



University of Arizona
Hearing Conservation Program
For Compliance With 29 CFR 1910.95

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1.0 Purpose

The University of Arizona (UArizona) aims to provide employees with a safe and healthy work environment. This Hearing Conservation Program (HCP) has been developed to ensure that employees are protected from hearing loss resulting from occupational noise exposure through a continuous, effective, and comprehensive hearing conservation program. The content has been written to, at minimum, assure compliance with the Occupational Health and Safety Administration (OSHA) rules and regulations 29 CFR 1910, and where practical and possible, to meet industry standards set by the American Conference of Governmental Industrial Hygienists (ACGIH).

Work environments will be surveyed to identify ACGIH and OSHA-defined hazardous noise levels and personnel at risk. Wherever it is technologically and economically feasible, environments with high noise levels should be modified to reduce noise exposure to acceptable levels. Employees may use hearing protection as interim protection while engineering controls are being explored. Where engineering controls are not feasible, administrative controls and/or the use of hearing protective devices will be employed. Noise emission levels will be considered when purchasing new equipment and tools, and acoustical requirements will be considered when designing or remodeling locations where high noise levels are expected to occur.

2.0 Scope

The UArizona HCP applies to all University-affiliated activities where employees are exposed to high noise levels due to the nature of their work. This includes locations that serve as assigned workplaces and educational or research settings for University employees including:

- University of Arizona Tucson Campus,
- Agricultural and Extension Centers (Maricopa, Safford, Yuma, and others),
- College of Medicine-Phoenix (COM-Phoenix),
- College of Veterinary Medicine (CVM),
- Other University-owned property, University leased space, temporary field locations, and field trips that are under the control of University operations and staff.

This HCP does not apply to:

- University contractors, as contractors operating on University property will be informed of areas requiring hearing protection (by RMS, department negotiating and managing the contractor, or RLSS by request), but all hearing protection use and program functions shall be administered by their employer.

- Students, who may meet requirements but are not required to participate in the HCP. This only applies to students who are not considered employees/workers under OSHA definitions.

3.0 Definitions

HCPA: Hearing Conservation Program Administrator

** The UArizona HCP is administered by the Manager of Industrial Hygiene Services (RMS) and is supported by RMS, RLSS, and OH staff members.*

RMS: Risk Management Services

RLSS: Research Laboratory & Safety Services

OH: Occupational Health

HCP: Hearing Conservation Program

Hazardous Noise: Occupational noise exposure at or exceeding 85 decibels, A-weighted, as an 8-hour time-weighted average (85 dBA as an 8-hr TWA) using a 3-dB exchange rate and an 80 dBA action limit. Referred to as “high noise levels” throughout this document.

Response rate: Instruments used to measure sound levels have selectable response time constraints, which were originally established to describe the dynamic response characteristics of analog sound level meters. Two most commonly used time constants are: Slow (1 second) and Fast (.125 second). Typical occupational and environmental noise regulations require a Slow response rate.

Weighting networks: The sound level meter response at various frequencies can be controlled by electrical weighting networks (A, B, C). The C network provides a flat response over the frequency range 20-10,000 Hz; the B and A networks selectively discriminate against low (less than 1 kHz) frequencies. Typical occupational noise regulations require an A-weighted filter.

Permissible Exposure Limit (PEL): The average sound level allowed over an eight-hour work period, often referred to as the 8 hour time weighted average (TWA). OSHA regulations stipulate that an unprotected worker may be exposed to noise levels of 90dB for 8 hours while ACGIH recommends that an unprotected worker may be exposed to noise levels of 85 dB for 8 hours. The Occupational Safety and Health Administration (OSHA) sets the Permissible Exposure Limit (PEL) at 90 dBA TWA and a 90 dBA threshold.

Occupational Exposure Limit (OEL): A term used to represent the concentration or intensity of an airborne agent that is allowable in ppm or mg/m³ relative to the period over which workplace concentrations are averaged to compare with the allowable exposure, and the allowable concentration of a biological exposure index (BEI) in a biological sample. Each OEL consists of an exposure limit and an averaging time. A substance may have several OELs for short term or acute exposures (e.g., 15-minute STEL or 30-minute Excursion Limit), long term or chronic exposures (e.g., 8- hour Time Weighted Average), limits requiring intervention (Action Level, AL) or not-to-exceed limits (Ceiling Limit).

