USC HEARING CONSERVATION PROGRAM

JULY 2022

USC University of Southern California

OFFICE OF ENVIRONMENTAL HEALTH & SAFETY

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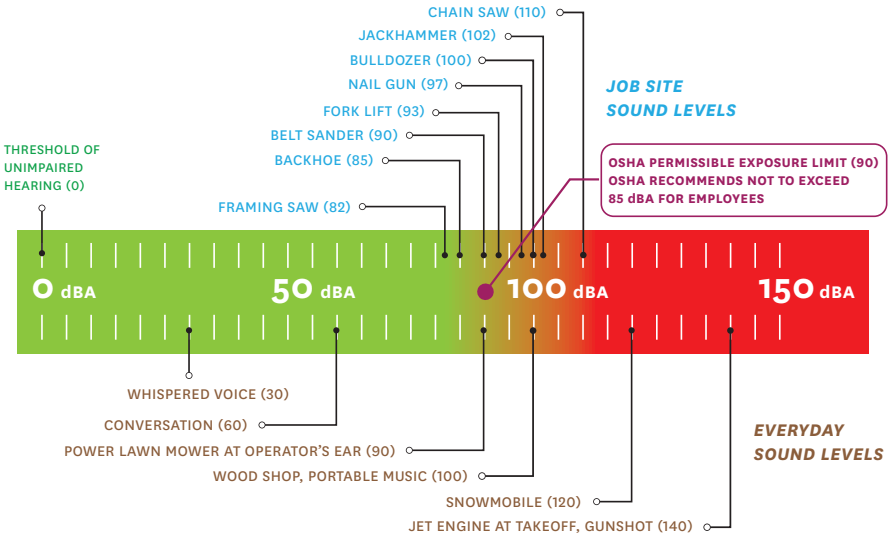
1.0 Purpose and Scope

The purpose of this document is to prevent occupational noise-induced hearing loss and comply with California OSHA requirements (8CCR5095-5100). Cal-OSHA regulations require employers to provide employees with proper protection against the effects of noise exposure when sound levels exceed an 8-hour time weighted average (TWA) of 90 dBA (Permissible Exposure Level). The protective measures may be provided either through engineering or administrative controls. If these control measures fail to reduce the noise within the acceptable limits, personal protective equipment shall be provided and used. Additionally, whenever employee noise exposures equal or exceed an 8-hour (TWA) sound level of 85 dBA (action level), the employer shall develop and administer a Hearing Conservation Program (HCP).

NOTE: Noise levels below 85 dBA are considered nuisance noise. While these levels may cause increased stress levels, distractions or discomfort, they are not expected to result in permanent hearing loss.



This program applies to all University of Southern California (USC) employees and students who are exposed to noise levels that are equal to or exceed the Action Level established by Cal-OSHA.

USC's Hearing Conservation Program includes:

- Noise surveys
- Audiometric testing
- Hearing protection
- Employee education and training
- Recordkeeping

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2.0 Regulations

State

Cal/OSHA

- Cal-OSHA regulations 8CCR5095-5100: Article 105, "Control of Noise Exposure": https://www.dir.ca.gov/title8/sb7g15a105.html
- Cal-OSHA regulation 8CCR14300, "Recording Criteria for Cases Involving Occupational Hearing Loss": https://www.dir.ca.gov/t8/14300_10.html

Federal

OSHA

- OSHA "Occupational Noise Exposure": https://www.osha.gov/SLTC/noisehearingconservation/hearingprograms.html

NIOSH

- NIOSH (National Institute for Occupational Safety and Health), "Controls for Noise Exposure": https://www.cdc.gov/niosh/topics/noisecontrol/
- NIOSH (National Institute for Occupational Safety and Health), "Buy Quiet": http://www.cdc.gov/niosh/topics/buyquiet/

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3.0 Definitions and Acronyms

