



Loss Control TIPS

Technical Information Paper Series

Innovative Safety and Health SolutionsSM

Occupational Noise Exposure and Hearing Conservation

Introduction

Noise, or unwanted sound, is one of the most pervasive occupational health problems. It is a by-product of many industrial processes. Sound consists of pressure changes in a medium (usually air), caused by vibration or turbulence. Exposure to high levels of noise causes hearing loss and may cause other harmful health effects as well. The extent of damage depends primarily on the intensity of the noise and the duration of the exposure. Noise-induced hearing loss can be temporary or permanent. Temporary hearing loss results from short-term exposures to noise, with normal hearing returning after a period of rest. Generally, prolonged exposure to high noise levels over a time gradually causes permanent damage.

A hearing conservation program should protect employees exposed to significant occupational noise from suffering hearing impairment. This is true even if the employees are subject to noise exposures over their entire working lifetimes. This paper summarizes the required components of an effective hearing conservation program; this program also meets OSHA's basic requirements.

Monitoring

A hearing conservation program requires employers to monitor noise exposure levels. The measurements must accurately identify employees who experience noise at or above 85 decibels A-weighting (dBA) averaged over 8 working hours, or an 8-hour time-weighted average (TWA). The exposure measurement must include all continuous, intermittent, and impulsive noise within an 80 dBA to 130 dBA range and must be taken during a typical work situation. Exposures greater than those listed in the Appendix, Table G-16A, exceed OSHA limits. Hearing conservation requirements commence for work times *half* of those listed in the Table. For example, the Table indicates that the allowable exposure for an 8-hour workday is 90 dBA, and for 16 hours is 85 dBA. Hearing conservation program requirements begin for 8-hour workdays (half of 16) for 85 dBA.

This requirement is performance-oriented since it allows employers to choose the monitoring method that best suits each individual situation. Employers should repeat monitoring when changes in production, process, or controls result in changes to noise exposure. Such changes may require the employer to monitor additional employees, or may mean that employees' hearing protectors may no longer provide adequate protection (attenuation).



Under a hearing conservation program, employees are entitled to observe monitoring procedures, and they must be notified of the results of exposure monitoring. The method used to notify employees is left to the discretion of the employer.

Employers have the duty to ensure the proper calibration (checking) of measuring instruments used for monitoring employee exposures to ensure that the measurements are accurate. (Follow manufacturers' instruction to determine when, and how extensively, to calibrate.)

Audiometric Testing

Audiometric testing monitors the sharpness and acuity of an employees hearing over time and also provides an opportunity for employers to educate employees about their hearing and the need to protect it. This testing also validates the effectiveness of the hearing protectors or other control options chosen to reduce employee noise exposure.

The employer shall establish and maintain an audiometric testing program. The important elements of an audiometric testing program include baseline audiograms, annual audiograms, training, and follow-up procedures. Audiometric testing must be made available at no cost to all employees who are exposed to an action level of 85 dBA or above, measured as an 8-hour TWA.

The audiometric testing program follow-up should indicate whether the employer's hearing conservation program is preventing hearing loss. A licensed or certified audiologist (a specialist dealing with an individual having impaired hearing), an otolaryngologist (physician specializing in the diagnosis and treatment of disorders of the ear, nose, and throat), or a physician must be responsible for the program. Both professionals and trained technicians may conduct audiometric testing. The professional in charge of the program does not have to be present when a qualified technician conducts tests, however. The medical professional's responsibilities include overseeing the program and the work of the technicians, reviewing problem audiograms, and determining whether referral is necessary.

The employee needs a referral for further testing when audiometric test results are questionable, when medical problems are suspected, or if the employer suspects that a medical pathology of the ear is caused or aggravated by the wearing of hearing protectors. The employee shall be referred for a clinical audiological evaluation or otological exam, if additional testing is necessary. Two types of audiograms are required in the hearing conservation program: *baseline* and *annual*.

Baseline Audiograms

The baseline audiogram is the reference audiogram against which future audiograms are compared. Within 6 months of an employee's first exposure at or above an 8-hour TWA of 85 dBA s/he must receive a baseline audiogram. An exception is the use of mobile test vans to obtain audiograms. In these instances, baseline audiograms must be completed within one year after an employee's first exposure to workplace noise at or above a TWA of 85 dBA. Employees, however, must be fitted with, issued, and required to wear hearing protectors for any period exceeding six months after their first exposure until the baseline audiogram is obtained.