Action level (AL): A level of worker exposure at which the employer must implement some actions (e.g., medical surveillance, training, etc.). The action level is typically, but not always, one-half of the permissible exposure limit (PEL) or occupational exposure limit (OEL). For noise, the action level is 85 dBA and requires implementing an occupational hearing conservation program.

Exchange rate: The exchange rate is the increase in sound level for which the permissible exposure time is halved, OR the decrease in sound level for which the permissible exposure time is doubled. ACGIH has set the exchange rate at 3 dB, so for every 3 dB the noise exposure increases the permissible exposure time is cut in half, and for every 3 dB the noise exposure decreases the permissible exposure time is doubled. The Occupational Safety and Health Administration (OSHA) sets the exchange rate at 5 dB.

Ceiling: The maximum allowable sound level to which an unprotected worker may be exposed.

L_{av} (Average Level): The average sound level measured over the run time of measurement. This becomes a bit confusing when thresholds are used, because the average does not include any sound below the threshold. Sound is measured in the logarithmic scale of decibels, so the average cannot be computed by simply adding the levels and dividing by the number of samples. When averaging decibels, short durations of high levels can significantly contribute to the average level. This is more commonly used to denote average noise exposure according to OSHA criteria.

L_{eq}: Equivalent continuous sound level over the elapsed measurement time. L_{eq} represents a varying sound source over a given period of time as a single number; it is the constant noise level that would result in the same total sound energy being produced over a given period. LEQ is functionally the same as LAVG, except that it is only used when the exchange rate is set to 3 dB and the threshold is zero. This is more commonly used to denote average noise exposure according to ACGIH criteria.

TWA (Time Weighted Average): The TWA is the level (in dB) at which exposure for the 8 hours that would produce a noise dose equal to that obtained for a shift length of

arbitrary duration. It is a conversion of the actual noise dose to an equivalent exposure sound level for 8 hours.

L_{\max} or Max_L : Maximum sound pressure level observed over the elapsed measurement time. OSHA specifies that L_{\max} measured with a “slow” response rate (sound level meter) must not exceed 115 dBA.

L_{\min} or Min_L : Minimum sound pressure level observed over the elapsed measurement time.

L_{pk} or Max_P : The highest instantaneous sound pressure level observed during a measurement interval. Under OSHA regulations, unprotected workers may not be exposed to peak sound levels greater than 140 dB.

Peak: The maximum peak level within the last one-second interval.

Sound Pressure Level (SPL): Ten times the logarithm to the base ten of the ratio of the time mean-square pressure of a sound, in a stated frequency band, to the square of the reference sound pressure in gases of 20 micro Pascals (μPa). Unit, dB; symbol, L_p . For sound in media other than gases, unless otherwise specified, reference sound pressure in 1 μPa (ANSI S1.11994: sound pressure level).

Dose: The actual dose (as a percentage) accumulated for the actual work shift length based on an 85 dBA limit and 80 dBA action limit.

Projected Dose: This is a computed estimation (as a percentage) of what the projected dose would be for an 8-hour work shift. For example: a workers' exposure may be monitored for four hours and a dose of 20% is obtained. If the assumption is made that for the remaining 4 hours of the shift the worker will continue to experience the same noise exposure, the instrument will compute an estimated 8 hour projected dose of 40%. OSHA requires employers to establish a Hearing Conservation program with monitoring, audiometric testing, personal protective equipment, training and record keeping requirements whenever the 8 hr. TWA equals or exceeds 85 dBA, or the projected dose equals or exceeds 50%.

Impact noise (or impulsive noise): Impact noise is created by the impact of one surface on another and is of a short duration. Impulsive noise is typically an air noise that has a short duration, such as the shooting of a firearm or the explosion of a firework. Impulsive or impact noises are considered to be much more harmful to hearing than continuous noises. Impulsive noise can be repetitive or a single event (like a sonic boom). Exposure to impulsive or impact noise should not exceed a 140-dB peak sound pressure level.

Occupational Safety and Health Administration (OSHA): Government body set forth in the 1971 Occupational Safety and Health Act to ensure safe and healthful working conditions for workers by setting and enforcing standards and by providing training, outreach, education and assistance. OSHA sets permissible exposure limits, requirements for exposure monitoring and medical surveillance, and may enforce regulatory requirements. Federal OSHA regulations must be met or exceeded by approved state programs, such as ADOSH.