ACTION LEVEL	A noise exposure equal to or exceeding an 8-hour time-weighted average (TWA) sound level of 85 decibels measured on the A-scale (slow response) or, equivalently, a dose of fifty percent.
ADMINISTRATIVE CONTROLS	Methods that limit an employee's exposure time to noise. This includes assigning the employee to less noisy areas in the workplace for a certain length of time so the employee shall not exceed the action level.
AUDIOGRAM TESTING	Exams that measure the sensitivity of a person's hearing threshold in decibels as a function of frequency.
AUDIOMETER	An instrument for measuring the threshold or sensitivity of hearing.
AUDIOLOGIST	A professional specializing in the study and rehabilitation of hearing, and certified by the American Speech-Language-Hearing Association or licensed by a state board of examiners.
A-WEIGHTED	The A-weighted, expressed as dBA, is the scale used for most occupational noise measurements. The A-weighted approximates the range of human hearing as it filters out lower frequency.
BASELINE AUDIOGRAM	An audiogram obtained after 14 hours of quiet. The baseline audiogram is the reference audiogram against which future audiograms are compared.
CONTINUOUS NOISE	Noise levels that vary with intervals of one second or less.
DECIBELS (DB)	A measure of the sound level (loudness). The decibel scale is a logarithmic scale; as an example, a 90 dB noise is ten times louder than an 80 dB noise.
DECIBELS, A-WEIGHTED (DBA)	The A-weighted is the scale used for most occupational noise measurements. The A-weighted approximates the range of human hearing by reducing the effects of lower and higher frequency noises with respect to the medium frequencies.
DECIBELS, C-WEIGHTED (DBC)	The C-weighted scale filters include both high and low frequency noise and are used for impact noise and in the selection of hearing protection.

ENGINEERING CONTROLS	Installation of quieter equipment, use of barriers, damping, isolating, muffling, installing noise adsorption material, mechanical isolation, variations in force, pressure, or driving speed or any combination of methods to decrease noise levels.
FREQUENCY	A sound's pitch measured in hertz (hz); high pitches are high frequency sounds.
HEARING CONSERVATION PROGRAM (HCP)	Program established when employees are exposed to noise exceeding the Action Level. Program must include noise surveys, audiometric testing, hearing protectors, training, and recordkeeping requirements.
HEARING PROTECTION DEVICES (HPDs)	Personal protective equipment that is designed to be worn in the ear canal or over the ear to reduce the sound level reaching the ear drum. Examples include ear muffs or plugs.
HEARING THRESHOLD LEVEL (HTL)	The lowest threshold that the employee can hear the test tone during an audiometric test. HTLs are recorded on the employee's audiogram.
HERTZ (HZ)	A unit of measurement of frequency, expressed as cycles per second.
IMPULSE/IMPACT NOISE	A sharp burst of sound, generally less than one-half second in duration, that does not repeat itself more than once per second.
NOISE	Unwanted sound.
NOISE DOSIMETER	An instrument worn by an individual that integrates the sound level exposure over a period of time.
NOISE REDUCTION RATING (NRR)	The Noise Reduction Rating of hearing protection devices (HPD) indicates the theoretical amount of reduction of noise levels that can be achieved if the HPD is worn correctly. This rating is shown on the HPD packaging.
OTOLARYNGOLOGIST	A physician specializing in diagnosis and treatment of disorders of the ear, nose, and throat.
PERMISSIBLE EXPOSURE LIMIT (PEL)	90 dBA 8-hr TWA. Employees may be exposed to 90 dBA for an 8 hour time weighted average (TWA) exposure without experiencing serious hearing effects. Ref: Cal-OSHA 8CCR§5096 "Exposure Limits for Noise" Table N-1: https://www.dir.ca.gov/title8/5096.html. Protection against the effects of noise exposure shall be provided when the sound levels exceed those shown in Table N-1 when measured on the A-scale of a standard sound level meter at slow response.
PITCH	Another term for sound frequency. Higher pitches are higher frequency sounds.