Baseline audiograms taken before the effective date of OSHA's hearing conservation regulation (April 7, 1983) are acceptable baselines if the medical professional in charge of the program determines that the audiogram is valid. Employees should not be exposed to workplace noise for 14 hours preceding the baseline test; however, appropriate hearing protectors can serve as a substitute for this requirement and can be worn during this time period. Be mindful that *exposure to loud noise or failure to wear hearing protection prior to an audiometric examination will influence the results.*

Annual Audiograms

Employees must receive their annual audiograms within one year of the baseline test. It is important to test hearing on an annual basis to identify deterioration in hearing ability so that the employer can initiate protective follow-up measures before hearing loss progresses. The medical professional in charge of the program must routinely compare annual audiograms to baseline audiograms to determine whether the audiogram is valid and to determine whether the employee has lost hearing ability; i.e., if a standard threshold shift (STS) has occurred. *STS is an average shift in either ear of 10 dB or more at 2,000, 3,000, and 4,000 Hertz.* OSHA recommends an averaging method to determine STS because this method reduces the number of persons falsely identified as having STS and who are later shown not to have had a change in hearing ability. In addition, the averaging method is sensitive enough to identify meaningful shifts in hearing early on. The medical professional in charge of the program will make this determination.

Audiogram Evaluation

If an employee is identified as having an STS, the employee must be fitted (or refitted) with adequate hearing protectors, shown how to use them, and required to wear them. An employee must be notified within 21 days from the time the determination is made that his or her audiometric test results showed a STS. Some employees who demonstrate STSs may need to be referred for further testing. This could occur if the medical professional in charge determines that the employee's test results are questionable or if the employee has a medical ear problem that is thought to be caused or aggravated by wearing hearing protectors. If the suspected medical problem is not thought to be related to wearing hearing protection, the employee must be informed that he or she should see a physician. If subsequent audiometric tests show that the STS identified on a previous audiogram is not persistent, an employee whose exposure to noise is less than a TWA of 90 dBA may legally discontinue wearing hearing protectors. *It is prudent, though, for employees to continue to wear hearing protectors anytime their TWA noise exposures exceed 85 dBA.* Always seek medical confirmation before discontinuing hearing protection.

An annual audiogram may be substituted for the original baseline audiogram if the professional in charge of the program determines that the employee's STS is persistent. The original baseline audiogram, however, must be retained for the length of the employee's employment. This substitution will ensure that the same shift is not identified repeatedly. The medical professional may also decide to revise the baseline audiogram if an improvement in hearing occurs. This will ensure that the baseline reflects actual hearing thresholds to the extent possible. Audiometric tests must be conducted in a room which meets specific background levels and with calibrated audiometers that meet specifications outlined in American National Standard Institute (ANSI) SC-1969.

Hearing Protection

Hearing protection must be available to all workers who are exposed to 8-hour TWA noise levels of 85 dBA or above. This requirement will ensure that employees have access to hearing protectors *before* they experience a hearing loss. OSHA requires that hearing protectors must be worn by employees:

1. for any period exceeding six months from the time they are first exposed to 8-hour TWA noise levels of 85 dBA or above until they receive their baseline audiograms. This applies in situations where baseline audiograms are delayed because it is inconvenient for mobile test vans to visit the workplace more than once a year;
2. who have incurred standard threshold shifts since these workers have demonstrated that they are susceptible to noise; and
3. who are exposed over the permissible exposure limit of 90 dBA over an 8-hour TWA.

Although OSHA does not require that employees wear hearing protectors until their noise exposure reaches 90 dBA for the 8-hour workday, it is prudent for employers to mandate protection when exposures exceed 85 dBA. That is, everyone included in the hearing conservation program should be required to wear hearing protection!

Employees should decide, with the help of a person who is trained in fitting hearing protectors, which size and type protector is most suitable for their working environments. The protector selected should be comfortable to wear and should offer sufficient attenuation to prevent hearing loss.

Hearing protectors must adequately reduce the noise level for each employee's work environment. The employer must reevaluate the suitability of the employee's protector whenever there is a change in working conditions that may cause the hearing protector being used to become inadequate. If workplace noise levels increase, then employees must be given more effective protectors. OSHA mandates that the protector must reduce employee exposures to at least 90 dBA and to 85 dBA when an STS has already occurred in the worker's hearing. *Although employers are not required to do so, it is prudent to offer protectors that reduce noise exposure to 85 dBA rather than to 90 dBA.* Employees must be shown how to use and care for their protectors and must be supervised on the job to ensure that they continue to wear them correctly.

Training

Employee training is very important. When workers understand the reasons for the hearing conservation programs' requirements and the need to protect their hearing, they will be better motivated to participate actively in the program and to cooperate by wearing their protectors and by taking audiometric tests. Employees exposed to TWAs of 85 dBA and above must be trained at least annually in

- the effects of noise
- the purpose, advantages, and disadvantages of various types of hearing protectors
- the selection, fit, and care of protectors
- the purpose and procedures of audiometric testing

The training program may be structured in any format, with different portions conducted by different individuals and at different times, as long as the required topics are covered. OSHA does not specify trainer requirements.

Recordkeeping

Records of noise exposure measurement must be kept for two years to meet minimum legal requirements. It is prudent, however, to retain noise exposure measurement records indefinitely.

Records of audiometric test results must be maintained for the duration of employment of the affected employee. Audiometric test records must include:

- the name and job classification of the employee
- the date
- the examiner's name
- the date of the last acoustic or exhaustive calibration
- the measurements of the background sound pressure levels in audiometric test rooms
- the employee's most recent noise exposure measurement

Loss of hearing (along with other injuries or illnesses) must be recorded on the OSHA 200 log. Employers must record work-related shifts in hearing of an average of 25 dB or more at 2000, 3000, and 4000 hertz (Hz) in either ear on the OSHA 200 log. The medical professional in charge of the program should assist in determining this.