Arizona Division of Occupational Safety and Health (ADOSH): Arizona's state program for occupational health and safety, as approved by Federal OSHA. All programs and requirements shall meet or exceed Federal requirements.

American Conference of Governmental Industrial Hygienists (ACGIH): A scientific organization that advances occupational and environmental health through provisions of standards such as the Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs).

Standard Threshold Shift (STS): A change in hearing of 10 dB or more in either ear at 2000, 3000, and 4000 Hz.

Recordable Hearing Loss: An STS combined with the employee's overall hearing level being 25 dB or more above audiometric zero (averaged at 2000, 3000, and 4000 Hz) in the same ear(s) as the STS.

4.0 Roles and Responsibilities

4.1 Hearing Conservation Program Administrator (HCPA)

The HCPA and support staff are responsible for:

- Conducting noise assessments for each operation, process, or work area where high noise levels are suspected to exist.
- Performing noise monitoring to identify noise at or above action levels (above recommended action level or permissible exposure limit).
- Identifying and informing employees who require annual audiometric testing.
- Coordinating exploration of engineering and administrative controls for equipment and machinery that produces high noise levels.
- Performing additional noise assessments to verify changes made to lower exposure levels and to address new equipment and work process changes.
- Calculating and ensuring adequate hearing protection (i.e., attenuation) is provided to and worn by employees, in conjunction with direct supervisors.

- Providing annual and as needed training that is readily available and easily accessible.
- Providing notification to employees and supervisors of individual noise exposure dosimeter measurements and any significant changes in hearing (standard threshold shifts) and conducting required follow-up investigations.
- Coordinating baseline and annual audiograms for employees enrolled in the HCP.
- Ensure HCP program records are kept and maintained for the appropriate time frames, in accordance with OSHA requirements.

4.2 Supervisors

Supervisors are responsible for:

- Assisting the HCPA and/or support staff with the completion of noise assessment for operations and processes in their department.
- Becoming aware of tasks that require the use of hearing protection.
- Ensuring that all their employees exposed to recommended and legal action levels have access to appropriate hearing protective devices in the work area and that these devices are worn properly.
- Enforcing the use of hearing protection, engineering, and administrative controls in their area.
- Ensuring that employees under their supervision (including new hires) have received appropriate training and audiometric testing at required frequencies (within 6 months of starting and annually thereafter) and as processes and/or equipment changes.
- Instructing new workers on the proper fit of hearing protection.
- Continually monitoring work areas and operations to identify new noise hazards and coordinating with the HCPA and/or support staff for noise assessments and monitoring.
- Considering noise mitigation as a selection factor for equipment purchases and activity planning.

4.3 Employees

Employees are responsible for:

- Recognizing hazardous tasks or areas where hearing protection may be required.
- Obtaining and using their hearing protection properly when required.
- Storing, maintaining, and disposing of their hearing protection as instructed.

- Participating in training and keeping appointments regarding compliance with audiometric testing requirements.
- Informing their supervisor if the hearing protection does not fit well, needs repair, or needs replacement.
- Informing their supervisor, the HCPA, and/or support staff of any noise hazards that they feel have not been adequately addressed in the workplace and of any other concerns that they have regarding the program.

3.0 Noise Monitoring

HCPA and/or support staff will conduct noise monitoring and identification of high-noise (≥ 85 dBA TWA) areas. Areas and tasks where noise levels meet or exceed, or where information indicates the noise levels meet or exceed the 85 dBA action level will be periodically monitored. Whenever an employee exhibits a standard threshold shift (STS), as determined by an audiologist, the employee's workplace should be re-monitored and current engineering and administrative controls will be evaluated.

In order to effectively control noise, it is necessary that the noise be accurately measured according to standard procedures and that the measurements are properly evaluated against acceptable criteria. All noise monitoring will be conducted in accordance with established standard operating procedures per [29 CFR 1910.95](#). Determination of noise exposure doses and levels will be accomplished using calibrated noise dosimeters (personal dose) and sound level meters (sound level). All exposures will be measured on an A-weighted scale and sound level meters will be set to the slow response mode.

If the employee noise level exposure is less than a time-weighted average of 85 dBA, no action is required but may still be taken. Employees are permitted to voluntarily wear hearing protection when they are exposed to levels below the action level but otherwise feel the noise level is uncomfortable (which may differ according to individual preferences), unless chosen hearing protection creates additional safety hazards.