REPRESENTATIVE EXPOSURE	Measurements of an employee's noise dose or 8-hour time weighted average sound level that is representative of the exposures of other employees in the workplace.
SOUND	A vibration or pressure oscillation that is detectable by the ear drum.
SOUND LEVEL METER	An instrument used for the measurement of noise in sound level surveys.
SPEECH INTERFERENCE LEVELS (SILs)	The frequencies most associated with speech, which are the 500-4000 Hz (frequency) range. Vowels (a, e, i, o, u) are low frequency sounds (below 2000 hz) and consonants (b, c, d, etc.) are high frequency sounds. The low frequencies are the least affected by noise. If the high frequencies are affected, t's and p's or s's and f's may be easily confused.
RECORDABLE THRESHOLD SHIFT	A recordable threshold shift is recorded on the OSHA 300 Log when an employee has experienced a work-related standard threshold shift in one or both ears, and the employee's average threshold of hearing is 25 decibels (at 2000, 3000, and 4000 Hz) or greater. The 25 decibel threshold is not adjusted for age-related hearing loss. Once the threshold is verified, the loss is recorded on the OSHA 300 Log.
STANDARD THRESHOLD SHIFT (STS)	An average shift from the baseline measurement in either ear of 10 dB or more at 2000, 3000 and 4000 Hz. These frequencies are the most important frequencies in communication and the most sensitive to damage by industrial noise exposure.
TEMPORARY THRESHOLD SHIFT (TTS)	A short term loss of hearing that is not permanent. A loss may be observed on an audiogram, but would not be verified when retested on an alternate day. TTS is effectively a warning the body has exceeded its limits. TTS is common when employees are exposed to impulse-impact noises, or to high noises without hearing protection to reduce the exposures. TTS can take as long as three weeks to fully recover, and over time, TTS will become permanent.
TIME-WEIGHTED AVERAGE SOUND LEVEL (8-HR TWA)	That sound level, which if constant over an 8-hour exposure, would result in the same noise dose measured in an environment where noise level varies.
THRESHOLD OF PAIN	A noise level of 120 dB causes pain.

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4.0 Roles and Responsibilities

Supervisor / Instructor / Department

1. Ensure that:
    a. Noise controls are considered when procuring equipment, machinery and tools. Technical specifications shall be reviewed for any equipment likely to produce more than 90 decibels.
    b. Noise-hazardous equipment/areas are properly labeled or posted (greater than or equal to 85 dBA operating noise level).
    c. Employees are provided with hearing protectors when required.
    d. Employees properly use and care for hearing protectors.
    e. Potentially overexposed employees are provided with a baseline audiometric hearing test prior to the initial work assignment and then annually thereafter. High noise exposure must be avoided for 14 hours prior to an audiometric exam.
    f. New employee HCP orientation/training and annual refresher HCP training of employees are provided to all potentially overexposed personnel.
2. Notify Environmental Health and Safety (EH&S) of:
    a. Noise complaints or potential noise hazards.
    b. Process, materials, or equipment changes that may alter noise exposures.
3. Notify employees and scheduling audiometric testing.
4. Enforce the use of hearing protectors or noise reduction procedures in the designated areas/ assignments.
5. Post a copy of occupational noise regulation (California Code of Regulation, Title 8, Sections 5096-5100, Article 105) in a conspicuous area (e.g., breakroom, common area).
6. Maintain the following records:
    a. Name and job classification of the employee in the HCP
    b. Audiometric test results from USC's Occupational Health Provider
    c. Noise exposure assessment
    d. Training documentation - see Recordkeeping Section

Environmental Health and Safety (EH&S)

1. Administer the Hearing Conservation Program.
2. Perform the workplace and employee noise evaluations to:
    a. Determine if engineering and administrative controls are needed, and how they should be implemented.
    b. Identify areas or processes that require noise abatement and/or posting.
    c. Evaluate employees' exposure, by job classification, to determine which job titles need to be included in the Hearing Conservation Program.
3. Maintain records of employee exposure measurements.
4. Provide comprehensive annual training on HCP and HPDs (Hearing Protection Devices).
5. Assist employees in selecting the proper HPDs and provide instruction on their use.
6. Record cases of occupational hearing loss if the current employee's current audiogram reveals a work-related Standard Threshold Shift (STS) of 25 decibels or more (averaged at 2000, 3000, and 4000 Hz) above audiometric zero in the same ear on the Cal/OSHA Form 300 (or equivalent). [Title 8 CCR 14300.10].