Employers are required by the OSHA standard (29 CFR 1910.95) to inform employees in writing within 21 days of the determination of a Standard Threshold Shift and to conduct specific follow-up procedures as required in paragraph (g) of the standard. Employers must use this STS information as a tracking tool for focusing noise reduction and hearing protection efforts.

References

1. *Fundamentals of Industrial Hygiene*, 4th ed. Barbara A. Plog, ed. Itasca, IL: National Safety Council, c1996.
2. "Occupational Noise Exposure." (29 CFR 1910.95) Washington, DC: U.S. Department of Labor, Occupational Safety and Health Administration.
3. *Hearing Conservation: A Training Kit*. San Bruno, CA: Krames Communications, c1992.
4. "Noise Control and Hearing Conservation Audit Checklist" in *How to Conduct Safety and Health Audits*. Stephen D. Bruce, ed. Madison, CT: Business & Legal Reports, c1993-
5. *Royster, Julia Doswell and Larry H. Royster*. Hearing Conservation Programs: Practical Guidelines for Success. *Lewis, c1990*.

For more information, contact your local Hartford agent or your Hartford Loss Control Consultant. Visit The Hartford's Loss Control web site at <http://www.thehartford.com/corporate/losscontrol/>

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Hearing Conservation Program Checklist

Use this checklist to review the phases of a hearing conservation program.

Evaluations and Monitoring

- Conduct noise tests to measure sound levels between 80-130 dBA. (Refer to Table G-16A in the Appendix.)
- Allow employees to observe monitoring.
- Identify jobs or areas where noise exposures routinely exceed 85 dBA, 90 dBA.
- Determine representative time-weighted averages (TWAs) for all employees or job classifications exposed to noise, especially those where sound exceeds 85 dBA and 90 dBA.
- Correlate noise data to individual employees or jobs to include them in the Hearing Conservation Program (HCP).
- When process or production requirements change, re-evaluate noise levels.
- Make noise survey findings available to all employees.

Controls

- Gain management support for enforcement of the HCP.
- Identify primary sources of noise and document possible engineering solutions.
- Evaluate employees' participation in the HCP during their annual performance reviews.
- Include noise control in planning for new facilities, new equipment, and new processes.

Education

- Educate employees about hearing loss and hearing conservation (both on and off the job).
- Notify employees about noise levels at their individual jobs or classifications.
- Issue informal reminders about the HCP at least quarterly.
- Update the education program for the Hearing Conservation Program annually.

Hearing Protection Devices (HPD)

- Make several different types and styles of effective HPD available for each employee in the HCP.
- Fit each employee individually with his or her own HPD
- Train each employee in its proper fitting, use, and care.
- Post noise maps of the plant to show areas where HPDs are required; enforce their use.
- Replace or maintain HPDs regularly.

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Audiometric Evaluations

- Ensure proper maintenance and calibration of audiometers. Ensure that calibration records are up-to-date.
- Train audiometric technicians.
- Operate equipment only with trained technicians.
- Update each employee's medical and auditory history.
- Be sure that testing technicians give employees immediate feedback about test results.
- Have a medical professional review audiograms for any significant threshold shift (>10dB or >25dB).
- Be sure that HCP staff follow through with counseling, retraining, and possibly with retesting of employees who experience hearing change.

Recordkeeping

- Retain all noise measurement records for a minimum of two years (ideally, they should be retained indefinitely).
- Retain results of each employee's audiometric examinations for the duration of that person's employment.
- Include noise results on individual audiometric records.
- Notify employees in writing within 21 days of a threshold shift in hearing (in either ear) that averages 10 dB or more at 2000, 3000, and 4000 Hertz.
- Record in the OSHA 200 log any work-related shift in hearing (in either ear) that averages 25 dB or more at 2000, 3000, and 4000 Hertz.

Appendix:
 Computation of Employee Noise Exposure
 TABLE G-16A

Reference A-weighted sound level

L (decibel)	duration, T (hour)
80	32.0
81	27.9
82	24.3
83	21.1
84	18.4
85	16.0
86	13.9
87	12.1
88	10.6
89	9.2
90	8.0
91	7.0
92	6.1
93	5.3
94	4.6
95	4.0
96	3.5
97	3.0
98	2.6
99	2.3
100	2.0
101	1.7
102	1.5
103	1.3
104	1.1
105	1.0

L (decibel)	duration, T (hour)
106	0.87
107	0.76
108	0.66
109	0.57
110	0.50
111	0.44
112	0.38
113	0.33
114	0.29
115	0.25
116	0.22
117	0.19
118	0.16
119	0.14
120	0.125
121	0.110
122	0.095
123	0.082
124	0.072
125	0.063
126	0.054
127	0.047
128	0.041
129	0.036
130	0.031