Employees exposed to at or above the 8-hour time-weighted average (TWA) of 85 dBA shall be enrolled in the HCP. Hearing protection for employees exposed to ≥ 85 dBA is required in situations or locations with hazardous noise exposure. When noise exposures occur > 8 hours (extended work shifts), noise monitoring will be conducted for the worst continuous 8-hour work period of the extended shift, multiple samples will be collected during the first 8 hours of the work shift and additional samples after that (through the end of the shift). The calculation will remain based on 8 hours, not the extended work shift total time ([OSHA letter of interpretation](#)).

Employees exposed above the OSHA Permissible Exposure Limits (PELs) and ACGIH Threshold Limit Values (TLVs) as referred to in the following diagram are also enrolled

in the HCP and are required to wear hearing protection until engineering or administrative controls can lower noise to acceptable levels. All employees exposed to above 115 dBA for any length of time (or over 140 dBA impulse sound) will be required to wear double hearing protection until noise controls can be implemented.

Noise Permissible Exposure Limits <i>Based on ACGIH TLVs</i>	
Duration/Day (Hours)	Sound Level (dBA)
12	82
8	85
4	88
2	91
1	94
0.5	97
0.25	100

If the employee's exposure exceeds the OEL, that employee will receive written notification of the noise exposure within 15 days of the exposure determination and corrective action will be taken.

4.0 Identification of High Noise Areas or Activities

Warning signs requiring the use of proper hearing protection should be posted at either the entrances to work areas or on specific machines where high noise levels exist. Personnel who work in these areas, or with these machines, shall have hearing protection supplied to them, be instructed in its proper use, and be required to wear this equipment when in these identified areas or using identified machines. It is the responsibility of the area supervisor to ensure that these precautions are maintained. HP will be also provided to visitors in high noise areas. Supervisors should maintain a list of specific tools and tasks that require hearing protection (such as pneumatic tools).

5.0 Hearing Protection (HP)

UArizona supervisors shall make appropriate hearing protection available at no cost to all employees and DCCs exposed to an 8-hour time-weighted average of 85 decibels or greater within the areas/units they supervise. The following hearing protection devices (HPDs) may be used and made available: disposable earplugs, reusable earplugs, and earmuffs.

Please see Section 5.3 Earplugs and 5.4 Earmuffs for more information on HPDs.

Any employee experiencing difficulty wearing or using assigned hearing protection (i.e., irritation of the canals, pain) should immediately report this to their supervisor, and alternative hearing protection will be reviewed by the HCPA and/or support staff. An additional selection of hearing protection devices will be provided to the employee when medical pathology warrants (e.g., in the event of medical need).

5.1 Noise Reduction Rating (NRR)

Not all hearing protection is the same. Different types of hearing protection have different noise reduction ratings. The NRR can be found on the hearing protective device packages and is a lab value, based on dBC instead of dBA, that must be adjusted for the workplace used (converted to dBA and safety factor provided). To provide adequate hearing protection, adjustment calculations are available for each type of measuring device used.

The HCPA and/or support staff can assist in calculating the Noise Reduction Rating (NRR) that is required for each employee or each area to reduce the noise at the eardrum to less than the OEL. Supervisors and employees should refer to or request a noise hazard assessment to help identify the specific protection that is needed for the task or while working in a particular area. Research staff may contact RLSS for noise assessments; non-research staff may contact RMS for noise assessments.

The NRR used for calculating attenuated noise exposure levels will be calculated in the following manner, using a safety factor of 50%:

$$\text{Reduction (dB)} = (\text{NRR} - 7) \div 2$$

For example: If the NRR on a pair of earplugs is 21, subtract 7 from that number and divide that by 2, $(21 - 7) \div 2 = 14 \div 2 = 7$. Therefore, this pair of earplugs will reduce the TWA 7 decibels and the supervisor must determine if this will be enough protection for the employee. Hearing protection must lower employee exposure at the ear to no more than a TWA noise level of 85 dBA. The adequacy of hearing protection shall be reevaluated whenever employee noise exposures increase.

When double hearing protection is used, the NRR for each is not added—only 5 dBA of additional protection will be added for earmuffs when they are used in combination with ear plugs.