Employees / Students

1. Wear hearing protection devices and follow any noise reduction procedures as required.
2. Store and maintain hearing protective devices in a clean and sanitary manner.
3. Report noise hazards and hearing protector problems to their Supervisor.
4. Attend training when required.

Occupational Health Provider (OHP)

1. Provide baseline, annual, and post-employment audiometric testing.
2. Perform audiogram evaluations.
3. Communicate any identified work-related Standard Threshold Shifts to the employee, his/her supervisor, and EH&S (if reportable under Title 8 CCR 14300.10).
4. Maintain audiometric test records.
5. Recommend appropriate hearing protectors and fitting as needed.

5.0 Noise Surveys/Testing

Noise Surveys / Noise Monitoring

1. Representative noise monitoring with a designed sampling strategy will be performed by EH&S to identify employees for inclusion in the HCP and to enable the proper selection of hearing protection.
2. All continuous, intermittent, and impulsive sound levels from 80 to 130 dBA shall be integrated into the computation of an 8-hr TWA.
3. Monitoring shall be repeated when any changes occur in production, process, equipment, or controls which might render the hearing protectors inadequate or require additional employees to be included in the program.
4. Employees exposed at or above the action level shall be notified of the results of the monitoring.
5. Employees' noise exposure shall be reassessed periodically as needed (i.e., following changes in processes, job responsibilities, equipment, or when a STS is determined).

Employees that are or may be exposed to potential high sound levels in their work area may request a noise survey/noise monitoring by completing the online Report a Safety Concern Form. Once submitted, EH&S will follow up with the affected party.

Audiometric Testing

1. Audio Audiometric testing program shall be managed by the OHP.
2. The OHP will perform audiometric database analysis (ADBA) procedures, as defined in ANSI Standard S12.13-1991, to assess the effectiveness of hearing conservation efforts (i.e., is hearing loss being prevented).
3. Baseline audiograms shall be:
    a. Preceded by at least 14 hours without exposure to workplace noise. This requirement may be met by wearing hearing protectors which will reduce the employee's exposure to a sound level of 80 dBA or below.
    b. Provided for the employees whose job classification are included in the HCP upon employment, and annually thereafter.
4. Evaluation of audiograms shall be done in compliance with CCR Title 8, section 5097(d).

5. If an annual audiogram shows that an employee has an STS (Standard Threshold Shift), the employee may be given a retest within 30 days and the retest results may be considered the annual audiogram.
6. Employees shall be informed in writing within 21 days when an audiogram indicates a STS which is determined to be work related.

6.0 Noise Exposure Control

When employees are subjected to sound exceeding those levels listed in Table 6.1 (below), feasible engineering and administrative controls shall be utilized as the first step in noise control. If these controls fail to reduce sound to acceptable levels, Hearing Proteciton Devices (HPDs) shall be used. During the implementation of engineering and/or administrative controls, affected employees shall be provided with HPDs and trained in accordance with this program.

Table 6.1. OSHA Permissible Noise Exposure Limits

DURATION (HOURS)	SOUND LEVEL dBA (SLOW RESPONSE)
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

NOTE: Exposures to impulsive/impact noise shall not exceed 140 dB peak sound pressure level.

Engineering Controls

Noise control through engineering practices is the preferred control method as it is an attempt to remove the hazard. This allows the sound intensity to be reduced either at the source or in the hearing zone of the worker. Examples include:

- Buy Quiet - Select and purchase low-noise tools and machinery. Useful reference: NIOSH (National Institute for Occupational Safety and Health), "Buy Quiet": http://www.cdc.gov/niosh/topics/buyquiet/
- Replace worn, loose, or unbalanced parts (e.g. replace mufflers when needed on gasoline engines)
- Lubricating machines
- Substitute the machinery or process.

- Modify the path between the noise source and the worker. This may include installing absorption materials, silencers, barriers and acoustical enclosures around the noise sources.

