as actually worn by the worker. The difference between the earplug-in measure and the earplug-out measure is the amount of hearing protection the worker receives.

Permanent Threshold Shift (PTS)

A permanent decline in hearing following overexposure to noise. PTS usually occurs after repeated exposures to loud noise, but can also occur after only one traumatic exposure to noise. Most workers experience a Temporary Threshold Shift in hearing prior to a Permanent Threshold Shift. But because of individual variations in tolerance to noise, there is no way to predict when a shift in hearing will become permanent. Therefore, hearing protection is critical for all loud noise exposures.

Permissible Exposure Limit (PEL)

The maximum noise level allowed, beyond which protective measures are mandated. Also called the Criterion Level. In current OSHA regulations, the Permissible Exposure Limit is 90 dBA of noise exposure over an 8-hour time-weighted average. Workers exposed continuously at this level throughout a work shift will have a dose of 100%. Exposures over this PEL warrant protective actions - administrative or engineering controls, or mandatory use of hearing protection.

Personal Monitoring

A method recommended by OSHA to measure noise exposures [the other being Area Monitoring]. In personal monitoring, a noise dosimeter is used to average exposures over time. When worn by a noise-exposed worker, a dosimeter measures all continuous as well as intermittent noise exposures, and provides a readout of the worker's average exposure at the end of the monitoring period.

Real Ear Hearing Testing (REAT)

A straight forward, subjective method of testing an individual's hearing that captures the performance as experienced by the individual.

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Recordable Hearing Loss

The amount of decline in hearing that triggers required reporting on OSHA health and safety records. Current criteria for recordability on OSHA's Log of Work-Related Injuries and Illnesses [OSHA Form 300] define a hearing loss as recordable when any work-related Standard Threshold Shift occurs, and when the resulting average hearing thresholds are 25 dB HL or higher at the STS frequencies in that ear [2000, 3000 and 4000 Hz on the audiogram]. This means a hearing loss is recordable when a significant noise-induced shift in hearing occurs, and when that shift is out of the normal range of hearing.

Revised Baseline

The audiologist or physician reviewing the audiograms may revise the baseline, by designating a later hearing test to be more indicative of stable hearing levels. A baseline audiogram might be revised due to improved thresholds [if the employee undergoes corrective surgery, for example, for a physical disorder in the ear] or due to worse thresholds. OSHA regulations specify a process for revising baselines for workers who demonstrate a persistent shift in hearing, thus avoiding informing a worker repeatedly year after year of the same shift in his hearing.

Sound Level Meter

A noise monitoring device that measures instant noise levels. Since noise monitoring with a sound level meter is specific to the immediate area where the measurement is being taken, these measurements are also referred to as area sampling. The input to a sound level meter can be filtered through different weightings [see A-Weighting and C-weighting] to mimic the reception of the human ear. Optional attachments, such as Octave Band filters, can further restrict the noise measurement only to specific frequency bands. Sound level meters used for regulatory compliance must meet specifications in ANSI Standard S1.4-1971, "Specifications for Sound Level Meters."

Standard Threshold Shift (STS)

A significant change in hearing thresholds, defined by OSHA as an average decline of 10 dB or more at 2000, 3000, and 4000 Hz in a given ear, relative to a baseline audiogram. A Standard Threshold Shift can only be determined when at least two audiograms for the same worker are compared - the baseline and the annual audiograms. Optional age corrections can be applied when determining whether an STS has occurred. When an STS occurs, employers are obligated under OSHA regulations to inform the worker, and carry out a series of preventive measures to reduce the employee's noise exposure and refit/retrain the worker in hearing protection.

Temporary Threshold Shift (TTS)

Initial overexposures to noise cause a temporary decline in hearing, which may last for a few minutes or hours. A worker with a Temporary Threshold Shift will perceive incoming sound as being muffled, or not as sharp; but once the ear has rested for some time, hearing recovers to normal levels. Physiologists believe the receptor cells in the ear fatigue with loud noise exposures, and require several hours of relative quiet to return to their normal state.

Time Weighted Average (TWA)

A computed average of all incoming sound levels, that represents what the average noise level would be if that level remained constant over an 8-hour work shift. According to current OSHA standards, the Action Level is an 8-hour time-weighted average of 85 dBA and the Permissible Exposure Limit is an 8-hour time-weighted average of 90 dBA.