5.2 Use, storage, and disposal

Workplace supervisors should handle the issuance of hearing protection devices; the HCPA or designee may assist as needed or requested. The supervisor should provide initial instructions on the proper use and care of earplugs and earmuffs; the HCPA or support staff may assist as needed or requested. Workers must always use and maintain hearing protection as originally intended and per the manufacturer's instructions.

5.3 Earplugs

Disposable earplugs typically come as “one size fits all,” but some makes and models may be more or less compatible with different ear shapes and sizes. Some are made of material that expands to form a seal in the ear canal after being compressed and inserted. When properly inserted, they can provide high noise attenuation values. It is important to instruct users in the proper insertion and use of these earplugs. It is important that the ear canal be straightened before insertion and that the earplug be held in place while it expands enough to remain firmly seated. There is a very large difference between the comfort and fit of different brands. A large, cheap brand may not fit someone with a small ear canal (i.e., it may apply too much pressure). Earplugs must be disposed of after each use.



Reusable earplugs are pliable in design and come in various sizes and shapes and often are sold with a cord attached. These earplugs may be washed after use and are, therefore, reusable. While pre-molded earplugs are reusable, over time they may deteriorate, become hard, or no longer form an airtight seal when properly inserted. As such, they should be replaced periodically. Reusable earplugs should be washed in lukewarm water using hand soap, rinsed in clean water, and dried thoroughly before reuse. Alcohol-based cleaners should not be used because they will degrade the material. Wet or damp earplugs should not be placed in their containers. Earplugs should be cleaned as needed with soap and water, ideally after every day's use.



Custom Molded Earplugs are built from a custom-made mold of the employees' ear. They are more expensive, but can achieve the best fit and, in some cases, may be the only type of ear plugs that fit a particular individual. Individuals wanting custom earplugs will be referred to an audiologist and must have a document referring them for custom hearing protection; requests can also be routed through the HCPA and/or support staff. If an employee has a referral for a custom ear plug, the plug will be provided at no cost to the individual. Custom molded earplugs should be kept clean and may be cleaned in the same way as reusable earplugs (soap and water).

5.4 Earmuffs

Earmuffs are devices worn around the ear to reduce the level of noise that reaches the ear. Their effectiveness depends on an airtight seal between the cushion and the head. Earmuff performance may be degraded by anything that compromises the cushion's seal, including:

- Other pieces of personal protective equipment, such as eyewear, masks, face shields, and helmets.
- Facial hair, such as sideburns, may also interrupt this seal.

Earmuff cushions should be kept clean. The plastic or foam cushions may be cleaned in the same way as earplugs (soap and water; never alcohol-based cleaners), but the inside of the muff should not get wet. When not in use, earmuffs should be placed in open air to allow moisture that may have been absorbed into the cups to evaporate.



6.0 Audiometric Testing

Upon entry into the HCP, based upon identification of noise exposure of 8-hour TWA equal to or exceeding action limits and/or permissible exposure limits (85 dBA or 140 dBA for impulse noise), employees will receive a baseline audiogram within 6 months of their hire date/noise exposure date and annually thereafter. If the employee is transferred to another job or location where noise exposure does not exceed the action level, audiograms will be discontinued for those employees without a documented STS, but continued for those employees with a documented STS.

Employees will be notified when it is time to take an audiogram. Before a baseline audiogram, employees must avoid high levels of noise for a minimum of 14 hours, and preferably 24 hours. Annual audiograms do not have this requirement, however. All audiometric testing will be performed during the employee's normal work schedule at no cost to the employee.

The objective of audiometric testing is to identify workers who may be beginning to lose their hearing (as evidenced by a standard threshold shift, STS) due to occupational exposure to high noise levels. This allows for intervention before the hearing loss becomes worse. Audiometric testing will be provided by CAOHC-certified Occupational Hearing Conservationists (OHC) from RLSS and other University departments as needed. Qualified persons, such as the Professional Supervisor (PS) and/or audiologist, will evaluate audiograms and make final determinations. All audiometric testing will be done in accordance with OSHA regulations (see, e.g., 29 CFR 1910.95 (g) [and standard interpretation](#)). Audiometric testing may be conducted within an appropriate booth or using boothless audiometric testing technology in an area meeting OSHA and ACGIH requirements. Additional audiometric testing will be provided if the PS and/or audiologist deems it necessary based on an STS or other finding—this must be completed within 30 days of the initial test. Results and interpretations of the original or, if there was a retest based on that date, will be provided to the employee within 21 days of the receipt of the audiograms from the HCPA and/or support staff.