Administrative Controls

Administrative controls inform workers of noise hazards (e.g., training, fact sheets) as well as limit their length of exposure to noise in the work area (e.g., SOPs, best practices). Examples include:

- Conduct hearing protection training - see Section 7 Training.
- Rotate workers to job assignments with lower sound exposure levels throughout their 8-hour work day.
- Schedule machine operating times during off hours to expose fewer workers (when possible).
- Rotate exposed workers' shift to reduce exposure time.
- Post signs notifying employees that they must wear HPDs in areas where noise levels exceed 85 dBA. Post sign at entrance to the high noise area.

Personal Protective Equipment

When engineering and/or administrative controls are not feasible, hearing protective devices must be used. Employees exposed to noise levels at or above an 8-hour TWA of 90 dBA shall wear hearing protectors. Employees exposed to noise levels at or above the action level of an 8-hour TWA of 85 dBA shall wear hearing protection if they have experienced a documented standard threshold shift or have not obtained a baseline audiogram.

Hearing Protection

- Hearing protectors must attenuate the noise level to an 8-hour TWA of 90 dBA or less.
- All workers must be trained before being issued hearing protection.
- Hearing protectors shall be available, at no cost, to all employees exposed to:
  - Noise levels at or above the action level of 85 dBA 8-hr TWA (82 dBA for 12-hour shifts).
  - Noise in excess of the limits set in Cal-OSHA Title 8, Section 5096 (see Table 1).
- Employees shall be given the opportunity to select their hearing protectors (e.g., earmuffs, ear plugs) from a variety of suitable types to ensure a good fit.
  - Proper initial fitting and supervision of the correct use of hearing protectors shall be provided.
- Hearing protector attenuation shall be evaluated for the specific noise environments in which the protector will be used. The methods used for measuring attenuation shall be one of the four methods described in CCR Title 8, Section 5098, Appendix E.
- Re-evaluation of hearing protectors shall be done whenever a workplace noise level increase renders the hearing protector's attenuation inadequate.

- The use of hearing protectors is required in all areas posted or otherwise designated as requiring hearing protection.

Hearing Protection Devices (HPDs)

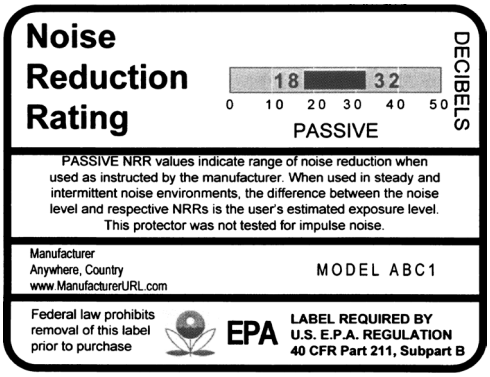
HPDs, when worn properly, decrease the risk of excessive noise exposure and subsequent hearing loss. There are three basic types of HPDs: (a) ear plugs, (b) ear muffs, and (c) canal caps (see Table 6.2 for HPD comparisons).

How do I pick my hearing protectors?

- The choice of hearing protectors is a very personal one and depends on a number of factors including level of noise, comfort, and the suitability of the hearing protector for both the worker and his/her environment.
- Most importantly, the hearing protector should provide the desired noise reduction. It is best, where protectors must be used, to provide a choice of a number of different types to choose from.
- If the noise exposure is intermittent, ear muffs are more desirable, since it may be inconvenient to remove and reinsert earplugs.

How can I find out how much a hearing protector can reduce a worker's exposure to noise?