6.1 Standard Threshold Shift (STS)

The PS will use the audiogram to determine if a standard threshold shift of 10dB has occurred in one or both ears. Written notification will be sent to the employee within 21 days after receiving audiograms or follow-up results by the HCPA and/or support staff. The notification will include the results/interpretation of the audiogram and the need and reason for any further testing or evaluation. An employee may be retested within 30 days to confirm that STS has occurred; supervisors of employees with STS will also be notified of the need to retest and the presence of STS. Employees with a confirmed STS must be retrained and follow-up investigations must be conducted to evaluate the effectiveness of the engineering and/or administrative controls and determine if any

changes or modifications need to be made. Hearing protection will be required immediately upon notice if previous use has only been voluntary. Once an STS has occurred and stabilized, the PS or audiologist should establish a new baseline so that the employee is not targeted as having an STS every year.

6.2 Recordable Hearing Loss

Potentially recordable hearing losses, defined per OSHA as when the employee's overall hearing level is 25 dB or more above audiometric zero (averaged at 2000, 3000, and 4000 Hz) in the same ear(s) as the STS, will be referred to the supervisor and UArizona Workers' Compensation for a work-related determination and potential inclusion on the annual OSHA 300 logs. Supervisors are responsible for completing the workplace injury/illness report to initiate the process and workers' compensation is responsible for the work-related determination. Workers' compensation will be provided with records of the employee's audiograms and any relevant noise sampling data.

7.0 Training

Initial and annual training will be provided to all employees enrolled in the HCP. Annual training will be provided online and/or during audiometric testing by the HCPA and/or support staff. All training will be documented and maintained by the HCPA.

At a minimum, **initial training** will cover the following:

- The effects of noise on hearing;
- The purpose and value of the hearing protection provided;
- The advantages, disadvantages, and attenuation potential of hearing protection provided;
- Instruction on selection, fit, use and, care of hearing protection provided;
- The purpose and procedures of audiometric testing;
- The requirements of the OSHA 1910.95 standard.

Additional training may include:

- Content of the Hearing Conservation Program;
- Responsibilities of each position;
- Types of hearing loss;
- Noise hazards at work;
- Noise hazards outside of work;
- Anatomy and functioning of the ear;
- Types of audiometric test results;
- Explanation of noise measurement machines and procedures.

8.0 Recordkeeping

Copies of the UArizona Hearing Conservation Program will be available on the RMS website and may also be located on the support staff website(s). OSHA standard [29 CFR 1910.95 is available online](#). Upon request, employees, former employees, and representatives designated in writing by the individual employee will be provided with copies of all records pertaining to audiometric testing and noise exposure to the specific worker. The following records will be kept at the following locations for the following period(s) of time:

Documentation		
Record	Location	Time
Area Noise Assessments	HCPA	2+ yrs
Personal Dosimetry	HCPA	Employment + 30yrs
Audiograms/Notifications	HCPA	Employment + 30yrs
Training Records	HCPA	Updated Annually; 2+ years
Written HCP	HCPA	Updated Annually
List of Employees in HCP	HCPA	Updated Annually

8.0 Program Evaluation

This program shall be reviewed annually to assess effectiveness. The program evaluation will include a review of the employees enrolled, incidence of STS and any recordable hearing loss, use of hearing protection, and employee participation/satisfaction.

Appendix A: Recommended Controls for Workplace Noise Reduction

Engineering controls are procedures other than administrative controls or personal protection procedures/equipment that reduce the sound level either at the source or within the hearing zone of workers. The following are examples of engineering principles that can be applied to reduce noise levels.

Maintenance:

- Replacement or adjustment of worn, loose, or unbalanced parts of machines
- Lubrication of machine parts and use of cutting oils
- Use of properly shaped and sharpened cutting tools

Substitution of machines:

- Larger, slower machines for smaller, faster ones
- Step dies for single-operation dies
- Presses for hammers
- Rotating shears for square shears
- Hydraulic presses for mechanical presses
- Belt drives for gears

Substitution of processes:

- Compression riveting for impact riveting
- Welding for riveting
- Hot working for cold working
- Pressing for rolling or forging

Reduction of the driving force of vibrating surfaces:

- Reduction of the forces
- Minimization of rotational speed
- Isolation

Reduction of the response of vibrating surfaces:

- Damping
- Additional support
- Increased stiffness of the material
- Increased mass of vibrating members
- Change in the size to change resonance frequency

Reduction of the sound radiation from vibrating surfaces:

- Reduction of the radiating area
- Reduction of the overall size
- Perforation of the surfaces

Reduction of the sound transmission through solids:

- Use of flexible mountings
- Use of flexible-shaft couplings
- Use of fabric sections in ducts
- Use of resilient flooring

Reduction of the sound produced by gas flow:

- Use of fan blades designed to reduce turbulence
- Use of large, low-speed fans instead of smaller, high speed fans
- Reduction of the velocity of fluid flow (air)
- Increase in the cross section of streams
- Reduction of the pressure
- Reduction of air turbulence
- Use of intake and exhaust mufflers

Reduction of noise by reducing its transmission through air:

- Use of sound-absorptive material on walls and ceiling in work areas
- Use of sound barriers and sound absorption along the transmission path
- Complete enclosure of individual machines
- Use of baffles
- Confinement of high-noise machines to insulated rooms

Isolation:

- Machine from operator
- Operator from machine

Appendix B: Hearing Conservation Program Evaluation Checklist

HEARING CONSERVATION PROGRAM EVALUATION CHECKLIST *(adapted from [NIOSH](#))*

Inspector(s): Click or tap here to enter text.

Site(s): Click or tap here to enter text.

Date of Evaluation: Click or tap to enter a date.

TRAINING AND EVALUATION

Action	YES	NO	N/A	Corrective Measure(s)
Has training been conducted at least annually?				
Was the success of the training program evaluated?				
Is the content revised periodically?				
Are managers and supervisors, as well as company leadership, directly involved or supportive?				
Are posters, regulations, handouts, and employee newsletters used as supplements?				
Are documented counseling sessions conducted for employees having problems with hearing protection devices or showing hearing threshold shifts?				
Does training include the following (at minimum): <ul style="list-style-type: none"> • The effects of hazardous noise on hearing; • The purpose and value of the hearing protection; • The advantages, disadvantages, and attenuation potential of hearing protection provided; • Instruction on selection, fit, use and, care of hearing protection provided; • The purpose and procedures of audiometric testing; • The requirements of the OSHA 1910.95 standard. 				

SUPERVISOR AND LEADERSHIP INVOLVEMENT

Action	YES	NO	N/A	Corrective Measure(s)
Have supervisors been provided with the knowledge required to supervise the use and care of hearing protectors by subordinates?				
Do supervisors wear hearing protectors in appropriate areas?				
Have supervisors been counseled when employees resist wearing protectors or fail to show up for hearing tests?				
Have supervisors been counseled when employees resist wearing protectors or fail to show up for hearing tests?				
Are disciplinary actions enforced when employees repeatedly refuse to wear hearing protectors?				

NOISE MEASUREMENT

Action	YES	NO	N/A	Corrective Measure(s)
Were the essential/critical noise studies performed or data otherwise provided?				
Was the purpose of each noise study clearly stated? Have noise-exposed employees been notified of their exposures and appraised of auditory risks?				
Are the results routinely transmitted to supervisors and other key individuals?				
Are results entered into health/medical records of noise-exposed employees?				
If noise maps at locations/sites exist, are they used by the proper staff?				
Are noise measurement results considered when contemplating the procurement of new equipment? Modifying the facility? Relocating employees?				

Have there been changes in areas, equipment, or processes that have altered noise exposure?				
Have follow-up noise measurements been conducted?				
Are appropriate steps taken to include (or exclude) employees in the hearing loss prevention programs whose exposures have changed significantly?				

ENGINEERING AND ADMINISTRATIVE CONTROLS

Action	YES	NO	N/A	Corrective Measure(s)
Have noise control needs been prioritized?				
Has the cost-effectiveness of various options been addressed?				
Are employees and supervisors apprised of plans for noise control measures? Are they consulted on various approaches?				
Have employees and supervisors been counseled on the operation and maintenance of noise control devices?				
Are noise control projects monitored to ensure timely completion?				
Has the full potential for administrative controls been evaluated? Are noisy processes conducted during shifts with fewer employees? Do employees have sound-treated lunch or break areas?				