- Manufacturers provide information about the noise reducing capability of a hearing protector as an NRR (noise reduction rating) number. The following is an example of an NRR label found on the package containing the earmuff or earplugs:



- The NRR ratings are based on a noise reduction obtained in laboratory conditions and and does not take into account the loss of hearing protection that occurs when the hearing protectors are not fitted properly.
- For more information, see OSHA Noise and Hearing Conservation, Appendix IV:C, "Methods for Estimating HPD Attenuation": https://www.osha.gov/dts/osta/otm/noise/hcp/attenuation_estimation.html

Table 6.2. HPD comparisons

HPD Type	Notes	Directions
Ear Plugs  	• *Inserted to block the ear canal* • *Sold as disposable products or reusable plugs* **Advantages** • *Lighter weight vs ear muffs* • *Can be worn without interference from eyeglasses, headgear, earrings, or hair* • *More comfortable in hot/humid environments* • *Less expensive than ear muffs* **Disadvantages** • *Amount of protection may vary among workers*	• *Before inserting ear plugs, wash hands to prevent infecting ear.* • *Inspect ear plugs for tears, cracks, or hardening.* • *To insert a malleable foam plug, roll the plug between the fingers and thumb to make it thinner. Ensure there are no wrinkles or creases in the plug. See instructional video on inserting foam ear plugs.* • *Reach behind head to pull ear outward and upward to widen auditory canal. Insert plug into the ear and hold in place until it expands. Insertion of foam plug cannot harm the eardrum because it is too short to reach it. NOTE: If seal is not tight, earplug will not be effective.*
Ear Muffs  	• *Some are adapted to hard hats to form a good seal* **Advantages** • *More consistent protection than plugs* • *One size fits most heads* • *Easy to put on and take off* • *Good for short jobs* **Disadvantages** • *Heavier than ear plugs* • *May be uncomfortable in hot environments* • *Eyeglasses may impact seal* • *More expensive than other HPDs* • *Resonate (vibrate) at lower sound frequencies (<400 Hz)*	• *Anything that comes between ears and ear muffs will make the ear muffs less effective. Choose eyewear with thin temples to reduce interference with the seal.* • *Inspect ear muffs for cracks, tears, or other signs of wear.* • *Push hair away from ears when donning ear muffs. Center ear muffs over the head and make sure the seal is tight.* • *Adjust headband for a comfortable fit over the head. Ensure cups cover the ears entirely.*
Canal Caps  	• *Flexible tips that cap the ear canal* **Advantage** • *Ideal for situations where hearing protection is donned and doffed frequently* **Disadvantages** • *Only closes ear opening; does not extend into ear canal* • *NOT designed for continuous, long-term wearing* • *Not as protective as ear muffs or ear plugs*	• *To insert canal caps, follow directions for ear plugs.* • *Pull the outer ear up and back.* • *Insert the tips of the caps into the ear, firmly pushing and wiggling them into place.*

7.0 Training

Annual training is required for all employees exposed to noise at or above an 8-hour TWA of 85 dBA. The training shall cover the following information:

- Effects of noise on hearing
- Purpose, advantages, disadvantages, and attenuation of various types of hearing protectors
- Instruction of proper fitting and care of protectors
- Purpose and procedures of audiometric testing

Copies of the occupational noise regulation (CCR Title 8, Section 5096-5100, Article 105) shall be available to affected employees and their representatives. A copy of the regulation shall also be posted in the workplace.

Any informational materials pertaining to this standard that are supplied by Cal/OSHA shall be available to the affected employees.

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8.0 Recordkeeping

Noise exposure measurement records shall be retained for at least 2 years by EH&S.

Departments with employees enrolled in the HCP will retain their audiometric test records provided by the OHP. These records are maintained for the duration of the person's employment at USC and are made available to employees upon request. Audiometric test records must include:

- Name and job classification of the employee
- Date of the audiogram
- Examiner's name
- Employee's most recent noise exposure assessment
- Date of the last acoustic or exhaustive calibration of the audiometer and the measurement of the background sound pressure levels in the audiometric test rooms

Record Retention Schedule

Record	Location	Retention Time
• *HCP Manual*	• *EH&S and website*	• *On-going*
• *Medical Evaluations and Audiograms*	• *Occupational Health Provider*	• *During the time the employee is enrolled in HCP*
• *Medical Evaluation Results*	• *Supervisor/Department*	• *During the time the employee is enrolled in HCP*
• *Noise Surveys and Employee Noise Monitoring*	• *EH&S and/or Supervisor/ Department*	• *At least 2 years*
• *Training Records*	• *Supervisor and/or Department*	• *At least 2 years*

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