AUDIOMETRIC TESTING AND RECORDKEEPING

Action	YES	NO	N/A	Corrective Measure(s)
Has the audiometric technician been adequately trained, certified, and recertified as necessary?				

Do on-the-job observations of the technicians indicate that they perform a thorough and valid?				
Are records complete (in accordance with 1910.95(m))?				
Are follow-up actions documented?				
Are hearing threshold levels reasonably consistent from test to test? If not, are the reasons for inconsistencies investigated promptly?				
Are the annual test results compared to the baseline to identify the presence of an OSHA standard threshold shift?				
Is the annual incidence of standard threshold shift greater than a few percent? If so, are problem areas pinpointed and remedial steps taken?				
Are audiometric trends (deteriorations) being identified, both in individuals and in groups of employees? (NIOSH recommends no more than 5% of workers showing 15 dB Standard Threshold Shift, same ear, same frequency.)				
Do records show that appropriate audiometer calibration procedures have been followed?				
Is there documentation showing that the background sound levels in the audiometer room were low enough to permit valid testing?				
Are the results of audiometric tests being communicated to supervisors and managers as well as to employees?				
Has corrective action been taken if the rate of no-shows for audiometric test appointments is more than about 5%?				
Are employees incurring STS notified in writing within at least 21 days? (NIOSH recommends immediate notification if the retest shows 15 dB Standard Threshold Shift, same ear, same frequency)				

REFERRALS FOLLOWING TESTING

Action	YES	NO	N/A	Corrective Measure(s)
Are referral procedures clearly specified?				
Have letters of agreement between the company and consulting physicians or audiologists been executed?				
Have mechanisms been established to ensure that employees needing evaluation or treatment receive the service (i.e., transportation, scheduling, reminders)?				
Are records properly transmitted to the physician or audiologist and back to the company?				
If medical treatment is recommended, does the employee understand the condition requiring treatment, the recommendation, and the methods of obtaining such treatment?				
Are employees being referred unnecessarily?				

HEARING PROTECTION DEVICES

Action	YES	NO	N/A	Corrective Measure(s)
Have hearing protectors been made available to all employees whose daily average noise exposures are 85 dBA or above for 8 hours? (Note: permissible exposure levels vary depending upon the time exposure)				
Are employees allowed to select from a variety of appropriate protectors?				
Are employees thoroughly trained, not only initially but at least once a year?				
Are the protectors checked regularly for wear or defects and replaced immediately if necessary?				

If employees use disposable hearing protectors, are replacements readily available?				
Do employees understand the appropriate hygiene requirements?				
Have any employees developed ear infections or irritations associated with the use of hearing protectors? Are there any employees who are unable to wear these devices because of medical conditions? Have these conditions been treated promptly and successfully?				
Have alternative types of hearing protectors been considered when problems with current devices are experienced?				
Do employees who incur noise-induced hearing loss receive counseling?				
Do workers complain that protectors interfere with their ability to do their jobs? Do they interfere with spoken instructions or warning signals? Are these complaints followed promptly with counseling, noise control, or other measures?				
Are employees encouraged to take their hearing protectors home if they engage in noisy non-occupational activities?				
Are new types of or potentially more effective protectors considered as they become available?				
Is the effectiveness of the hearing protector program evaluated regularly?				
Is each hearing protector user required to demonstrate that he or she understands how to use and care for the protector? The results documented?				

ADMINISTRATIVE

Action	YES	NO	N/A	Corrective Measure(s)
Have there been any changes in federal or state regulations? Have the hearing loss prevention program's policies been modified to reflect these changes?				
Are copies of company policies and guidelines regarding the hearing loss prevention program available to all employees in a centralized location? Are employees aware of these programs?				
Are necessary materials and supplies being ordered with a minimum of delay?				
Are procurement officers overriding the hearing loss prevention program implementor's requests for specific hearing protectors or other hearing loss prevention equipment? If so, have corrective steps been taken?				
Is the performance of key personnel evaluated periodically? If such performance is found to be less than acceptable, are steps taken to correct the situation?				
Has the failure to hear warning shouts or alarms been tied to any accidents or injuries? If so, have remedial steps been taken?				

Effective Date	Version #	Authors	Description
2021	000	RLSS, RMS, OH	New document
3/29/2023	001	RLSS, RMS	Annual review
6/11/2024	002	Maggie Murphy, Celia Ritter, RMS	Annual review – typo corrections, added recordable hearing loss section